SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 06/29/1992
Operable Unit: 01
ROD ID: EPA/ROD/R04-92/108

Media: Soil; Sludge; SW.

Contaminant: VOCs, Metals; Radioactive Materials

Abstract: SITE HISTORY/DESCRIPTION: The 300-square-mile Savannah River (USDOE) site (SRS) is a Department of Energy (DOE) facility located in Aiken, Barnwell, and Allendale Counties, South Carolina, 20 miles south of Aiken, South Carolina, and 25 miles southeast of Augusta, Georgia. Land use in the surrounding area is primarily agricultural. The Savannah River Site is a secured facility with no residents. The site, cooperated by the Westinghouse Savannah River Company, is a national defense-related facility producing tritium, plutonium, and other special nuclear materials. From 1958 to 1985, SRS used a northwest portion of the site, termed the "M-area," as a hazardous waste management facility (HWMF). The M-area HWMF or OU1 consisted of an unlined surface impoundment (settling basin), a process sewer line, an overflow drainage/seepage area, and an area known as Lost Lake, which represents a special ecological environment known as Carolina Bay. Manufacturing wastes from aluminum-forming and metal-finishing operations conducted onsite were discharged through the sewer line to the basin, where metals such as uranium, nickel, lead, and aluminum settled out of solution. Any basin overflow went to the drainage/seepage area and then on to Lost Lake. Use of this system ended in 1985, when a new wastewater treatment facility was installed. This interim ROD integrates previously completed RCRA closure activities that were required and approved by the South Carolina Department of Health and Environmental Control. Future RODs will address final remedial

actions for other contaminated media, including the vadose zone and ground water, associated with the M-area HWMF. The primary contaminants of concern affecting soil, sludge, and surface water are VOCs, including TCE and PCE; metals, including lead; acids; and radioactive materials, including uranium. PERFORMANCE STANDARDS OR GOALS: No chemical-specific clean-up goals were provided in this interim ROD, but will be provided for the final M-area HWMF remedial action. The goal of this interim ROD is to integrate prior RCRA decisions into the CERCLA process. The goal of the remediation is to minimize the migration of contaminants to the ground water and eliminate surface transport pathways. INSTITUTIONAL CONTROLS: A deed restriction on the M-area HWMF will be maintained with the Aiken County zoning authority as required by the South Carolina Hazardous Waste Management Regulations.

Remedy: SELECTED REMEDIAL ACTION: The selected remedial action for this site includes pumping and onsite treatment of any standing water that remained in the basin; excavating, dewatering, and stabilizing approximately 37,000 cubic yards of basin sludge using Portland cement; placing, consolidating, and compacting the stabilized sludge into the basin; discharging the sludge effluent from the dewatering process offsite to a permitted NPDES outfall; consolidating approximately 39,700 cubic yards of contaminated soil excavated from the seepage area, Lost Lake, and a portion of the sewer line into the basin; installing and maintaining a low permeability cap over the settling basin, which includes a surface soil layer that will be graded and vegetated to promote drainage; monitoring ground water; and implementing institutional controls including deed restrictions. The estimated present worth cost for this remedial action ranges from $3,000,000 to $5,000,000, which includes an annual O&M cost of $20,000 for 30 years.

Text: Full-text ROD document follows on next page.

Text:
INTERIM ACTION RECORD OF DECISION REMEDIAL ALTERNATIVE SELECTION

M-Area Hazardous Waste Management Facility Operable Unit

Savannah River Site
Aiken County, South Carolina

Prepared by:

U.S. Department of Energy
Savannah River Field Office
Aiken, South Carolina

DECLARATION FOR THE INTERIM ACTION RECORD OF DECISION

Site Name and Location
M-Area Hazardous Waste Management Facility (HWMF) Operable Unit
Savannah River Site
Aiken County, South Carolina

Appendix C of the draft Federal Facility Agreement (FFA) refers to this operable unit as the M-Area Settling Basin, M-Area/Lost Lake (Building Numbers 904-51G, 904-112G).

Statement of Basis and Purpose

This document presents the selected interim remedial action for the M-Area HWMF Operable Unit at the Savannah River Site (SRS), which was developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record file for this specific operable unit.

Description of the Selected Remedy

The selected interim action remedy involves the stabilization and placement of all contaminated materials under a low permeability cap. This remedy prevents physical exposure to contaminants and mitigates further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport.

A risk evaluation is currently being developed for the M-Area HWMF Operable Unit. A final remedy will be selected following the evaluation of any post-closure risks and will be contained in the final Record of Decision (ROD).

The major components of the remedial action include:

- Dewatering the basin.

- Treating basin liquid and discharging the liquid to a permitted

outfall.

- Waste consolidation by stabilizing and compacting dewatered basin sludge.

- Excavation of a portion of the process sewer line and associated soils and contaminated soils from the seepage area and areas of Lost Lake.

- Consolidation and compaction of excavated contaminated materials on top of the stabilized sludge within the basin.

- Installing a low permeability cap system over the basin.

Declaration Statement

The interim action is hereby selected by mutual agreement of the U.S. Department of Energy and the U.S. Environmental Protection Agency. This interim action is protective of human health and the environment, complies with Federal and State applicable or relevant and appropriate requirements (ARARs) for this limited-scope action, and is cost-effective. This action is interim and is not intended to utilize permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable for the MArea HWMF Operable Unit. Because this action does not constitute the final remedy for the M-Area HWMF Operable Unit, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, although partially addressed in this remedy, will be fully addressed by the final response action.

Subsequent actions are planned to address fully the threats posed by the conditions at the M-Area HWMF. Because this remedy may result in hazardous substances remaining within the operable unit above health-based levels, a five-year review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment after commencement of the remedial action. Because this is an interim action ROD, review of this operable unit and of this remedy will be conducted by the Environmental Protection Agency (EPA) until a final remedial alternative for the M-Area HWMF Operable Unit is selected.

SUMMARY OF INTERIM ACTION
REMEDIAL ALTERNATIVE SELECTION

M-Area Hazardous Waste Management Facility Operable Unit

Savannah River Site
Aiken County, South Carolina

Prepared by:

U.S. Department of Energy
Savannah River Field Office
Aiken, South Carolina

DECISION SUMMARY

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I. Site and Operable Unit Names, Locations, and Descriptions

The Savannah River Site (SRS) occupies approximately 300 square miles adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina (Figure 1). SRS is a secured facility with no permanent residents. The site is approximately 25 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina. The average population density in the counties surrounding SRS ranges from 23-560 people per square mile with the largest concentration in the Augusta, Georgia, metropolitan area. Based on 1980 census data (1990 data not available), the population within a 50-mile (80 km) radius of SRS is approximately 555,100.

SRS is owned by the United States Department of Energy (DOE). Westinghouse Savannah River Company (WSRC) is a co-operator, providing management and operation services for DOE. SRS produces tritium, plutonium, and other special nuclear materials for national defense. The site also provides nuclear materials for the space program, and conducts medical, industrial, and research efforts. The A/M Area, located in the northwest portion of the SRS (Figure 1), contains nuclear fuel fabrication buildings, office buildings, and research areas.

The M-Area Hazardous Waste Management Facility (HWMF) is a sourcespecific operable unit within the A/M Area Fundamental Study Area. The MArea HWMF

includes an unlined surface impoundment (settling basin), a portion of an inactive process sewer line, drainage and seepage areas, and a Carolina bay known as Lost Lake (Figure 2). The nearest plant boundary is approximately 5800 feet northwest of the M-Area HWMF.

II. Operable Unit History and Compliance History

Operable Unit History

The M-Area settling basin was constructed in 1958 to settle out metals (primarily uranium, nickel, lead and aluminum) discharged from MArea manufacturing operations. The manufacturing processes consisted of aluminum forming and metal finishing processes which produced fuel and targets for SRS reactors. Waste effluents from the aluminum forming and metal finishing processes were discharged from three production buildings and two support laboratories to the settling basin through a process sewer line. The waste effluents generally contained hydroxides, precipitates of aluminum, uranium, nickel, lead and other metals, solvents (1,1,1-trichloroethane, trichloroethylene, and tetrachloroethylene), acids, and caustics. Very low concentrations (<50 ppm) of polychlorinated biphenols (PCBs) were detected in the early 1980s in soils in an isolated portion of the drainage ditch downstream of the basin. No PCBs are known to have ever been detected in thebasin. The drainage ditch soils were excavated and stabilized with cement in the basin during closure activities.

The basin dimensions were approximately 330 feet by 280 feet (surface dimensions) by 17 feet (depth) with a volumetric capacity of approximately eight million gallons. Overflow from the settling basin was directed to a natural seepage area and ultimately to Lost Lake. In July 1985, a permitted wastewater treatment facility was placed in operation and discharges to the settling basin were discontinued.

Compliance History

Remedial actions were started at the M-Area HWMF under the Resource Conservation and Recovery Act (RCRA). In 1985, a RCRA Closure Plan was submitted to the South Carolina Department of Health and Environmental Control (SCDHEC). The closure plan underwent several revisions prior to approval by SCDHEC in 1987. A Part B Permit Application for M-Area operations and for postclosure of the M-Area HWMF was also submitted to SCDHEC. In September 1987, DOE received a Hazardous Waste Permit (SC1-890-008-984) for container storage areas and post-closure care of the M-Area HWMF. Closure of the operable unit was initiated in 1988 and completed in 1990. In 1991, the closure certification was accepted by SCDHEC as being in compliance with RCRA requirements.

Closure activities specifically included removal and treatment of any standing water remaining in the basin; discharge of the effluent to the NPDES-permitted M-004 Outfall; excavation, dewatering, and stabilization of the basin sludge with Portland cement; placement, consolidation and compaction of stabilized sludge in the basin; excavation of a portion of the process sewer line and contaminated soils associated with the sewer line, drainage ditch, seepage area and Lost Lake; placement and compaction of contaminated materials in the basin; construction of a low permeability cap

over the settling basin; andrestoration of the area.

Remedial activities at the M-Area HWMF became subject to CERCLA when the entire SRS facility was placed on the National Priorities List (NPL) in December 1989. Due to the multiple source areas in close proximity and the comingling of contaminants emanating from these source areas, the A/M Area has been designated a Fundamental Study Area.

The purpose of this designation is to facilitate the coordination of remedy selection decisions for the operable units in this area. The MArea HWMF has been designated as a source-specific operable unit within the A/M Area Fundamental Study Area.

III. Highlights of Community Participation

No comments were received during the public review period.

IV. Scope and Role of Operable Unit within the Site Strategy

The selected remedy involves the placement of all contaminated materials under a low permeability cap. The remedy prevents physical exposure to contaminants and mitigates further migration of contaminants from the settling basin to groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport.

The interim action is consistent with any planned future actions for this operable unit.

Groundwater remediation is addressed in the ROD for the A/M Area Groundwater Operable Unit.

V. Summary of Operable Unit Characteristics

Waste effluents from aluminum forming and metal finishing processes were discharged from three production buildings and two support laboratories to the M-Area settling basin through a process sewer line. The waste effluents generally contained hydroxides, precipitates of aluminum, uranium,nickel, lead and other metals, solvents (1,1,1-trichloroethane, trichloroethylene, and tetrachloroethylene), acids, and caustics. Cracks in the sewer pipeline allowed some effluent to leak into the ground, contaminating underlying soils. The pipeline was slip-lined after cracks and misalignments were discovered in 1983, and an inactive portion was excavated in 1989 as part of the settling basin closure.

Contamination was detected in groundwater, surface water, soil, sediments, and air prior to closure of the M-Area HWMF. Constituents evaluated in a 1985 risk analysis include aluminum, barium, cadmium, chromium, copper, cyanide, lead, lithium, mercury, nickel, nitrate, phosphate, silver, sodium, zinc, depleted uranium, PCBs, tetrachloroethylene, 1,1-dichloroethylene, trichloroethane, and bis(2-ethylhexyl)phthalate. Chemical analyses indicate that elevated levels (hundreds of parts per million) of contaminants appear to be restricted to the area beneath the M-Area HWMF and the A/M Area. Very low concentrations of PCBs (< 50 ppm) were detected in the early 1980s in soils in an isolated portion of the drainage ditch downstream of the basin.

No PCBs are known to have ever been detected in the basin.

The volume of waste within the settling basin was estimated to be 37,800 cubic yards. The volume of contaminated soils and dried sludge in the overflow ditch, seepage area, process sewer line, and Lost Lake was estimated to be 39,700 cubic yards.

VI. Summary of Operable Unit Risks

A risk evaluation is currently being developed for the M-Area HWMF Operable Unit. The risk evaluation will be based on available data. A previous risk analysis performed in 1985 for the M-Area HWMF was used in the development of closure alternatives. The results of the previous risk analysis and available closure and post-closure data will also be utilized, asappropriate, for evaluation of potential post-closure risk.

As noted in Section V, constituents evaluated in the 1985 risk analysis included aluminum, barium, cadmium, chromium, copper, cyanide, lead, lithium, mercury, nickel, nitrate, phosphate, silver, sodium, zinc, depleted uranium, PCBs, tetrachloroethylene, 1,1-dichloroethylene, trichloroethane, and bis(2-ethylhexyl)phthalate. Chemical analyses indicate that elevated levels (hundreds of parts per million) of contaminants appear to be restricted to the vadose and groundwater zones beneath the M-Area HWMF and the A/M Area.

Risk assessment work conducted in 1985 to evaluate closure options for the M-Area HWMF indicated that contamination was present in groundwater, surface water, soil, sediments, and air. The M-Area risk evaluation program currently under development also is considering these media. However, the current risk work addresses potential risks through these media based on postclosure conditions. Furthermore, the risk evaluation work is being conducted in two parts based on media-specific units within the A/M Area Fundamental Study Area.

Contaminated sediments and surface soils of the M-Area HWMF were excavated and placed in the basin during closure. The basin then was covered with a low permeability soil cap. Therefore, current exposure through surface soil and sediment pathways is minimized because of this soil remediation. This aspect of sediment and surface soil exposure pathways will be addressed in detail in the risk evaluation for surface pathways.

The potential pathways for human exposure are through surface, subsurface, and atmospheric transport of contaminants. However, as noted above, the extent to which soil and sediment remediation have eliminated surface and associated atmospheric pathways is being evaluated in the M-Area risk evaluation. Subsurface contamination associated with the M-Area HWMF groundwater is currently being addressed as part of the on-going A/M Area Groundwater Corrective Action Program. Therefore, M-Area HWMF subsurface unit risks will be addressed as part of the separate risk assessment for the A/M Area Groundwater Operable Unit.

Potential human health risks associated with surface pathways will be evaluated further in the risk evaluation under development. Because these media were remediated during closure, the risk evaluation should show

reduced or no potential for risks from these media.

Results of the ecological assessment conducted in 1985 indicate that adverse effects on river quality and wildlife for any of the three closure alternatives examined would be insignificant. The risk evaluation currently under development will characterize any ecological affects for postclosure conditions. Lost Lake is currently being monitored for any ecological impacts from closure activities. Results of this monitoring program will be included in future reviews of the operable unit.

VII. Description of Alternatives

Remedial alternatives were developed for the M-Area HWMF based on effective technologies available at the time the RCRA Closure Plan was prepared. The RCRA Closure Plan was initially submitted to SCDHEC in 1984 and was approved, following several revisions, in 1988. Options regarding the M-Area HWMF evaluated at that time included:

Alternative 1

No Action

Alternative 2

No Waste Removal, Waste consolidation, Treatment, and Closure

Alternative 3

Waste Removal and Closure

Alternative 2 was selected within the RCRA closure process in 1988 as the most technically effective of the three alternatives for protection of human health and the environment. Closure of the M-Area HWMF was begun in 1988 and completed in 1990 utilizing a modification of the components of Alternative 2. The closure was certified in 1991 by SCDHEC as being in compliance with RCRA and state requirements. The closure is currently considered an interim action under CERCLA. However, upon completion of the risk evaluation, SRS will submit appropriate documentation to EPA, SCDHEC, and the public requesting that the alternative be designated a final action. This section contains a description of each of the three alternatives as they were developed and considered under NCP guidelines.

Alternative 1: No Action

Under the No Action Alternative, the settling basin would be allowed to dry by natural evaporation. The soils in the drainage ditch, seepage area, and Lost Lake would remain in place. The groundwater monitoring program would continue for a 30-year period or as required to remediate the A/M Area groundwater.

Treatment Components. No treatment would be instituted for the No Action Alternative. Materials within the settling basin and contaminated soils associated with the drainage ditch, the sewer line, and Lost Lake would remain in place.

Engineering Controls. With the exception of continued groundwater monitoring, no engineering controls would be required under the No Action Alternative. As stated in the approved Application for Post-Closure Permit, the existing groundwater monitoring network would be utilized to monitor groundwater in the vicinity of the M-Area HWMF. Post-closure monitoring will be continued for 30 years following the date of completing closure plus any additional time required to separately remediate the A/M Area groundwater. Institutional Controls. Public access to areas within SRS is controlled by existing security personnel. Access specifically to the M-Area HWMF would be restricted through an exclusion fence, which surrounds the immediate area of the settling basin. Exclusion fence maintenance would occur on a periodic basis. Additionally, a deed restriction of the M-Area HWMF would be maintained with the Aiken County zoning authority as specified in South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.264.119. A survey plat indicating the location and dimensions of the basin and the type and quantity of waste within the basin would be filed with the Aiken County zoning authority as specified in SCHWMR R.61-79.264.120.

Quantity of Waste. Waste within the settling basin and contaminated soils associated with the drainage ditch, the sewer line, and Lost Lake would remain in place under the No Action Alternative. The volume of waste that would remain within the settling basin is estimated to be 37,800 cubic yards.

Implementation Requirements. The No Action Alternative requires no special implementation procedures and can be initiated immediately.

Estimated Construction and Operation and Maintenance (O&M) Costs. Additional monitoring wells would not be installed under the No Action Alternative. Costs for this alternative were originally estimated to be:

- Capital Cost $0
- Annual O&M Costs $20,000

ARARs Associated with the Considered Alternative. The No Action Alternative would allow the continued migration of chemical residuals associated with the basin to groundwater within the A/M Area. Risks to human health would still exist due to associated surface migration pathways.

Alternative 2: No Waste Removal, Waste Consolidation, Treatment, and Closure This alternative involves pumping and treating any standing water remaining in the basin; excavating, dewatering, and stabilizing the basin sludge with Portland cement; placement, consolidation and compaction of stabilized sludge into the basin; discharging the effluent to the NPDES permitted M004 Outfall; consolidation by excavating and placing contaminated soils associated with the seepage area, a portion of the sewer line, and Lost Lake into the basin; and installing a low permeability cap over the settling basin.

Treatment Components. The free liquid in the settling basin and Lost Lake would be pumped to a permitted temporary wastewater treatment facility (WTF)

for processing. The treatment steps of the WTF would consist of pH adjustment, polymer addition, clarification by precipitation, and filtration. Following treatment, the effluent would be discharged at the NPDES-permitted M-004 Outfall. Pumping rates would not exceed historical overflow rates (200 to 300 gallons per minute) so as not to disturb the underlying sludge layer.

Sludge dewatering would take place by dredging and pumping sludge materials through a filter press. The filter cake resulting from this operation alone would have a solids content on the order of 65% (i.e., the consistency of clay). The filter cake (sludge) would then be further stabilized by the addition of kiln dust and Type I Portland Cement, and the mixture would be placed back into the basin. Air entrainment would be minimized by design of the pumping apparatus.

Engineering Controls. Following placement of the stabilized sludge, contaminated soils and material from surrounding areas including Lost Lake will be excavated and placed within the basin, on top of the stabilized sludge. Areas from which contaminated media would be removed are shown in Figure 3. A low permeability cap would then be placed over the settling basin as an engineering control. The cap would be designed and constructed toprovide a permeability of no more than 1.0 x 10[-7] cm/s. The RCRA cap installed over the M-Area settling basin would consist of an impermeable layer overlain by a drainage layer which would, in turn, be protected by a layer of soil. The impermeable layer would include 24 inches of compacted clay and a synthetic Hypalon membrane. The drainage layer would consist of open-graded stone and incorporate a perimeter drain. It would be overlain by a synthetic geotextile filter fabric to prevent soil particles from migrating into the drainage layer and clogging the interstices of the stone. The surface soil layer would be sloped to promote drainage and vegetated to minimize potential for erosion. A schematic of the soil cap is presented in Figure 4.

In accordance with the approved post-closure permit application, the existing groundwater monitoring network would be utilized to monitor groundwater in the vicinity of the M-Area HWMF. Groundwater monitoring will continue for 30 years following completion of closure (1990) of the settling basin plus any additional time required to complete on-going remediation of A/M Area groundwater.

Institutional Controls. Institutional controls would be identical to those described in Alternative 1.

Quantity of Waste. The contaminated soils and dried sludge from the overflow ditch, seepage area, and Lost Lake would be excavated, and a portion of the process sewer line, manholes, and approximately 2 feet of soil beneath the sewer line between the settling basin and manhole No. 1 would be removed (Figure 3, Section II). The total volume of soil to be excavated is shown below:

Overflow ditch	6,700 yd[3]
Remainder of seepage area	9,800 yd[3]
Lost Lake	22,100 yd[3]

Process sewer, manholes, and soil	1,100 yd[3]
TOTAL	39,700 yd[3]

All excavated materials would be placed in the settling basin and compacted to support the basin cap. Common fill would be added to level the material to the top of the basin. The estimated amount of materials currently within the settling basin was 37,800 cubic yards.

Implementation Requirements. Construction of a cap is a commonly implemented operation that has been accomplished at numerous sites. Clearing and grubbing would be required for access of heavy machinery. Liner installation would be scheduled during suitable climatic conditions. The estimated construction schedule for complete closure of the M-Area HWMF was originally estimated to be 18 to 24 months.

Cap maintenance can be readily implemented. Periodic cap maintenance would involve cutting grass and clearing any accumulation in the drainage swales. Inspections would be required to determine whether repairs to the cap, drainage system, or exclusion fence are required.

Estimated Construction and Operation and Maintenance Costs. The estimated cost for Alternative 2 was originally estimated to be:

. Capital Cost	$3,000,000 $5,000,000
. Annual O&M Costs	$20,000

ARARs Associated with the Considered Alternative. Alternative 2 requires remedial activity that may impact surface water and potential wetland areas. To ensure consistency with the Clean Water Act, erosion control must be employed through Best Management Practices to mitigate or minimize impacts to surface water from remedial activities. Also, remedial activities must be controlled to minimize the effects to wetland functions and beneficial values.

Federal RCRA regulations regarding capping would be relevant and appropriate for implementation of Alternative 2. The single synthetic liner would meet the equivalent performance standard of SCHWMR R.61-79.265.310. These requirements include the following:

- provide long-term minimization of migration of contaminants
- function with minimum maintenance
- promote drainage and minimize erosion or abrasion of the cover
- accommodate settling and subsidence to maintain cover integrity
- have a permeability less than that of natural subsurface soils.

Materials being handled in this remedy may contain both hazardous and radioactive components and may have to be handled as mixed waste (53 FR

37045, September 23, 1988).

Alternative 3: Waste Removal and Closure

Under this alternative, the liquid in the settling basin would be processed through the permitted wastewater treatment facility and discharged to NPDES outfall M-004. Contaminated soils would be excavated from the settling basin and seepage area, a portion of the sewer line, and Lost Lake. Soils and sludges would be placed in a treatment, storage and disposal (TSD) facility within SRS. The settling basin would be backfilled with clean fill.

Treatment Components. The remaining liquid in the basin would be processed through the permitted WTF and discharged to NPDES outfall M-004. The gelatinous sludge layer in the basin would be stabilized to facilitate removal and handling. The sludge would be treated with absorbants or drying agents to produce a material that could be removed by normal excavation methods. Contaminated soils and sludges would be removed from the basin, overflow ditch, seepage area, and Lost Lake. Also the process sewer line, manholes, and 2 feet of soil beneath the sewer line between the basin and manhole No. 1 would be removed (Figure 3, Section II). The soils removed from the basin and vicinity would be placed in a TSD facility within SRS.

Engineering Controls. The basin and vicinity would be backfilled with clean fill material under Alternative 3. The area of the basin would then be covered with topsoil and graded and seeded for erosion control.

Institutional Controls. No exclusion fence, deed restriction or other institutional controls would be required under this alternative.

Quantity of Waste. Original estimates of the total volume of material required to be removed from the basin and vicinity were as follows:

Sludge/soil beneath basin	14,400 yd[3]
Stabilized sludge	5,900 yd[3]
Overflow ditch and adjacent seepage area	6,700 yd[3]
Remainder of seepage area	9,800 yd[3]
Lost Lake	22,100 yd[3]
Process sewer, manholes, and soil	1,100 yd[3]
TOTAL	39,700 yd[3]

Implementation Requirements. Implementation of this alternative requires standard excavation equipment and procedures. However, approximately 3,000 truck loads of materials containing chemical and possibly radioactive constituents would be hauled from the unit to a permitted TSD facility within SRS. Approximately 3,000 truck loads of clean fill would be hauled back to the unit. Clearing and grubbing would be required for heavy equipment access and staging areas. Maintenance of the basin and vicinity

could easily be implemented following closure. The time required for completeclosure of the M-Area HWMF under this alternative was originally estimated to be 18 to 24 months.

Estimated Construction and Operation and Maintenance Costs. The costs for implementation of Alternative 3 were originally estimated to be:

. Capital Cost	$150,000,000
. Annual O&M Costs	$20,000

The capital cost reflects values associated with removal and temporary storage at a TSD facility and final disposal on SRS property.

ARARs Associated with the Considered Alternative. As described in Alternative 2, erosion control measures and management practices to minimize impacts to wetlands would have to be employed during remedial activities.

Removed materials contain both hazardous and radioactive components and would have to be handled as mixed waste. Treatment, storage and disposal of hazardous components are regulated under SCHWMR R.61-79.264. The radioactive components are controlled under DOE Order 5820.2A, RCRA regulations (40 CFR 193 and 764), and Atomic Energy Act (AEA) regulations (10 CFR 61). Shipment of hazardous and radioactive substances is regulated under Department of Transportation regulations (49 CFR 100 to 177), and DOE internally controls the shipment of radioactive wastes under DOE Order 1540.1.

VIII. Summary of Comparative Analysis of Alternatives

The NCP (40 CFR 300.430 (e) (g)) sets forth nine evaluation criteria that provide the basis for evaluating alternatives and subsequent selection of a remedy. The criteria are:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- ù Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

Overall Protection of Human Health and the Environment. Alternative 1, the No Action Alternative, would allow continued leaching of chemical residuals

associated with the basin and surrounding media to the groundwater.

Alternative 2, No Waste Removal, Waste consolidation, Treatment, and Closure, achieves overall protection by minimizing potential exposure to contaminated media and minimizes the transport of chemical residuals to groundwater. This is accomplished through stabilization of the sludge in a cement matrix, waste consolidation by excavation and placement of surrounding contaminated soils in the basin, and installation of a low permeability cap over the basin.

Alternative 3, Waste Removal and Closure, achieves overall protection of human health by removing contaminated media associated with the seepage basin. However, under this alternative the contaminated media is transported to a TSD facility at another location within SRS. Potential risks associated with exposure to the chemical residuals are, in effect, relocated.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs). No chemical-specific action levels exist for chemical residuals in soils. The No Action Alternative would, however, allow continued leaching of chemical residuals to the groundwater within the A/M Area and potentially cause exceedance of promulgated groundwater standards.

Alternative 2 would control incidental exposure to chemical residuals at the M-Area HWMF. A particular action-specific ARAR for Alternative 2 is the regulations regarding capping, SCHWMR R.61-79.265. The cap for this alternative must be designed and installed according to RCRA requirements to comply with the action-specific ARAR. Capping would help achieve groundwater chemical-specific requirements because it would minimize leaching of chemical residuals to groundwater.

Under Alternative 3, the removed materials must be stored at a storage facility designed to meet the TSD facility requirements set forth under regulations SCHWMR R.61-79.264.

Long-term Effectiveness and Permanence. Alternative 1 would allow continued leaching of chemical residuals to the groundwater, thus failing to provide a long-term remedy of the M-Area HWMF. Alternative 2 would effectively and permanently minimize the migration of chemical residuals to groundwater through stabilization of sludge materials and installation of the low permeability cap. Use of Alternative 3 would permanently remove sludges and other associated contaminated media from the basin, but the excavated materials would then have to be relocated to a TSD facility within SRS until a permanent treatment or disposal remedy is developed. Cap maintenance for Alternative 2 would continue for at least 30 years (the post-closure care period), with extension of this period reviewed every five years. Maintenance of the exclusion fence would also continue for at least 30 years.

Reduction of Toxicity, Mobility, or Volume Through Treatment. Alternative 1 provides no treatment to reduce the toxicity, mobility, or volume of chemical residuals. Capping under Alternative 2 would significantly reduce the mobility of chemical residuals within the basin although the volume of contaminants will remain unchanged. This alternative would reduce the

toxicity and mobility of chemical residuals through soil stabilization with Portland cement. This treatment would chemically bind soils and chemical residuals into a stable solid block. Alternative 2 would also consolidate waste materials in one location, thereby reducing the surface area of leachable constituents. Alternative 3 reduces the volume of contaminants specifically at the M-Area basin and surrounding media; however, the excavated quantity of waste is relocated to a TSD facility within SRS and will ultimately require treatment and eventual disposal at a future date when a permanent remedy is developed.

Short-term Effectiveness. Implementation of Alternatives 1 or 2 would pose little or no risk to the community or remedial workers through exposure to chemical residuals. Little or no significant environmental impacts would occur from implementation of either of the alternatives. Impacts to Lost Lake would be mitigated through restoration activities. Alternative 3 requires 3,000 truck loads of potentially contaminated material to be transported to another location within SRS. Remedial workers would have the potential for exposure to waste materials due to the transportation. Also, potential accidents resulting from transportation of the materials may expose other SRS employees or contractors.

Construction schedules for the alternatives were originally estimated as follows:

Alternative 1

No action
None

Alternative 2

No Waste Removal, Waste Consolidation, Treatment, and Closure 18 - 24 Months

Alternative 3

Waste Removal and Closure 18 - 24 Months

The cap under Alternative 2 would be kept in place indefinitely to minimize infiltration of precipitation. Alternative 3 requires no engineering controls.

Implementability. The proposed alternatives would pose no significant construction or operational difficulties. Materials and construction services are readily available for Alternatives 2 and 3. Both Alternatives 2 and 3 would require approval from SCDHEC for certain elements of the remedies (i.e., cap design and TSD facility storage). Periodic inspections and, as necessary, repair of the cap would be required under Alternative 2.

Cost. The originally estimated present worth costs for each alternative are presented below:

Alternative 1

No action		$600,000
Alternative 2		
No Waste Removal, Waste Consolidation, Treatment, and Closure	$3,000,000	$5,000,000
Alternative 3		
Waste Removal and Closure		$150,000,000

The original estimated costs for all three alternatives include an annual O&M cost of $20,000 for a 30-year period for groundwater monitoring. These costs do not include monitoring beyond the 30-year period potentially required to complete A/M Area groundwater remediation.

State Acceptance. SCDHEC has reviewed the closure and post-closure plans and concurs with the preferred alternative for the M-Area HWMF. The MArea HWMF was closed using Alternative 2 in 1990. SCDHEC accepted certification of the M-Area HWMF closure in 1991.

Community Acceptance. (To be addressed by DOE/EPA after the Proposed Plan public comment period.)

IX. Selected Remedy

The preferred interim action alternative for the M-Area HWMF is Alternative 2: No Waste Removal, Waste Consolidation, Treatment, and Closure. The selected remedy (Alternative 2) involved pumping and treating the standing water remaining in the basin; excavating, dewatering, and stabilizing the sludge in the basin with Portland cement; placement, consolidation and compaction of stabilized sludge into the basin; discharging the effluent to the NPDES-permitted M-004 outfall; waste consolidation by excavating and placing within the basin contaminated soils from the seepage area, a portion of the sewer line, and Lost Lake; and installing a low permeability cap over the settling basin. This alternative implements an interim remedial action to protect human health and the environment. The goal of this remediation was to minimize migration of contaminants to the groundwater and eliminate surface transport pathways. Upon completion of the unit risk evaluation, this interim action will become a final action for review and approval.

X. Path Forward

Remedial actions regarding the M-Area HWMF are currently being addressed as interim actions. "Path Forward" activities associated with this operable unit include a risk evaluation of the unit and continued monitoring and management of Lost Lake. Upon completion of this risk evaluation, a final remedy will be selected.

XI. Statutory Determination

The preferred alternative for the M-Area HWMF is Alternative 2: No Waste Removal, Waste Consolidation, Treatment and Closure. The alternative was selected for its ability to provide overall protection of human health and

the environment through reduction of associated risks and compliance with ARARs. The remedy is protective because it prevents physical exposure to contaminants by use of containment and institutional controls and mitigatesfurther migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport.

Alternative 2 appears to provide the best balance with respect to the nine evaluation criteria specified in the NCP. Alternative 2 is more technically effective than Alternative 3 in providing a remedy for the M-Area HWMF and is also more cost-effective. Stabilization and capping under the preferred alternative significantly minimizes the potential for chemical residuals to leach into groundwater. Alternative 2 is preferred over Alternative 3 which reduces the volume of contaminated media associated with the settling basin, relocates the material to a TSD facility within SRS, and would require transportation of approximately 60,000 cubic yards of waste material containing both hazardous and radioactive constituents. This action is interim and the final ROD for this operable unit will address the permanence of the final action and the preference for any treatment utilized in the final action to reduce the mobility toxicity and volume of hazardous substances.

Appendix A

References for Development of ROD Format

Crane, Jeffrey L., 1992. "Working Meeting Notice for M-Area RODs, M-Area Groundwater, M-Area Settling Basin, Met Lab Basin," Letter to Chris Bergren (WSRC), U.S. Environmental Protection Agency, Region IV, Atlanta, GA, March 12, 1992.

EPA, 1989. "A Guide to Developing Superfund Records of Decision," OSWER Directive 9335.3-02FS-1, U.S. Environmental Protection Agency, Washington, D.C., November 1989.

EPA, 1991. "Guide to Developing Superfund No Action, Interim Action, and Contingency Remedy RODs," OSWER Publication 9355.3-02FS-3, U.S. Environmental Protection Agency, Washington, D.C., April 1991. Longest, Henry L., and Bruce M. Diamond, 1990. "Suggested ROD Language for Various Groundwater Remediation Options," OSWER Directive 9283.103, U.S. Environmental Protection Agency, Washington, D.C., October 10, 1990.

WSRC, 1990. "RCRA Facility Investigation/Remedial Investigation Program Plan," WSRC-RP-89-994, Chapter 15, Westinghouse Savannah River Company, Aiken, South Carolina, September 1990.

Appendix B

Responsiveness Summary

(No comments were received during the public comment review period.)

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 06/29/1992
Operable Unit: 03
ROD ID: EPA/ROD/R04-92/110

Media: Ground water

Contaminant: VOCs

Abstract: SITE HISTORY/DESCRIPTION: The 300-square-mile Savannah River (USDOE) site (SRS) is a Department of Energy (DOE) facility located in Aiken County, 20 miles south of Aiken, South Carolina, and 25 miles southeast of Augusta, Georgia. Land use in the area is primarily industrial, and SRS is a secured facility with no residents. The site, co-operated by Westinghouse Savannah River Company, is a national defense-related facility producing tritium, plutonium, and other special nuclear materials. The A/M area, located in the northwest portion of the SRS, contained many operations that involved the use of hazardous substances. Between 1952 and 1981, an estimated 13 million pounds of chlorinated solvents were used in the A/M area to degrease fuel and target tubes for use in the SRS reactors. An estimated 50 to 90 percent of the solvents evaporated during use; however, the remaining solvents were discharged to the process sewer system. There are four main sections to the A/M area. The A-014 outfall received waste solvents (mainly TCE and PCE) via an underground sewerage line from buildings 313-M and 320-M onsite until 1976. From 1958 to 1985, the M-area basin hazardous waste management facility (HWMF) received an estimated 2 million pounds of spent solvents from degreasing operations in buildings 313 -M, 320-M, and 321-M. In transit, some of the solvents leaked into the ground through cracks in the pipeline. Finally, the 321-M solvent storage area contained various storage tanks for TCE and PCE. In 1975, an estimated 1,200 gallons of PCE leaked from a cracked

ceramic pump seal connected to a solvent storage tank located west of building 321-M. As a result of these activities and incidents, a ground water plume, encompassing 1,200 acres beneath the A/M area, is contaminated with significant concentrations of VOCs. In 1981, SRS voluntarily initiated a ground water RCRA corrective action program to investigate the nature and extent of ground water contamination and to develop a remedial program. Ground water monitoring wells were installed, and beginning in 1983, extraction and treatment of ground water began. To date, over 1.3 billion gallons of contaminated ground water have been treated. This ROD addresses an interim remedy for the A/M area ground water subsurface vadose zone, as OU3. Other RODs have addressed interim remedies for the M-area HWMF and the Savannah Metallurgical Laboratory (SRL) HWMF. Future RODs will address final remedies for these OUs. The primary contaminants of concern affecting the ground water in the A/M area are VOCs, including PCE and TCE. PERFORMANCE STANDARDS OR GOALS: No chemical-specific clean-up goals were specified in this interim ROD, but they will be provided for the final remedial action. The goal of this remediation is to reduce ground water contaminants and minimize migration of the contaminant plume. INSTITUTIONAL CONTROLS: Not applicable.

Remedy: SELECTED REMEDIAL ACTION: The selected interim remedy for this site includes installing 11 or more ground water recovery wells under the RCRA program throughout the A/Marea; extracting and treating contaminated ground water using an air stripper to remove volatile solvents, followed by onsite discharge to an NPDES permitted outfall; upgrading the air stripping tower to include an off-gas treatment system based on the result of a treatability study. The estimated present worth cost for this remedial action is $7,800,000, which includes an annual O&M cost of $20,000 for 30 years.

Text: Full-text ROD document follows on next page.

Text:
INTERIM ACTION RECORD OF DECISION REMEDIAL ALTERNATIVE SELECTION

A/M Area Groundwater Operable Unit

Savannah River Site
Aiken County, South Carolina

Prepared by:

U.S. Department of Energy
Savannah River Field Office
Aiken, South Carolina

DECLARATION FOR THE INTERIM ACTION RECORD OF DECISION

Site Name and Location

A/M Groundwater Operable Unit

Savannah River Site

Aiken County, South Carolina

Appendix C of the draft Federal Facility Agreement (FFA) refers to this operable unit as the Groundwater Remediation, A- and M-Areas.

Statement of Purpose

This document presents the selected interim remedial action for the A/M Area Groundwater Operable Unit at the Savannah River Site, developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision isbased on the administrative record file for this specific operable unit.

Description of the Selected Remedy

The selected interim action remedy involves groundwater recovery with treatment by air stripping. This remedy reduces contaminant levels in the groundwater and minimizes migration of the contaminant plume.

A risk assessment will be conducted in the future to determine if additional remediation is required. Results of the risk assessment will be contained in the final Record of Decision (ROD).

The major components of the interim action remedy include the following:

- Installing strategically located groundwater recovery wells.

- Extracting groundwater and processing it through an air stripper to

release volatile organic compounds.

- Discharging the treated water to an NPDES permitted outfall.

- Pursuing the application of new technologies to enhance the reduction of volatile organic compounds in the groundwater.

- Conducting a treatability study to evaluate technologies to control air stripping tower gaseous emissions.

Declaration Statement

The interim action is hereby selected by mutual agreement of the U.S. Department of Energy and the U.S. Environmental Protection Agency. This interim action is protective of human health and the environment and complies with Federal and State applicable or relevant and appropriate requirements (ARARs) for this limited-scope action, and is cost-effective. This action is interim and is not intended to utilize permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable for the A/M Area Groundwater Operable Unit. Because this action does not constitute the final remedy for the A/M Area Groundwater Operable Unit, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, although partially addressed in this remedy, will be fully addressed by the final response action. Subsequent actions are planned to address fully the threats posed by the conditions at the A/M Area Groundwater Operable Unit and to establish final remediation goals. Because this remedy may result in hazardous substances remaining in the operable unit above health-based levels, a five-year review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment after commencement of the remedial action. Because this is an interim action ROD, review of this operable unit and of this remedy will be conducted by the Environmental Protection Agency (EPA) until a final remedial alternative for the A/M Area Groundwater Operable Unit is selected.

SUMMARY OF INTERIM ACTION
REMEDIAL ALTERNATIVE SELECTION

A/M Area Groundwater Operable Unit

Savannah River Site
Aiken County, South Carolina

Prepared by:

U.S. Department of Energy
Savannah River Field Office
Aiken, South Carolina

DECISION SUMMARY
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B. Responsiveness Summary

I. Site and Operable Unit Names, Locations, and Descriptions

The Savannah River Site (SRS) occupies approximately 300 square miles adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina (Figure 1). SRS is a secured facility with no permanent residents. The site is approximately 25 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina. The average population density in the counties surrounding SRS ranges from 23-560 people per square mile with the largest concentration in the Augusta, Georgia, metropolitan area. Based on 1980 census data (1990 data not available), the population within a 50-mile (80 km) radius of SRS is approximately 555,100.

SRS is owned by the United States Department of Energy (DOE). Westinghouse Savannah River Company (WSRC) is a co-operator, providing management and operation services for DOE. SRS produces tritium, plutonium, and other special nuclear materials for national defense. The site also provides nuclear materials for the space program, and conducts medical, industrial, and research efforts. The A/M Area, located in the northwest portion of SRS (Figure 1), contains nuclear fuel fabrication buildings, office buildings, and research areas.

The A/M Area groundwater is a media-specific operable unit within the A/M Area Fundamental Study Area. As a result of past waste disposal practices, the groundwater beneath A/M Area has been contaminated with organic solvents, primarily trichloroethylene (TCE) and tetrachloroethylene (perchloroethylene; PCE). Total plume size beneath the A/M Area, as currently defined, is approximately 1200 acres. This plume has not migrated

beyond the SRS boundaries. The contamination in the A/M Area groundwater and the overlying unsaturated zone (vadose zone) appears to be associated with releases from the

following A/M Area source units: the A-014 Outfall, the M-Area Settling Basin/Lost Lake (M-Area Hazardous Waste Management Facility (HWMF)), the M-Area HWMF Process Sewer, and the 321-M Solvent Storage Area.

II. Operable Unit History and Compliance History

Operable Unit History

From 1952 to 1981, an estimated 13 million pounds of chlorinated solvents were used in the A/M Area to degrease fuel and target tubes used in SRS reactors. An estimated 50 to 90 percent of the solvents evaporated during degreasing operations. The remaining solvents were discharged as waste to the process sewer system. Additionally, significant quantities of chlorinated solvents were inadvertently spilled during handling and storage.

The waste effluent was piped, via a process sewer system, from the fuel tube processing facility to two primary locations: A-014 Outfall and the M-Area Settling Basin. As a result of this disposal practice and leakage within the process sewer line leading to the Settling Basin, four specific locations within the A/M Area have been identified as being potential sources for significant groundwater contamination by TCE and PCE. Additionally, somesmaller sources, such as the Metallurgical Laboratory Basin and Building 313-M, a solvent transfer station, which probably have impacted groundwater, exist in the A-Area. The four specific locations are shown on Figure 2 and are described below.

A-014 Outfall. Buildings 313-M and 320-M were operational by the end of 1952 and used TCE as a degreasing agent. Waste solvents were released to the A-014 Outfall (Tims Branch) via an underground sewer line. In 1962, the processes in Building 313-M were

redesigned, and PCE was substituted for TCE. By 1976, all waste solvents from Building 313-M were diverted and discharged to the M-Area Settling Basin.

M-Area Basin HWMF. Built in 1958, the M-Area HWMF consisted of an unlined Settling Basin that received spent solvents from degreasing operations located in Buildings 313-M, 320-M, and 321-M. The M-Area HWMF also included a natural seepage area and Lost Lake (a Carolina bay) which received effluent from the basin. From 1958 to 1985, an estimated two million pounds of solvent were released to the sewer leading to the Settling Basin. In 1985, discharges of waste solvents to the Settling Basin ceased.

M-Area HWMF Process Sewer. The process sewer was used to transport spent solvents from Buildings 313-M, 320-M, and 321-M to the M-Area Basin beginning in 1958. In transit, some of the solvent leaked into the ground through cracks in the sewer pipeline. The pipe was slip-lined after cracks and misalignments were discovered in 1983, and an inactive portion was excavated in 1989 as part of the Settling Basin closure.

321-M Solvent Storage Area. During 1971, Buildings 320-M and 321-M substituted PCE for TCE in their process operations. In 1975, an estimated 1200 gallons of PCE leaked from a cracked ceramic pump seal connected to a solventstorage tank located west of Building 321-M.

In response to the detection of volatile organic compounds (VOCs) in the groundwater near the M-Area HWMF, SRS voluntarily initiated a groundwater corrective action program (June, 1981). The objective of the program was to investigate the nature and extent of groundwater contamination, and to develop a remediation program. Known and potential sources of groundwater contamination were identified through investigations which included personnel interviews, record reviews, soil borings, and the installation of monitoring wells. SRS now has an extensive groundwater monitoring network in the A/M Area with over 350 monitoring wells installed to provide definition of the aquifer plume.

In February 1983, a South Carolina Department of Health and Environmental Control (SCDHEC)-approved corrective action was initiated with the startup of an experimental pilot air stripper and one recovery well. The system operated at a design capacity of 20 gallons of water per minute (gpm). Later in 1983, two more recovery wells were installed and a 70 gpm air stripper was placed in operation in January 1984. The 70 gpm air stripper replaced the 20 gpm unit. In 1985, eight additional recovery wells were added to the three existing recovery wells, expanding the recovery well network to eleven. The eleven recovery wells were connected to a full scale air stripper which treated 400 gpm. In 1990, the flow of the air stripper was increased to 500 gpm. The air stripper removes the organics to levels below drinking water standards prior to discharge to the NPDES-permitted outfall, A-014. To date, over 1.3 billion gallons of contaminated groundwater have been treated and about 260,000 pounds of solvents have been removed from the subsurface. The eleven recovery wells have been designed and installed to maximize removal and minimize migration of solvents from the center of the plume in the shallow aquifer. The location of the current system, including the existing wells and the air stripper, are shown in Figure 3. An additional recovery well has been installed in AArea near the Savannah River Laboratory (SRL). The previous M-Area prototype air stripper (the 70 gpm unit) has also been relocated to this part of A-Area. This new system became operational in March 1992. A thirteenth well has also been installed in the Southern Sector of A/M Area to function as an aquifer test well and possibly as a future remediation well.

SRS has initiated an evaluation of a vadose zone corrective action program to remediate soils above the groundwater at specific areas where solvents were released. An

investigation of the extent of the vadose zone contamination associated with the groundwater contamination has been performed. Presently, SRS is evaluating the designs and costs of potential systems and will be testing several innovative technologies which could be utilized to treat organics recovered from the vadose zone. Selection of a preferred alternative for the vadose zone will be carried out in a future Proposed Plan. Further discussion of the vadose zone remediation activities is contained in Section X.

Compliance History

DOE developed an Implementation Plan and Groundwater Protection Plan in June 1984 which required compliance with the groundwater protection requirements of 40 CFR SS 264, 265, and 270 and with all other Federal and State regulations. Settlement Agreement SA 86-52-W, signed on June 20, 1986, required groundwater quality assessments at several sites, including the A/M Area. Results of the assessments have been provided to SCDHEC and future actions are being defined under SRS' RCRA Facilities Investigation program.

In 1985, the Natural Resources Defense Council (NRDC), et. al., initiated a lawsuit against DOE for alleged RCRA groundwater management violations at six SRS waste management areas including the A/M Area. On May 26, 1988, a Consent Decree was signed by DOE. Requirements of this decree are outlined in Civil Action No. 1:85-2583-6, filed on May 31, 1988 in the U.S. District Court, District of South Carolina, Aiken Division.

In 1985, a Resource Conservation and Recovery Act (RCRA) PostClosure Care Part B Permit Application for the M-Area HWMF was submitted to SCDHEC. The application, approved in 1987, describes the A/M Area Groundwater Corrective Action Program in detail. A revised permit application was submitted to SCDHEC in September 1990 and the renewal application was submitted to SCDHEC on April 1, 1992. The revisions describe new groundwater and soil corrective action projects.

Remedial activities in the A/M Area became subject to CERCLA requirements when the entire SRS facility was placed on the National Priorities List (NPL) in December 1989. Due to multiple source areas in close proximity and the co-mingling of contaminants emanating from these source areas, the A/M Area has been designated a Fundamental Study Area. The purpose of this designation is to facilitate the coordination of remedy selection decisions for the operable units in this area. The A/M Area groundwater has been designated as a media-specific operable unit within the Fundamental Study Area.

III. Highlights of Community Participation

No comments were received during the public review period.

IV. Scope and Role of Operable Unit within the Site Strategy

The purposes of the interim action for the A/M Area Groundwater Operable Unit are to prevent further groundwater plume migration and initiate groundwater restoration while risk assessment activities are being planned and conducted, and to obtain further information about the response of the aquifer to remediation measures.

The interim action is consistent with any planned future actions for this operable unit.

Evaluation of treatment for the A/M Area subsurface soils (i.e., vadose zone) containing volatile organic compounds is being conducted as an ongoing treatability study associated with the A/M Area Groundwater Operable Unit. Selection of a preferred remedial action alternative for the vadose zone

will be presented in a future Proposed Plan for the A/M Area Vadose Zone Operable Unit.

V. Summary of Operable Unit Characteristics

Closely associated with the A/M Area Groundwater Operable Unit is the Vadose Zone Operable Unit. The vadose zone consists of the subsurface region between the ground (land) surface and the water table. Mobile waste constituents released at the ground surface typically migrate vertically and gradually through the vadose zone to the groundwater. Longitudinal dispersion of contamination also occurs, but generally to a limited extent. Consequently, vadose zone contamination would be localized in areas where contaminants were released. Contamination in groundwater migrates horizontally and vertically depending on recharge/discharge relationships, stratigraphy, and other hydrogeologic factors. If left in place, mobile contaminants in the vadose zone would slowly migrate to the groundwater.

Most of the contaminants in the A/M Area groundwater are located in the uppermost aquifer. Concentrations in the uppermost aquifer range from hundreds of parts per million to less than one part per billion. The plume under A/M Area, as currently defined, encompasses approximately 1200 acres. The contaminated uppermost aquifer is not used as a source of drinking water at SRS but is currently being used for domestic purposes north of the SRS boundary where no contamination is present. The deepest aquifer beneath the uppermost aquifer provides domestic (drinking) and process water to various facilities at the SRS. A thick and laterally continuous low permeability layer (principal confining unit) separates the uppermost aquifer from the principal confined aquifer and the deepest aquifer, and greatly retards downward migration of chemical residuals. Contamination concentrations of the principal confined aquifer in the A/M Area range from 1000 parts per billion to less than one part per billion. Groundwater flow direction within this unit is to the south-southeast. The town of Jackson, South Carolina, located hydraulically upgradient and three miles west of the A/M Area, also draws water from public supply wells in the deeper aquifer. No off-site groundwater contamination resulting from the migration of the A/M Area groundwater plume has been detected.

Recent monitoring results indicate groundwater contamination has occurred in the Northeastern Sector of the A/M Area in the vicinity of the SRL complex resulting from past uses and disposal of solvents. These findings are significant due to the proximity to the plant boundary and the contamination of the principal confined aquifer. The combined areal extent of the contaminant plume is shown in Figure 4 and represents the maximum lateral extent of detected constituents in all aquifers. The vertical extent of groundwater contamination through the uppermost and principal aquifers (Watertable Unit, Upper Congaree, Lower Congaree, and Peedee) is depicted along one cross section line in Figure 5. These two plume maps reflect TCE and PCE concentrations in excess of detectable quantities.

Groundwater contamination in the Southern Sector of A/M Area (south of the M-Area HWMF and southwest of the A-014 outfall) is presently outside the influence of the present recovery system. The selected interim action addresses areas of higher concentration in the center of the plume and at the sources of contamination. SRS is investigating the Southern Sector of

A/M Area to further delineate the extent of contamination and increase understanding of the hydrogeology of the area. SRS also will install a system of recovery wells to remediate groundwater in the Southern Sector.

VI. Summary of Operable Unit Risks

As a result of past waste disposal practices, the groundwater beneath A/M Area has been contaminated with the organic solvents TCE and PCE in both the dissolved state and, in limited occurrences, as concentrated Dense Non-Aqueous Phase Liquids (DNAPLs). These DNAPLs consist of concentrated, undissolved accumulations of chlorinated solvents.

As required by CERCLA, a risk assessment will be performed to provide a basis for determining if additional remediation is required to protect human health and the environment. Previous risk analyses performed in 1985 for the M-Area HWMF and Metallurgical Laboratory HWMF Operable Units were conducted prior to closure of those facilities and were used in the development of closure alternatives. The results of these previous risk analyses and available closure and post-closure data will be utilized as appropriate for evaluation of potential risk for the A/M Area Groundwater Operable Unit.

The risk assessment will address risk associated with groundwater underlying the entire A/M Area. The contribution of contamination to groundwater from the vadose zone will be considered in the evaluation of risk posed by exposure to groundwater. The surface water discharge pathway will be further evaluated.

Generally, for modeling purposes, potential pathways for human exposure are through hypothetical wells on-site, and through discharge to surface water. A program to develop the details of these exposure scenarios is underdevelopment and will be addressed in the risk assessment.

Currently, there are no drinking water wells in use within the contaminated zone of the A/M Area Groundwater Operable Unit. However, in the absence of remediation, there is a potential for risk from potential future wells and from exposure to surface waters receiving discharge from A/M Area groundwater. The risk assessment will further characterize and quantify these potential risks. Furthermore, the effect of the ongoing A/M Area Groundwater Corrective Action Program will be considered in the risk assessment. No off-site groundwater contamination resulting from the migration of the A/M Area groundwater has been detected. However, if the contaminants are allowed to remain, the potential for off-site migration and public exposure may exist.

There is limited potential for significant plant uptake of contaminants from the vadose zone. This pathway will be characterized further to confirm this assessment. The primary potential for ecological risks is through exposure to surface water receiving contaminated groundwater discharge. The extent of this potential risk for post-closure conditions will be characterized in the risk assessment currently under development.

VII. Description of Alternatives

The following remedial alternatives were developed in 1985 for the A/M Area Groundwater Operable Unit, based on demonstrated effective technologies available at the time that the M-Area HWMF RCRA Closure Plan was first prepared. In accordance with the NCP, the No Action Alternative was included as a baseline for comparison. The alternatives considered at that time for the Groundwater Corrective Action Program (remediation of the groundwater plume) included:

Alternative 1
No Action

Alternative 2
Groundwater Recovery with Treatment by Air Stripping

Alternative 3
Groundwater Recovery with Treatment by Activated Carbon Adsorption

Alternatives 2 and 3 both called for groundwater recovery by extraction. The alternatives differed only in the type of groundwater treatment technology utilized.

Alternative 2 was implemented in 1985 as an interim remedial action. This section contains a description of each of the three alternatives as they were developed and considered in 1985.

Alternative 1: No Action

Under the No Action Alternative, no groundwater extraction would be conducted. Chlorinated solvent concentrations would gradually be reduced with time and distance through natural attenuation processes such as biodegradation or dispersion. Institutional controls and long-term monitoring of groundwater could be added as components of the No Action Alternative. Further description of this alternative appears below:

Treatment Components. No treatment would be implemented.

Engineering Controls. No engineering controls would be required.

Institutional Controls. Access to SRS is controlled at primary roads by continuously manned barricades. Other roads entering the site are closed to traffic by gates or barriers. The entire facility is surrounded by an exclusion fence, except along the Savannah River. The site is posted against trespassing under state and federal statutes. Much of the A/M Area is surrounded by a separate fenced area with manned gates. The area is continuously patrolled by security personnel.

Quantity of Waste. SRS estimates that approximately 2 million pounds of chlorinated solvents are currently contained in the A/M Area groundwater plume. Approximately 260,000 pounds of solvents have been extracted andtreated to date. The plume, as currently defined, encompasses approximately 1200 acres.

Implementation requirements. This alternative requires no additional implementation.

Estimated Construction and Operation and Maintenance (O&M) Costs. No additional monitoring wells would be installed under this alternative, so there would be no construction costs. Costs for this alternative, excluding groundwater sampling and analysis were originally estimated to be:

- Capital cost $0
- Annual O&M Costs $20,000

ARARs Associated with the Considered Alternative. This alternative would not comply with the South Carolina Primary Drinking Water Regulations (R.61-58) Maximum Contaminant Levels (MCLs) or the Federal Safe Drinking Water Act (SDWA) (40 CFR 141) promulgated MCLs. Certain contaminants would remain elevated above MCLs and the calculated health-based levels should the No Action Alternative be implemented.

Alternative 2: Groundwater Recovery with Treatment by Air Stripping

Groundwater recovery with air stripping is a demonstrated and widely used technology. Air stripping is considered by EPA as the Best Demonstrated Available Technology (BDAT) for VOC removal. Air stripping forces the contaminated groundwater into contact with air. The volatile contaminants are then transferred into the air and released to the atmosphere. This alternative includes evaluation of technologies for controlling emissions from the air stripping system. One of the most efficient stripping devices is a counter-current packed column. In this column, the water stream is pumped to the top and allowed to trickle down over the column packing. Air is blown in through the bottom of the column and exits at the top. Thestripper requires electricity for a pump and blower and very little maintenance. Further description of this alternative appears below.

Treatment Components. The comprehensive remedial action system in A/M Area (as it was designed in 1985) would consist of treatment components in the general M-Area and in the Northeastern Sector of A/M Area. In the general M-Area, the treatment system would consist of 11 groundwater recovery wells and a full-scale production air stripper with an air blower, effluent pumps, instrument air system, and control building. (The 11 recovery wells (RWM-1 through RWM-11) were installed during 1982-1985). A 20-inch, zero-leakage drainline to transfer treated groundwater from the air stripper to the NPDES-permitted A014 Outfall would also be included.

In the Northeastern Sector of A/M Area, a groundwater recovery and air stripper system has been installed near the SRL. A zero-leakage drainline to carry treated liquid from the air stripper to a nearby permitted outfall has also been designed. Further design details regarding the air stripping systems were contained in Appendix F of the M-Area Post-Closure Permit Application.

Engineering Controls. The primary engineering control for minimizing the spread of the A/M Area groundwater plume involves installation of 11 or more recovery wells. The recovery wells would be strategically spaced laterally and vertically in an attempt to maximize recovery of high VOC concentration groundwater, and control groundwater migration. Location of the recovery

wells is depicted in Figure 2 (Section II).

Institutional Controls. These controls are identical to those discussed in Alternative 1.

Quantity of Waste. The quantity is identical to that discussed in Alternative 1.

Implementation requirements. Implementation time was originally estimated to be 24 to 36 months. Installation of the 11 recovery wells and the MArea stripping tower was completed in 1985. The system began operating at a 400 gpm treatment rate at that time. The system is currently operating at a rate of 500 gpm. Start-up of the Northeastern Sector recovery system occurred in March 1992.

Estimated Construction and Operation and Maintenance Costs. Costs for this alternative were originally estimated to be:

- Capital Cost $4,800,000
- Annual O&M Costs $100,000

ARARs Associated with the Considered Alternative. The remedial action would minimize migration of contaminated groundwater through groundwater recovery and provide pertinent information for the development of a complete groundwater remediation system.

Groundwater would be treated by an air stripper that would remove VOCs from the groundwater and emit them to the atmosphere. An ongoing treatability study will select an appropriate technology for treating air emissions. ARARs for air emissions include regulations under the Federal Clean Air Act and the South Carolina Air Pollution Control Regulations (R.61-62), specifically the South Carolina Ambient Air Quality Standards (R.61-62.5). An air emissions permit would be required under the South Carolina regulations prior to operation of the air stripper. Discharge of the treated groundwater will be to NPDES permitted outfalls within SRS. Discharges of this type are regulated under the Clean Water Act and the South Carolina NPDES Permit Regulations (R.61-9). Treated water must meet the discharge limits of the permitted outfall unless a permit modification is obtained.

SRS has evaluated the RCRA Subpart AA "Air Emission Standards for Process Vents" (40 CFR 265.1030) and has concluded it is not an applicablerequirement for the treatment of extracted groundwater at the site. EPA Region IV has stated that the Subpart AA standards may be relevant and appropriate. Therefore, the standards will be evaluated during the off gas treatability study for consideration in the design and implementation of the off gas treatment system for consistency with and relevancy to the Subpart AA emission standards. The system is permitted through the SCDHEC Air Quality Control Program and the Clean Water Act (wastewater treatment discharge permit) rather than through RCRA. Upon completion of the treatability study, the existing M-Area stripping tower will be upgraded, if necessary, with an off-gas treatment system in compliance with ARARs.

Alternative 3: Groundwater Recovery with Treatment by Activated Carbon Adsorption

Activated carbon adsorption is another principal method used for groundwater and drinking water treatment. With carbon adsorption, contaminated water is brought into contact with particles of activated carbon. The organic molecules migrate into microspores on the carbon particles and become trapped. The operating equipment for carbon adsorption is similar to that required for air stripping, except two carbon adsorption beds in series would replace a packed stripping column and an air blower. Two carbon beds allow replacement of the spent bed while groundwater continues to be fed to the fresh carbon unit. Volatile organics are not released to the atmosphere with carbon adsorption but must be disposed of in some other fashion. The system requires considerable attention because of the need to regenerate the carbon adsorbent. Further descriptions of this alternative appear below.

Treatment Components. Two fixed bed carbon adsorption systems would be placed in series. Each bed would be 10 feet in diameter, 10 feet in height, and contain 20,000 pounds of granular activated carbon. One bed wouldbe taken off-line every 1 to 6 months. The carbon media would be shipped off site for regeneration and further treatment of the adsorbed organic constituents. Alternately, an on-site carbon regeneration and treatment system could be adopted. The treated groundwater would be discharged through the NPDES-permitted outfall, A-014.

Engineering Controls. As in Alternative 2, engineering control to minimize the spread of groundwater contamination would be primarily accomplished by installing at least 11 recovery wells at selected A/M Area locations. Further control of volatile constituents would be accomplished during offsite organic residual treatment following carbon regeneration.

Institutional Controls. On-site institutional controls are discussed in Alternative 1.

Quantity of Waste. The quantity of groundwater to be treated would be identical to that discussed in Alternative 1. In addition, waste carbon from the adsorption process would also be generated.

Implementation Requirements. Implementation time for construction and start -up was originally estimated to be 24 to 36 months. One operating option would be to construct a fixed bed system on site and then lease the adsorption system (carbon media) from an industrial supplier. The supplier would be responsible for replacing spent media with clean media and then transporting the spent media off site for regeneration. A pilot test using an M-Area groundwater sample was conducted by the Calgon Corporation prior to 1982, in order to calculate system design parameters.

Estimated Construction and Operation and Maintenance Costs. Costs for this alternative were originally estimated to be:

- Capital Cost $5,000,000
- Annual O&M Costs $100,000

ARARs Associated with the Considered Alternative. ARARs for groundwater recovery and discharge are as discussed for Alternative 2. Treatment under this alternative is by activated carbon adsorption. Spent carbon would be regenerated off site. Organic residuals would be further treated as a final off-site remedy. Shipment of spent carbon would require proper labeling and shipment requirements per DOT regulations (49 CFR SS 100-172). Spent carbon handling and treatment thereof would be performed by an off-site treatment facility permitted under RCRA.

VIII. Summary of Comparative Analysis of Alternatives

The NCP (40 CFR SS 300.430(e)(9)) sets forth nine evaluation criteria that provide the basis for evaluating alternatives and subsequent selection of a remedy. The criteria are:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- ù Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Costs
- State acceptance
- Community acceptance

The three alternatives are compared in this section using these nine evaluation criteria.

Overall Protection of Human Health and the Environment. Alternative 1, the No Action Alternative, is not protective of and offers no reduction in risk to human health and the environment. This approach uses institutional controls to minimize threats to human health. This alternative continues toallow organic constituents in groundwater to migrate horizontally and vertically.

Both Alternative 3, Groundwater Recovery with Treatment by Activated Carbon Adsorption, and Alternative 2, Groundwater Recovery with Treatment by Air Stripping, offer a reduction in risk to human health and the environment. Groundwater recovery wells located at strategic points mitigate the spread of the A/M Area groundwater plume. Volatile organic contaminants are then removed from the groundwater prior to discharge of the treated effluent to a NPDES-permitted outfall, A-014.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs). Alternative 1 will not meet the federal and state groundwater protection

standards since groundwater is not treated. Alternatives 2 and 3 both meet the Clean Water Act standards governing the treatment and/or disposal of groundwater. Alternatives 2 and 3 also satisfy requirements under the South Carolina Air Pollution Control Regulations and Standards.

Since the A/M Area Groundwater Corrective Action is still an interim action, additional ARARs will be met or waived, as appropriate, in the final remedial action for this operable unit.

Long-term Effectiveness and Permanence. Alternative 1 does not provide long-term effectiveness and permanence since no active remediation occurs. Groundwater would not be recovered and contaminants would eventually migrate off site where they could present a risk to human health or the environment.

Both Alternatives 2 and 3 provide for a long-term remedy for removal of volatile organic constituents from the A/M Area groundwater. Currently, Alternative 2 is in operation. Initially, during system start up in the mid -1980s, the extracted groundwater entering the air stripper contained 50,000 parts per billion of chlorinated solvents. Effluent leaving the stripper has consistently contained less than 1 part per billion. During the almost six years of operation, influent concentrations have decreased to about 15,000 parts per billion.

Reduction of Toxicity, Mobility, or Volume Through Treatment. Alternative 1 provides no treatment to reduce the toxicity, mobility or volume of the groundwater contaminants.

Both Alternatives 2 and 3 would reduce the quantity of VOCs in the groundwater through treatment. During the almost six years of operation of Alternative 2, the system (including all of the experimental air strippers) has removed about 260,000 pounds of chlorinated solvents from the shallow groundwater. Both alternatives utilize a separation rather than a treatment technology to remove organic constituents from the extracted groundwater. For both air stripping and activated carbon adsorption, an additional technology to treat gaseous effluents would be needed to fully comply with the reduction of toxicity, mobility, and volume criteria. SRS is preparing to initiate an off-gas treatment evaluation for air stripping gaseous effluents.

Short-term Effectiveness. There should be no short-term adverse impacts to human health and the environment resulting from the implementation of any of the three alternatives. Under the No Action Alternative, groundwater is not recovered and has not moved off-site, so there is no additional threat to human health or environment. In Alternative 3, spent activated carbon might be shipped off-site for regeneration. Packaging, labeling, and transport of the spent media in accordance with DOT and RCRA (if necessary) regulations would be followed, so no adverse effects from off-site transit would be anticipated.

Alternative 2 is now in place; no adverse impacts were expected, nor did they occur during the construction or operation of the extraction system. There are no adverse health effects due to operation of the system. In addition, air quality in the immediate vicinity of the stripper was monitored to ensure that there would be no adverse impact to the workers in

the area. Air dispersion modeling was also conducted to obtain the required air quality permit from SCDHEC.

Implementability. Each of the three alternatives is technically and administratively feasible. Alternative 3 requires considerable attention due to system requirements, such as replacement of spent adsorption media every 1-6 months, potential off-site shipment of spent carbon, and regeneration of the used media. Operation of an on-site carbon regeneration system could necessitate extensive technical steps (e.g., system design and start up) and administrative constraints (e.g., permitting).

Alternative 2 has been on-line in A/M Area since the mid-1980s. Permitting applications have been submitted and approved. The air stripping unit in the Northeastern Sector completed final technical checks and started operation in March 1992.

Cost. The originally estimated present worth costs of each Alternative are presented below:

Alternative 1
No Action
$600,000

Alternative 2
Groundwater Recovery with Treatment by Air Stripping
$7,800,000

Alternative 3
Groundwater Recovery with Treatment by Activated Carbon Adsorption
$8,000,000

The original estimated costs for all three alternatives include an annual O&M cost of $20,000 for a 30-year period for groundwater monitoring. These costs do not include monitoring beyond the 30-year period potentially required to complete A/M Area groundwater remediation.

State Acceptance. SCDHEC has approved the existing A/M Area Groundwater Corrective Action Program as an intermediate step leading toward a complete RCRA corrective action program. The final action for this mediaspecific operable unit will be selected through subsequent Proposed Plans and modifications to the RCRA permit.

Community Acceptance. Community acceptance of the interim action will be evaluated and included after the public comment period for the Proposed Plan.

IX. Selected Remedy

The preferred alternative for the A/M Area Groundwater Corrective Action Program is Alternative 2: Groundwater Recovery with Treatment by Air Stripping. This alternative includes installing groundwater recovery wells at strategic locations throughout the A/M Area, extracting the contaminated groundwater, processing the groundwater through an air stripper to remove volatile solvents, discharging the treated effluent to an NPDES permitted

outfall, and conducting a treatability study for emissions from the air stripper. This alternative was implemented in 1985 as an interim remedial action.

This alternative calls for the design and implementation of an interim remedial action to protect human health and the environment. The goals of this remedial action are to (1) prevent further groundwater plume migration and initiate groundwater restoration while risk assessment activities are being planned and conducted, and (2) obtain further information about the response of the aquifer to remediation measures. The ultimate goal of remediation will be determined in a final remedial action for this operable unit. This remedial action will be monitored carefully to determine the feasibility of achieving this goal with this method and to ensure that hydraulic control of the contaminated plume is maintained. After completion of the characterization and evaluation of risk of the A/M Area Groundwater Operable Unit and the source-specificoperable units impacting the M-Area groundwater, a final ROD for the M-Area groundwater, which specifies the final remediation goals and anticipated remediation timeframe, will be prepared.

X. Path Forward

Currently, the groundwater corrective action program is undergoing enhancements and new technologies are being demonstrated. "Path Forward" accomplishments and programs that are part of the corrective action program and are related to the A/M Area Groundwater Operable Unit are described below.

M-Area Groundwater Remediation. Increasing groundwater flow to the M-Area HWMF air stripper was accomplished during 1990. SRS received approval from SCDHEC to operate the M-Area corrective action system (air stripper and 11 recovery wells) at increased flow rates. The air stripper is currently operating at 500 gpm. Testing will continue in an effort to further increase recovery of groundwater and speed up the removal of VOCs.

SRS is also preparing to initiate an off-gas treatment evaluation for air stripping gaseous effluents. The integrated demonstration program, sponsored by the DOE Office of Technology Development at SRS, will demonstrate and assess the efficiency and cost effectiveness of several innovative destructive or hybrid off-gas treatment systems. Classes of technologies to be demonstrated include catalytic, biologic, thermal, electrochemical, and carbon regeneration systems. The technologies were selected on the basis of technical merit and the appropriateness of the technology for DOE's (complex wide) remedial requirements.

The demonstration of the selected technologies will occur in the A/M Area of SRS in the vicinity of the A-014 outfall where a vadose zone vacuum extraction well currently exists. The technologies slated for assessment, beginning in 1992, include: steam regeneration of activated carbon, gas-phase bioreaction, membrane separation, high-energy corona, photocatalytic destruction, and thermal catalytic destruction.

SRS anticipates that gaseous effluents from the M-Area air stripper will undergo further treatment in the near future using one of these remedial

technologies. The air stripper effluent treatment will be added to the A/M Area Groundwater Corrective Action Program upon completion of the technical evaluation. The groundwater recovery efforts in A/M Area will continue to be expanded to meet the requirements of the RCRA Hazardous Waste Permit and the overall goal of achieving hydraulic control to minimize any further migration and expansion of the contaminant plume.

Northeastern Sector Groundwater Remediation. A remediation program is in progress to address contamination near the northern boundary of SRS. SRS has completed construction of a SCDHEC-approved groundwater recovery system located near the SRL facility. An air stripping system has also been relocated to this area which SRS began operating in March 1992. This facility is treating groundwater near the SRS boundary, initially from a single extraction well. Additional recovery systems are planned for this area.

A recovery well, different in design from that used in M-Area, will be used for the Northeastern Sector. The well will be designed to screen only selected zones of high concentration or high water production, instead of the fully penetrating screen design used in M-Area. This will allow for selective pumping of contaminated zones while avoiding pumping of clean zones. This approach is more costly though, since more wells are necessary to screen individual zones. Other designs which will be considered for cost savings include using 4- or 6-inch casing.

The final extent of remediation in the Northeastern Sector will be the initial work involved in a further remediation effort for this area. Design, construction, and implementation of further remediation systems will be the main focus of Phase II. At this time, it is anticipated that an additional air stripper will be required. The air stripping unit will be equipped with an off-gas treatment system which can accommodate the effluent from the 70 gpm air stripper which became operational in March 1992.

Southern Sector Groundwater Remediation. A less concentrated plume of chlorinated solvents exists south of the M-Area HWMF. An investigation was carried out in order to determine the degree and extent of remediation required. The investigation consisted of installing monitoring wells, collecting geologic information, and characterizing the aquifer. In an additional remediation effort, SRS will install additional groundwater recovery wells in order to upgrade the corrective action system to meet the requirements of the RCRA Hazardous Waste Permit.

In addition to further groundwater recovery efforts, SRS will also consider other treatment systems and technologies for the Southern Sector including remote or satellite air stripping, air sparged tanks, spray irrigation, reinjection or artificial recharge, in-situ remediation, UV peroxidation, and enhanced bioreclamation. SRS will use the characterization data, exposure assessment criteria, and technology test information to formulate a detailed corrective action plan.

Vadose Zone Corrective Action Program. SRS has initiated a program to remediate soils above the groundwater at four locations in M-Area where solvents were released. SRS has performed a characterization study of each area. Presently, SRS is preparing the designs and costs of the planned

systems.

SRS recently (7/27/90-12/18/90) conducted a large experimental program (In-situ Air-Stripping Demonstration) near the closed M-Area HWMF. This program included implementation of a vacuum extraction system and testing of new well installation techniques. The vacuum extraction system is designed to remove VOCs from soils above the shallow aquifer. The demonstration system has extracted VOCs that, if left in place, would have eventually migrated into the groundwater.

As part of the vacuum extraction system, SRL has installed a series of horizontal wells into contaminated soils and groundwater. These wells are designed to accelerate remediation through in-situ air stripping and have been used for soil and groundwater gas extraction.

The SRS decision to implement a vadose zone corrective action program was voluntary, and was based on the success of a vacuum extraction pilot study conducted in March 1987. The 1987 study was successful, with the removal of almost 1500 pounds of chlorinated solvents during 3 weeks of operation. About 16,000 pounds of chlorinated solvents were removed from the subsurface and groundwater during a 5-month test in 1990. The DOE Office of Technology Development is also sponsoring further demonstration activities associated with remediation of vadose zone soils (and underlying groundwater) using vacuum extraction.

SRS is proposing to conduct further in-situ testing by injecting small amounts of methane into a horizontal well to facilitate and enhance in-situ bioremediation. The demonstration will involve stimulation of indigenous microorganisms to degrade TCE and PCE in-situ by addition of nutrients (methane) to the subsurface via the horizontal well used for air injection during the in-situ air stripping demonstration. Horizontal wells provide an advantage due to the increased surface area for better delivery of nutrients, better extraction of gas in the vadose zone, and lesser likelihood for clogging and plugging of the well casing.

In-situ bioremediation coupled with vapor extraction is expected to lead to a significant reduction in the time required to complete aremediation since bioremediation provides a second simultaneous pathway for removal (destruction) of the TCE. Furthermore, the stimulated indigenous microorganisms will gain access to TCE in the subsurface that may be difficult to remove by conventional methods.

Air/methane mixtures have been demonstrated in the laboratory to stimulate selected members of the indigenous microbial community that have the capability to degrade TCE. The nutrient, methane, will be supplied via the horizontal wells at a low concentration in air (1-3%), for a period not to exceed 12 months. A vacuum will be applied to the upper well (vadose zone) to encourage air/methane movement through the upper saturated zone and lower vadose zone and to inhibit spreading of the plume. This technology also may be applicable to the treatment of underlying groundwater. A lower horizontal well screened in the saturated zone will test the feasibility of this approach.

Dense Non-Aqueous Phase Liquids (DNAPLs). Recent groundwater monitoring

results indicate the presence of a separate phase of concentrated, undissolved chlorinated solvents, known as DNAPLs, in one shallow aquifer monitoring well located near the closed M-Area HWMF. SRS has initiated plans to further characterize and recover these chlorinated solvents. These plans include confirmation sampling of specified monitoring wells for DNAPLs at suspect locations, geophysical and geological characterization of the subsurface, developing and testing a system to recover DNAPLs, and a method to treat or dispose of reclaimed DNAPLs.

An information workshop on DNAPLs was sponsored by DOE in mid-1991 in Atlanta, in an effort to better inform investigators and environmental regulators, and to become more familiar with the DNAPLs issue at other industrial sites. The workshop was very successful and promises to attract advanced technical applications to SRS for the planned DNAPLs characterization andassessment studies.

XI. Statutory Determination

The preferred alternative for the A/M Area Groundwater Operable Unit, an interim action, is Alternative 2: Groundwater Recovery with Treatment by Air Stripping. Based on information available at the time that this alternative was selected, and based on currently available information, this alternative appears to provide the best balance with respect to the nine evaluation criteria specified in the NCP. This alternative satisfies the statutory requirements of protection of human health and the environment, with respect to the water extracted from the ground. It was also selected for its cost effectiveness and implementability (minimal attention and maintenance during operation).

However, Alternative 2 is an action which will not fully remediate the A/M Area Groundwater Operable Unit. The action attempts to provide the best currently available method by which to remediate contaminated groundwater. The interim remedy complies with ARARs for that portion of the groundwater removed from the A/M Area Groundwater Operable Unit and treated at the surface, with the final remedy obtaining compliance with ARARs or justifying a waiver for the remainder of the A/M Area Groundwater Operable Unit. For this interim remedy, the alternative permanently and significantly reduces the toxicity, mobility, and volume of hazardous substances through their removal from the groundwater. Air effluent treatment will be discussed in the final proposed plan for this operable unit. This interim remedy is not inconsistent with, nor precludes the implementation of, the expected final remedy because it has, and continues to, reduce the overall quantity of contaminants in the A/M Area groundwater. This is not inconsistent with the overall remedial action goal of removing contaminants which could threaten human health or the environment.

APPENDIX A
References for Development of ROD Format

Crane, Jeffrey L., 1992. "Working Meeting Notice for M-Area RODs: M-Area Groundwater, M-Area Settling Basin, Met Lab Basin," Letter to Chris Bergren (WSRC), U.S. Environmental Protection Agency, Region IV, Atlanta, GA, March 12, 1992.

EPA, 1989. "A Guide to Developing Superfund Records of Decision," OSWER Directive 9335.3-02FS-1, U.S. Environmental Protection Agency, Washington, D.C., November 1989.

EPA, 1991. "Guide to Developing Superfund No Action, Interim Action, and Contingency Remedy RODs," OSWER Publication 9355.3-02FS-3, U.S. Environmental Protection Agency, Washington, D.C., April 1991.

Longest, Henry L., and Bruce M. Diamond, 1990. "Suggested ROD Language for Various Groundwater Remediation Options," OSWER Directive 9283.103, U.S. Environmental Protection Agency, Washington, D.C., October 10, 1990.

WSRC, 1990. "RCRA Facility Investigation/Remedial Investigation Program Plan," WSRC-RP-89-994, Chapter 15, Westinghouse Savannah River Company, Aiken, South Carolina, September 1990.

APPENDIX B

Responsiveness Summary

No comments were received during the public comment review period.

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 06/29/1992
Operable Unit: 02
ROD ID: EPA/ROD/R04-92/109

Media: Soil; Sediment; Debris; Surface Water.

Contaminant: VOCs; Metals; Acids.

Abstract: SITE HISTORY/DESCRIPTION: The 300-square-mile Savannah River (USDOE) site (SRS) is a Department of Energy (DOE) facility located in Aiken, Barnwell, and Allendale Counties, South Carolina, 20 miles south of Aiken, South Carolina, and 25 miles southeast of Augusta, Georgia. Land use in the surrounding area is primarily agricultural. The Savannah River Site is a secured facility with no residents. The site, cooperated by the Westinghouse Savannah River Company, is a national defense-related facility producing tritium, plutonium, and other special nuclear materials. From 1956 to 1985, SRS used a northwest portion of the site as a hazardous waste management facility (HWMF), which received waste from the Savannah River Metallurgical Laboratory (MET LAB). Activities at MET LAB included corrosion testing on stainless steels and nickel-based alloys. This process required degreasing and cleaning metal parts and sample etching. Solvents used in the degreasing included acetone, carbon tetrachloride, TCA, and TCE. Potassium chloride, sodium cyanide, and hydrofluoric acids were used in the etching. All of these chemicals were used and discharged to the HWMF in small quantities. The MET LAB HWMF, or OU2, consisted of a vitrified clay process sewer line, which carried effluent from the laboratory to a basin, and a drainage outfall, which flowed into an adjacent Carolina Bay, a special ecological environment. The contaminated sediment in the bottom of the basin total 450 cubic yards. The drainage outfall consisted of a pipe beneath a roadway

and a drainage ditch from the roadway into the Carolina Bay during periods of heavy rainfall. Effluents to this system consisted mainly of noncontact cooling waters and small quantities of laboratory rinse water containing the previously named hazardous substances. Beginning in 1983, hazardous wastes from the metallurgical laboratory building were sent to a TSD facility onsite at SRS, and in 1985 the process sewer line was closed. This interim ROD integrates previously completed RCRA closure activities that were required and approved by the South Carolina Department of Health and Environmental Control. Future RODs will address final remedy selection for the site ground water and remaining contaminants associated with the MET LAB HWMF. The primary contaminants of concern affecting the soil, sediment, debris, and surface water are VOCs, including TCE; metals, including lead and chromium; and acids. PERFORMANCE STANDARDS OR GOALS: No chemical-specific clean-up standards were specified in this interim ROD, but will be provided for the final MET LAB HWMF remedial action. The goal of this interim ROD is to integrate prior RCRA decisions into the CERCLA process. The goal of the remediation is to minimize the migration of contaminants to the ground water and eliminate surface transport pathways. INSTITUTIONAL CONTROLS: A deed restriction on the MET LAB HWMF will be maintained with the Aiken County zoning authority as required by the South Carolina Hazardous Waste Management Regulations.

Remedy: SELECTED REMEDIAL ACTION: The selected remedial action for this site includes excavating and compacting the process sewer line and associated soil and sediment, placing them in the basin, and installing a low permeability cap over the basin; sampling the accumulated rainwater in the basin with onsite discharge and/or treatment, if constituent concentrations in the accumulated rainwater exceed NPDES discharge standards; maintaining the cap; monitoring ground water; and implementing institutional controls, including deed restrictions. The estimated present worth cost for this interim remedial action is $2,000,000, which includes an annual O&M cost of $20,000 for 30 years.

Text: Full-text ROD document follows on next page.

Text:
INTERIM ACTION RECORD OF DECISION REMEDIAL ALTERNATIVE SELECTION

Metallurgical Laboratory Hazardous Waste Management Facility
Operable Unit

Savannah River Site
Aiken County, South Carolina

Prepared by:

U.S. Department of Energy
Savannah River Field Office
Aiken, South Carolina

DECLARATION FOR THE INTERIM ACTION RECORD OF DECISION

Site Name and Location

Metallurgical Laboratory Hazardous Waste Management Facility (HWMF) Operable Unit Savannah River Site Aiken County, South Carolina

Appendix C of the draft Federal Facility Agreement (FFA) refers to this operable unit as the 723-A Met Lab Basin/Carolina Bay (Building Number 904-110G).

Statement of Basis and Purpose

This document presents the selected interim remedial action for the Metallurgical Laboratory HWMF Operable Unit at the Savannah River Site (SRS), which was developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record file for this specific operable unit.

Description of the Selected Remedy

The interim action selected remedy involves the placement of all contaminated materials under a low permeability soil cap. This remedy prevents physical exposure to contaminants and mitigates further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport.

A risk evaluation will be developed for the Metallurgical Laboratory HWMF after final closure of the basin. A risk assessment of the Carolina Bay has been developed and is currently under review by the State and EPA. Both risk assessments will be addressed in the final Record of Decision (ROD).

The major components of the interim action remedy include:

- Sampling of accumulated rainwater in the basin;

- Treating and releasing excess water to a NPDES permitted outfall;
- Excavation of the process sewer line and associated soils and placement in the basin;
- Compacting of basin and process sewer line materials;
- Installing a low permeability cap over the basin.

Declaration Statement

The interim action is hereby selected by mutual agreement of the U.S. Department of Energy and the U.S. Environmental Protection Agency. This interim action is protective of human health and the environment, complies with Federal and State applicable or relevant and appropriate requirements (ARARs) for this limited-scope action, and is cost-effective. This action is interim and is not intended to utilize permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable for the Metallurgical Laboratory HWMF Operable Unit. Because this action does not constitute the final remedy for the Metallurgical Laboratory HWMF Operable Unit, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element will be fully addressed by the final response action. Subsequent actions are planned to address fully the threats posed by the conditions at the Metallurgical Laboratory HWMF Operable Unit. Because this remedy may result in hazardous substances remaining in the operable unit above health-based levels, a five-year review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment after commencement of the remedial action. Because this is an interim action ROD, review of this operable unit and of this remedy will be conducted by the Environmental Protection Agency (EPA) until a final remedial alternative for the Metallurgical Laboratory HWMF Operable Unit is selected.

SUMMARY OF INTERIM ACTION
REMEDIAL ALTERNATIVE SELECTION

Metallurgical Laboratory Hazardous Waste Management Facility
Operable Unit

Savannah River Site
Aiken County, South Carolina

Prepared by:

U.S. Department of Energy
Savannah River Field Office
Aiken, South Carolina

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Appendix A

References for Development of ROD Format

Crane, Jeffrey L., 1992. "Working Meeting Notice for M-Area RODs, M-Area Groundwater, M-Area Settling Basin, Met Lab Basin," Letter to Chris Bergren (WSRC), U.S. Environmental Protection Agency, Region IV, Atlanta, GA, March 12, 1992.

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Longest, Henry L., and Bruce M. Diamond, 1990. "Suggested ROD Language for Various Groundwater Remediation Options," OSWER Directive 9283.1-03, U.S. Environmental Protection Agency, Washington, D.C., October 10, 1990.

WSRC, 1990. "RCRA Facility Investigation/Remedial Investigation Program Plan," WSRC-RP-89-994, Chapter 15, Westinghouse Savannah River Company, Aiken, South Carolina, September 1990.

Appendix B

Responsiveness Summary

(No comments were received during the public review period)

I. Site and Operable Unit Names, Locations, and Descriptions

The Savannah River Site (SRS) occupies approximately 300 square miles adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina (Figure 1). SRS is a secured facility with no permanent residents. The site is approximately 25 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina. The average population density in the counties surrounding SRS ranges from 23-560 people per square mile with the largest concentration in the Augusta, Georgia, metropolitan area. Based on 1980 census data (1990 data not available), the population within a 50-mile (80 km) radius of SRS is approximately 555,100.

SRS is owned by the United States Department of Energy (DOE). Westinghouse Savannah River Company (WSRC) is a co-operator, providing management and operation services for DOE. SRS produces tritium, plutonium, and other special nuclear materials for national defense. The site also provides nuclear materials for the space program, and conducts medical, industrial, and research efforts. The A/M Area, located in the northwest portion of the SRS (Figure 1), contains nuclear fuel fabrication buildings, office buildings, and research areas.

The Metallurgical Laboratory HWMF is a source-specific operable unit within the A/M Area Fundamental Study Area. The Metallurgical Laboratory HWMF includes an abandoned portion of a process sewer line, a seepage basin, a drainage outfall, and a Carolina bay as shown in Figure 2. The nearest plant boundary is located approximately three-fourths of a mile to the northwest of this operable unit.

II. Operable Unit History and Compliance History

Operable Unit History

The Metallurgical Laboratory HWMF began receiving effluent from the Savannah River Laboratory (SRL) Equipment Engineering Division Metallurgical Laboratory (Building 723-A) in 1956. The effluent consisted primarily of noncontact cooling water (water which does not contact process operations) and small quantities of laboratory rinse water containing hazardous substances. The release of these substances to the Metallurgical Laboratory HWMF was discontinued in 1983. Since 1983, hazardous wastes from the Metallurgical Laboratory have been stored at a treatment, storage, and disposal (TSD) facility within SRS awaiting final treatment and disposal in accordance with South Carolina Department of Health and Environmental Control (SCDHEC) regulations. Discharges to the basin during the period from 1983 to November 8, 1985, consisted of non-hazardous effluent. All flow to the Metallurgical Laboratory Basin was terminated on November 8, 1985, when the process sewer line was plugged. The Metallurgical Laboratory non-hazardous effluent was rerouted to a National Pollutant Discharge Elimination System (NPDES) permitted outfall at SRS.

The Metallurgical Laboratory was used for corrosion testing on stainless steels and nickel-based alloys. This testing required degreasing and cleaning metal parts, etching sample identification information on the parts, and photographing the samples. Cooling water was used to condense nitric acid solution generated from corrosion testing. Small quantities of laboratory rinse water were generated from washing laboratory glassware.

Degreasing involved immersing metal parts in solvents to remove dirt and grease. Solvents used for degreasing metal samples included acetone, 1,1,1-trichloroethane, trichloroethylene, and tetrachloromethane (carbon tetrachloride). When the solvents became saturated with grease and were no longer usable, they were discharged to the HWMF in quantities of less than 0.25 gallons at a time.

Potassium cyanide, sodium cyanide, and hydrofluoric acids were used as etchants for preparing samples for metallographic evaluation. These chemicals were used and discharged intermittently in minute quantities (1 to 50 ml) to the HWMF over its operational history.

Laboratory operations included cleaning of stainless steel fill and capillary tubing. The waste from this operation, which contained hydrofluoric acid, acetic acid, and fluoride salts, was discharged intermittently in small quantities to the HWMF over its operational history.

Effluent was discharged intermittently from the Metallurgical Laboratory to the Metallurgical Laboratory Basin via an 8-inch diameter, vitrified clay process sewer line buried approximately 6 feet underground. A portion of the process sewer was capped and abandoned in place on November 8, 1985. Non-contact cooling water was discharged at a rate of approximately 1000 gallons per day (gpd) throughout the operating period of the basin (1956 to November 8, 1985). Rinse water from photographic processes and various laboratory operations, including cleaning metal samples and laboratory equipment, was discharged at a rate of approximately 125 gpd. No radioactive materials were known to have been discharged to the HWMF.

During periods of heavy rainfall, wastewater and surface water overflowed a drainage outfall at the Metallurgical Laboratory Basin into the adjacent Carolina Bay. The basin outfall consisted of a buried pipe beneath the roadway and a drainage ditch from the roadway into the Carolina Bay. The overflow pipe was excavated after discharges to the basin were halted in 1985. The Carolina Bay currently receives stormwater runoff from the spare machinery storage area, and surface runoff and discharge of cooling water from a coal-fired power plant (Building 784-A). The maximum volume of effluent discharged from the power plant was approximately 300,000 gpd, but is presently much less.

Compliance History

On September 24, 1985, the Natural Resources Defense Council (NRDC) and others filed a complaint against DOE concerning the Metallurgical Laboratory Basin and neighboring Carolina Bay. The associated lawsuit resulted in a Consent Decree in June 1988 which mandated that the Metallurgical Laboratory HWMF and associated Carolina Bay were subject to RCRA (Docket #CVAC1:85-2583

-6, U.S. District Court, District of South Carolina, Aiken Division). The basin and sewer line portions of the Metallurgical Laboratory HWMF are being closed under interim status regulations South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.265 and will be permitted as a hazardous waste management facility by a Post-Closure Care, Part B Permit SCHWMR R.61-79.264.

A RCRA closure plan for the basin and sewer line portions of the Metallurgical Laboratory HWMF was submitted to, and approved by, SCDHEC in June 1991. The intent of the closure plan is to ensure the basin and sewer line portions of the Metallurgical Laboratory HWMF will be closed in a manner that controls, minimizes, or eliminates (to the extent necessary to prevent threats to human health and the environment) post-closure migration of hazardous constituents and decomposition products to the vadose zone, groundwater, surface waters, or atmosphere.

The Metallurgical Laboratory HWMF became subject to CERCLA requirements as a result of SRS being placed on the National Priorities List (NPL) in December 1989. Due to the multiple source areas in close proximity and the co-mingling of contaminants emanating from these source areas, the A/M Area has been designated a Fundamental Study Area. The purpose of this designation is to facilitate the coordination of remedy selection decisions for the operable units in this area. The Metallurgical Laboratory HWMF has been designated as a source-specific operable unit within the A/M Area Fundamental Study Area.

III. Highlights of Community Participation

No comments were received during the public review period.

IV. Scope and Role of Operable Unit within the Site Strategy

The purpose of this interim action for the Metallurgical Laboratory HWMF Operable Unit is to minimize migration of contaminants to groundwater from the Metallurgical Laboratory Basin sediments and sediments associated with the process sewer line while risk assessment activities for the Carolina Bay are being planned and conducted.

The interim remedial action will be consistent with any planned future actions for this operable unit.

The groundwater associated with the Metallurgical Laboratory is addressed in the ROD for the A/M Area Groundwater Operable Unit.

V. Summary of Operable Unit Characteristics

Various sampling activities conducted at the Metallurgical Laboratory HWMF since November 1985, when its use was discontinued, indicate that contamination is present in groundwater, basin surface water, soil, and basin sediments. A characterization program for the Metallurgical Laboratory Basin and associated process sewer line was conducted from September 1984 to January 1985. A total of 70 sediment samples were analyzed, with 56 collected in and around the basin and 14 collected at joints in the process sewer pipeline. All 70 samples were analyzed for

metals, inorganic ions, pH, specific conductance, and volatile solids. A total of seven soil borings were taken from beneath and around the basin. Soil and sludge samples to a depth of 20 feet were collected at three locations within the basin and analyzed. Soil outside the basin was collected to a depth of 25 feet at four locations. The samples were analyzed for organic solvents, inorganic compounds, and metals.

Analytical results indicate that no significant organic contamination exists in any of the basin sediments sampled. Analytical results for inorganics indicate elevated concentration levels of sulfate and nitrate in the 5 to 8 foot-depth samples taken beneath the basin. Cyanide was detected only in the top layer of the basin sediments at concentrations slightly above background. Slightly elevated cyanide concentrations were detected along the process sewer line. Metals were detected; however, the results of the EP toxicity test (the approved leach test at the time these samples were taken) for the process sewer line and basin soils showed the concentrations of metals were all substantially below the EP concentration criteria.

The Metallurgical Laboratory HWMF is located in the general vicinity of a documented groundwater plume of volatile organic contamination in the A/M Area. The groundwater monitoring well network around the HWMF consists of 18 wells screened in various hydrologic intervals beneath the unit. The wells are monitored on a quarterly basis. Chlorinated solvents, specifically trichloroethylene and tetrachloroethylene, have been measured at levels above the primary drinking water standards in both downgradient and upgradient wells.

A preliminary characterization of the Carolina Bay was performed in 1988 to determine whether constituents had migrated from the Metallurgical Laboratory Basin. A baseline risk assessment for the Carolina Bay is currently being conducted. The potential remedial resolution for the bay will be contained in the final ROD.

VI. Summary of Operable Unit Risks

A risk evaluation will be performed after closure of the Metallurgical Laboratory Basin and characterization of the Carolina Bay. The previous risk analysis, performed in 1985 for the Metallurgical Laboratory HWMF, was used in the development of closure alternatives. The results of the previous risk analysis, in addition to available closure and post-closure data, will be utilized to evaluate potential post-closure risks.

The chemicals that were evaluated in the 1985 risk assessment work included: radium, chromium, lead, mercury, 1,1,1-trichloroethane, tetrachloromethane, tetrachloroethylene, and trichloroethylene.

Risk analysis work conducted in 1985 to evaluate closure options for the Metallurgical Laboratory HWMF, indicated that contamination was present in groundwater, basin surface water, soil, and basin sediments. However, the current risk evaluation program will be based on available post-closure information for groundwater, surface water, soil, and sediments. Furthermore, the risk evaluation work will be conducted in two parts based on source-specific units within the Fundamental Study Area.

The preferred alternative for closure of the Metallurgical Laboratory HWMF involves no waste removal, excavation of the process sewer line and associated contaminated sediments and placement in the basin, basin closure (capping), and characterization of the associated Carolina Bay. Because the basin will be capped, this closure will minimize any potential exposure through surface pathways (soil, sediment, and air). A risk evaluation will be performed to address these post-closure surface pathways.

Subsurface contamination resulting from the Metallurgical Laboratory HWMF is currently being addressed as part of the on-going A/M Area Groundwater Corrective Action Program. Risks associated with the Metallurgical Laboratory HWMF subsurface pathways (vadose zone and groundwater) are a subset of the risks for the entire A/M Area Groundwater Operable Unit. Therefore, the Metallurgical Laboratory HWMF subsurface unit risks will be addressed as part of a separate baseline risk assessment for the A/M Area Groundwater Operable Unit.

Additional analyses of the contamination associated with the Carolina Bay are being considered as part of a risk assessment currently being conducted. This will result in a complete characterization of the unit.

The potential pathways for human exposure are through surface, subsurface, and atmospheric transport of contaminants. The extent to which remediation and closure activities will eliminate surface and associated atmospheric pathways will be addressed in the Metallurgical Laboratory HWMF risk evaluation. Subsurface exposure pathways are to be evaluated in the separate A/M Area Groundwater risk assessment.

It is expected that the risk evaluation will show reduced or no potential for risk to human health and the environment. However, the potential for human exposure does exist.

The primary potential for ecological risks is through contamination associated with the Carolina Bay. Further assessment of these risks are to be conducted in the future.

Potential risks associated with the post-closure conditions of the basin and associated process sewer line will be evaluated in the Metallurgical Laboratory HWMF risk evaluation and the A/M Area Groundwater risk assessment.

VII. Description of Alternatives

The following sections include brief descriptions of the remedial alternatives developed in 1985 for the Metallurgical Laboratory HWMF. Because the risk assessment for the Carolina Bay is not completed, the alternatives were based on remediation of the process sewer line and basin portions of the Metallurgical Laboratory HWMF only. Final plans for the Metallurgical Laboratory HWMF will address all portions of the HWMF, including the Carolina Bay. In accordance with the NCP, the No Action Alternative was set forth as a baseline for comparison. The alternatives originally developed included:

Alternative 1

No Action

Alternative 2

No Waste Removal, No Action for Process Sewer Line, Basin Closure, and Evaluation of the Carolina Bay

Alternative 3

Waste Removal, No Action for Process Sewer Line, Basin Closure, and Evaluation of the Carolina Bay

Alternative 4

No Waste Removal, Excavation of Process Sewer Line, Basin Closure, and Evaluation of the Carolina Bay

Alternative 4 was selected in 1985 as the preferred alternative. Closure activities, in accordance with an approved RCRA Closure Plan, began in 1991 and are still in progress. The remainder of this section contains a description of each of the four alternatives as they were developed and considered in 1985.

Alternative 1: No Action

Under the No Action Alternative, soils near the process sewer line, the sediment in the Metallurgical Laboratory Basin and the soils in the Carolina Bay would remain in place. The groundwater monitoring program would continue for a 30-year period and any additional time required to remediate the A/M Area Groundwater

Treatment Components. Under this alternative, the Metallurgical Laboratory Basin sediments, the soils near the process sewer line, and the soils in the Carolina Bay would be left in place and no remedial efforts would be conducted to prevent the leaching of chemical residuals to the groundwater.

Engineering Controls. The groundwater would be monitored quarterly for one year, then annually for the next 29 years. Site maintenance, including inspection of the existing exclusion fence, would be implemented for the entire 30-year period, and any additional time required to remediate the A/M Area groundwater.

Institutional Controls. The Metallurgical Laboratory HWMF is located in an area accessible only by roads that are controlled continuously by manned barricades within SRS. The HWMF is located immediately outside the A-Area operating fence, but within the fenced area of the SRS. The basin area is periodically patrolled by security personnel and is surrounded by an exclusion fence. SRS must also inspect all HWMFs in accordance with RCRA requirements. Other institutional controls would include submission of applicable survey plats containing the information specified in SCHWMR R.61-79.264.119 to the Aiken County, South Carolina zoning authority and to SCDHEC. In addition, the plats would be recorded with the Aiken County Registrar of Deeds and, as required by SCHWMR R.61-79.265.120, notices would

be placed with the federal government's deed to the SRS land.

Quantity of Waste. No waste would be removed or treated under the No Action Alternative. The amount of contaminated sediment remaining in the basin would be approximately 450 cubic yards. The amount of rainwater in the basin would fluctuate, but would be approximately 30,000 gallons (based on a one foot depth).

Implementation Requirements. The No Action Alternative requires implementation of the aforementioned institutional controls.

Estimated Construction and Operation and Maintenance (O&M) Costs. Additional monitoring wells would not be installed under the No Action Alternative. Costs for this alternative were originally estimated to be:

- Capital Cost $ 0
- Annual O&M Costs $20,000

ARARs Associated with the Considered Alternatives. The alternative would not be protective of human health due to continued migration of chemical residuals from the basin to groundwater. The 1985 risk assessment for the Metallurgical Laboratory HWMF details the risks involved in the leaching of the hazardous constituents to groundwater.

Alternative 2: No Waste Removal, No Action for Process Sewer Line, Basin Closure, and Evaluation of the Carolina Bay

Alternative 2 consists of sampling the accumulated rainwater in the basin and, pending confirmation of allowable chemical residual levels, release of this water to the NPDES-permitted FS-002 Outfall at Upper Three Runs Creek. The basin would then be capped with a low permeability cap. In addition, the Carolina Bay would be investigated to determine if remedial action is necessary. No remedial action would be implemented for the process sewer line and associated soils.

Treatment Components. No treatment would be implemented under Alternative 2.

Engineering Controls. If the basin water sampled indicates that water quality standards specified in the NPDES permit would be exceeded at the outfall, the effluent would not be discharged. The water would be handled as a hazardous waste under SCHWMR R.61-79 or treated to meet the NPDES permit. The basin would then be filled with clean soils, and a low permeability cap would be constructed on top of the clean fill. The cap would consist of a low permeability compacted clay layer, a geotextile fabric, and another soil layer consisting of common fill and topsoil. The topsoil would be seeded to minimize erosion. The cap would serve as a barrier to infiltration of precipitation, which in turn would limit the mobility of subsurface chemical residuals. This alternative would significantly decrease the leaching of constituents to the groundwater from the basin. Source areas associated with the process sewer line would not be addressed under this alternative.

Institutional Controls. As discussed under Alternative 1, access to the Metallurgical Laboratory Basin would be restricted by the existing exclusion fence which surrounds the immediate area of the basin. Following closure, the appropriate plats would be submitted to regulatory agencies for deed restrictions as outlined in SCHWMR R.61-79.264.119.

Quantity of Waste. The only waste that would be involved in the implementation of Alternative 2 would be the accumulated rainwater in the basin, should any exist, if sampling during closure indicated elevated chemical levels. Basin levels fluctuate due to precipitation, and could evaporate altogether. The actual quantity of rainwater would be assessed at the time of remediation, but is expected to be approximately 30,000 gallons, based on one foot depth. The waste sediments remaining in the basin would be approximately 450 cubic yards.

Implementation Requirements. Alternative 2 would not pose any significant construction or operational difficulties, although periodic inspections of the cap would be necessary. A NPDES permit modification would be required for the outfall to Upper Three Runs Creek. It was estimated that Alternative 2 would take approximately four months to implement.

Estimated Construction and Operation and Maintenance Costs. Costs for this alternative were originally estimated to be:

- Capital Cost $1,000,000
- Annual O&M Costs $20,000

ARARs Associated with the Considered Alternative. Federal RCRA regulations would be applicable, and the cap design would have to meet RCRA equivalent performance standards (SCHWMR R.61-79.264.310). A NPDES permit modification would be required for the outfall to Upper Three Runs Creek.

Alternative 3: Waste Removal, No Action for Process Sewer Line, Basin Closure, and Evaluation of the Carolina Bay

Alternative 3 consists of sampling of the basin rainwater (if any), releasing this rainwater to NPDES permitted FS-002 Outfall at Upper Three Runs Creek, removing approximately 450 cubic yards of basin sediment, backfilling the basin with clean fill, and continuing groundwater monitoring. In addition, the Carolina Bay would be investigated to evaluate what remedial actions, if any, are applicable. No remedial action would be implemented for the process sewer line and associated soils.

Treatment Components. No treatment would be implemented under Alternative 3.

Engineering Controls. As with Alternative 2, the basin liquid would be sampled before discharge to Upper Three Runs Creek. Constituent concentrations exceeding the quality standards set forth in the NPDES permit would be handled as a hazardous waste under SCHWMR R.61-79 or treated to meet the NPDES permit standards. Approximately 450 cubic yards of the sediment at the bottom of the basin would be excavated and transported to a TSD facility within the SRS. The excavation would remove nearly all

remaining waste source materials. The basin would then be backfilled with soil, regraded to original land contours, and seeded. Because waste would be removed, a low permeability cap would not be required.

Institutional Controls. Because no contamination would be left in the basin, there would be no institutional control requirements. The existing exclusion fence surrounding the Metallurgical Laboratory Basin would remain.

Quantity of Waste. This waste removal option would include excavation of all remaining source materials (approximately 450 cubic yards). The amount of basin rainwater requiring discharge would be approximately 30,000 gallons (based on a one foot depth) depending on precipitation prior to remediation.

Implementation Requirements. Implementation would require a potential NPDES permit modification for the outfall. No construction or maintenance difficulties are anticipated in sediment removal. However, approximately 20 truck loads of hazardous materials would have to be transported to a TSD facility within SRS. It was estimated that implementation of Alternative 3 would take approximately seven months.

Estimated Construction and Operation and Maintenance Costs. Costs for this alternative were originally estimated to be:

- Capital Cost $1,000,000
- Annual O&M Costs $20,000

The capital cost reflected values associated with waste removal and temporary storage at the TSD facility on the SRS property. These costs did not include final disposal at a permanent facility.

ARARs Associated with the Considered Alternative. ARARs for the liquid discharge portion of this alternative would include a NPDES permit modification. Department of Transportation (DOT) regulations for shipment of hazardous substances specified in 49 CFR 100-177 are applicable if hazardous wastes are transported off site. Disposal of the contaminated sediments would be regulated under RCRA and as specified in SCHWMR R.61-79 Part 264.

Alternative 4: No Waste Removal, Excavation of Process Sewer Line, Basin Closure, and Evaluation of the Carolina Bay

Alternative 4 is a modification of Alternative 2. It included excavation of the process sewer line and associated soil materials and placement of the materials within the basin prior to capping.

Treatment Components. No treatment would be implemented under Alternative 4.

Engineering Controls. As in Alternative 2, the basin liquid rainwater would be sampled and if the constituent concentrations exceed the water quality standards required by the NPDES permit, the water would be handled as a hazardous waste under SCHWMR R.61-79 or treated to meet the NPDES permit. Otherwise, the water would be discharged through the NPDES permitted FS-002 outfall at Upper Three Runs Creek.

The process sewer line and associated sediments would be excavated and placed inside the basin prior to installation of a low permeability cap as presented in Figure 3. The cap would serve as a barrier to infiltration of precipitation, which in turn would limit the mobility of subsurface chemical residuals.

Institutional Controls. The existing exclusion fence would remain to restrict access. In addition, the deed restrictions and institutional controls action required by SCHWMR R.61-79.264.119 would be implemented.

Quantity of Waste. The quantity of rainwater in the basin could range from 0 gallons to approximately 100,000 gallons, depending on precipitation. Based on a one foot depth in the basin, the rainwater would total 30,000 gallons. The sediments in the bottom of the basin total approximately 450 cubic yards.

Implementation Requirements. There were no implementation concerns for the liquid removal or for the installation or maintenance of the cap. It was estimated that implementation of Alternative 4 would take approximately seven months.

Estimated Construction and Operation and Maintenance Costs. Costs for this alternative were originally estimated to be:

- Capital Cost $1,400,000
- Annual O&M Costs $20,000

ARARs Associated with the Considered Alternative. One ARAR for Alternative 4 would be a NPDES permit modification for discharge of the basin rainwater to FS-002 outfall at Upper Three Runs Creek. Another ARAR would include SCHWMR R.61-79.265 for RCRA equivalent performance standards for the cap design. The equivalent performance standards include the following:

- Provide long-term minimization of migration of contaminants.
- Function with minimum maintenance.
- Promote drainage and minimize erosion or abrasion of the cover.
- Accommodate settling and subsidence to maintain cover integrity.
- Have a permeability less than that of natural subsurface soils.

VIII. Summary of Comparative Analysis of Alternatives

The NCP (40 CFR 300.430 (e)(9)) sets forth nine evaluation criteria that provide the basis for evaluating alternatives and subsequent selection of a remedy. The criteria are:

- Overall protection of human health and the environment
- Compliance with ARARs

- Long-term effectiveness and permanence
- Reductions of toxicity, mobility or volume through treatment
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

The four alternatives described in Section VII are compared in this section using these nine evaluation criteria.

Overall Protection of Human Health and the Environment. Alternative 1, the No Action Alternative, would not be protective of, and would offer no reduction in risk to human health and the environment. The No Action Alternative would allow continued transport of organic and inorganic constituents within the basin sediments to groundwater.

Alternative 2, the No Waste Removal, No Action for Process Sewer Line, Basin Closure, and Evaluation of the Carolina Bay Alternative would provide protection by isolating chemical residuals within the basin beneath a low permeability closure cap. The cap would minimize the potential for chemical residuals to enter the groundwater and would prevent direct contact by environmental receptors (e.g., vegetation: plant and tree roots) with constituents in the basin. However, this alternative could continue to allow transport of organic and inorganic constituents from contaminated sediments associated with the sewer line to the groundwater.

In Alternative 3, the Waste Removal, No Action for Process Sewer Line, Basin Closure, and Evaluation of the Carolina Bay Alternative, chemical residuals would be removed from the basin, eliminating risks associated with the basin sediments. The constituents and their associated risks would be moved to another location. The risks would still have to be addressed by ensuring that the new location is a RCRA regulated TSD facility. In addition, Alternative 3 does not address the possible transport of constituents from the process sewer line and surrounding soils to the groundwater.

In Alternative 4, the No Waste Removal, Excavation of Process Sewer Line, Basin Closure, and Evaluation of the Carolina Bay Alternative, chemical residuals within the basin and those associated with the process sewer line would be isolated beneath a low permeability cap. This alternative would minimize the migration of constituents from sediments into the groundwater, both in the basin and associated with the sewer line.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs). No state promulgated chemical-specific ARARs exist for chemical residuals in soils. However, Alternative 1 would allow continued migration of chemicals to groundwater and potentially exceed promulgated groundwater standards and

pose risks to human health and the environment.

The chemical-specific ARARs for Alternative 2 would include a NPDES permit for discharge of basin rainwater and controlling incidental exposure to chemical residuals at the Metallurgical Laboratory HWMF. A particular action-specific ARAR for Alternative 2 is the regulations regarding capping, SCHWMR R.61-79.265. The cap for this alternative must be designed and installed according to RCRA requirements to comply with the action-specific ARAR. Capping would help achieve groundwater chemical-specific requirements because it would minimize leaching of basin chemical residuals to groundwater. However, the process sewer line and associated soils could continue leaching constituents to the groundwater.

As with Alternative 2, Alternative 3 would allow continued leaching of chemical residuals to the groundwater from soils associated with the sewer line. Additionally, the removed materials must be stored at a storage facility designed to meet the TSD facility requirements set forth under SCHWMR R.61-79.264 and require a NPDES permit modification.

Alternative 4 would meet all ARARs. This alternative would minimize leaching of chemical residuals to groundwater and would meet all requirements for capping SCHWMR R.61-79.265 and NPDES discharge.

Long-term Effectiveness and Permanence. The No Action Alternative (1) is not effective over the long term and is not a permanent solution because the chemical residuals may continue to leach to groundwater. Alternatives 2 and 3 would be effective in addressing basin sediments, but would not be effective with respect to the sewer line and associated soils. Alternative 4 would be effective for known risks at the site, both for sediments in the basin and soils associated with the sewer line. Cap maintenance for Alternative 4 would continue for at least 30 years (the post-closure case period), with extension of this period reviewed every five years.

Reduction of Toxicity, Mobility, or Volume. Alternative 1 would not reduced the toxicity, mobility, or volume of contaminants at the Metallurgical Laboratory HWMF.

Alternative 2 would reduce the mobility of chemical residuals in the basin because of the low permeability cap. Leaching of contaminants to groundwater would be significantly reduced at the basin, but the chemical residuals in the sediments surrounding the sewer line would have no reduction in mobility.

Alternative 3 would decrease the volume of the constituents in the basin, but the chemical residuals associated with the sewer line would remain in place.

Alternative 4 would reduce the mobility of the basin and sewer line sediment chemical residuals through the use of a low permeability cap.

Short-Term Effectiveness. Alternatives 1, 2, and 4 would pose little or no risk to on-site workers, the community, or the environment through exposure to the identified constituents. Twenty truck loads of hazardous material must be transported as part of Alternative 3. Exposure of workers, other

SRS employees, and contractors to the hazardous materials may result from this transportation.

Estimated construction times for the alternatives are presented below:

Alternative 1

No Action None

Alternative 2

No Waste Removal, No Action for Process Sewer Line, Basin Closure, and Evaluation of the Carolina Bay 4 Months

Alternative 3

Waste Removal, No Action for Process Sewer Line, Basin Closure, and Evaluation of the Carolina Bay 7 Months

Alternative 4

No Waste Removal, Excavation of Process Sewer Line, Basin Closure, and Evaluation of the Carolina Bay
7 Months

Implementability. All of the proposed alternatives for the Metallurgical Laboratory HWMF would be easily implemented. However, Alternative 3 requires the transport of hazardous substances. There should be no problems in securing equipment and materials for the low permeability cap system, excavation of the process sewer line and associated sediments, or discharge of basin rainwater. Alternatives 2, 3 and 4 would require approval from SCDHEC for certain parts of the remedies, including the cap design and the receiving TSD facility.

Periodic inspection and, as necessary, repair of the low permeability cap would be required under Alternatives 2 and 4.

Cost. The originally estimated costs for all four alternatives include an annual O&M cost of $20,000 for a 30-year period for groundwater monitoring. These costs do not include monitoring beyond the 30-year period potentially required to complete A/M Area Groundwater remediation. The originally estimated present worth costs of each Alternative are presented below:

Alternative 1

No Action $600,000

Alternative 2

No Waste Removal, No Action for Process Sewer Line, Basin Closure, and Evaluation of the Carolina Bay $1,600,000

Alternative 3

Waste Removal, No Action for Process Sewer Line, Basin Closure, and Evaluation of the Carolina Bay $1,600,000

Alternative 4

No Waste Removal, Excavation of Process Sewer Line, Basin Closure, and Evaluation of the Carolina Bay $2,000,000

State Acceptance. SCDHEC has reviewed the closure plan and concurs with the preferred alternative, which is Alternative 4. Final approval will be made after public comments have been reviewed.

Community Acceptance. (To be addressed by DOE and EPA after the Proposed Plan public comment period.)

IX. Selected Remedy

The preferred interim action alternative for the Metallurgical Laboratory HWMF Operable Unit is Alternative 4: No Waste Removal, Excavation of Process Sewer Line, Basin Closure, and Evaluation of the Carolina Bay. Alternative 4 includes no waste removal from the basin, excavation of process sewer line and associated contaminated sediments, basin closure with a low permeability soil cap, and evaluation of the Carolina Bay.

This alternative calls for the design and implementation of an interim remedial action to protect human health and the environment. The goal of the interim remedial action is to minimize migration to groundwater of the Metallurgical Laboratory Basin sediments associated with the process sewer line while risk assessment activities for the Carolina Bay are being planned and conducted. The ultimate goal of remediation will be determined in a final remedial action for this operable unit. Upon completion of the Carolina Bay risk assessment, this interim action may be incorporated into the design of the operable unit remedy specified in the final action ROD.

X. Path Forward

Remedial actions regarding the Metallurgical Laboratory HWMF are currently being addressed as interim actions. "Path Forward" activities associated with this operable unit include a risk evaluation of the closed basin and sewer line area and a baseline risk assessment of the Carolina Bay. Upon completion of the risk evaluations, a final remedy will be selected.

XI. Statutory Determination

The preferred alternative for the Metallurgical Laboratory HWMF is Alternative 4: No Waste Removal, Excavation of Process Sewer Line, Basin Closure, and Evaluation of the Carolina Bay. The remedy is protective of human health and the environment because it prevents physical exposure to contaminants by use of containment and institutional controls and mitigates further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport.

Based on current information, Alternative 4 provides the best balance with respect to the nine criteria specified in the NCP. Although the interim

action will not fully remediate the unit because the Carolina Bay has not been addressed, the action will result in disposal of basin rainwater, containment of basin and sewer line sediments and soils in a relatively small area beneath the cap of the basin, and therefore minimize migration of chemical residuals into the groundwater. Meanwhile, the investigation and risk assessment of the Carolina Bay will be reviewed. A final remedy for the unit will be selected following the risk assessment of the Bay, assuming that all ARARs have been satisfied. The final ROD for this operable unit will address the permanence of the final action and the preference for any treatment utilized in the final action to reduce the mobility, toxicity, and volume of hazardous substances.

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 09/10/1993
Operable Unit: 06
ROD ID: EPA/ROD/R04-93/163

Media: None

Contaminant: None

Abstract: The USDOE Savannah River (Operable Unit 6) site is part of the 300square mile Savannah River Site facility located in Aiken, Barnwell, and Allendale Counties, South Carolina. Land use in the area is predominantlyagricultural, with no residential uses. The Savannah River Site (SRS), co- operated by the Westinghouse Savannah River Company, is a secured, national defense-related facility that produces tritium, plutonium, and other special nuclear materials. The site also provides nuclear materials for the space program, and conducts medical, industrial, and research efforts. From 1955 to 1988, the central area of the site, known as the F-Area, was used as a Hazardous Waste Management Facility (HWMF). The F-Area HWMF consists of three unlined, earthen surface impoundments located near the center of SRS. During site operations, the facility received waste effluents from F-Area chemical separation facilities processes, including a nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads. The three basins had acombined maximum operating capacity of 20.5 million gallons of wastewater. Significant amounts of nitrate and caustic were received from wastewater discharge into the F-Area basins, and these radioactive releases to the three basins were greater than 99% tritium. Several studies showed that 90% of the radionuclides, cations, and anions were concentrated within the top 1 foot of basin soil. In 1988, a RCRA closure plan for the site was developed. The closure of the

F-Area HWMF began in 1989, and was completed in early 1991. Closure activities included removing standing water remaining in the basins; stabilizing the basin sludge with a layer of granite, limestone, and blast furnace slag; constructing a low permeability multi-layer cap over the basins; and restoring the area. The site closure prevents physical exposure to contaminants and mitigates further migration of contaminants from the F-Area HWMF to ground water through rainwater percolation. The F-Area HWMF is being routinely inspected for a minimum of 30 years, and institutional controls, including deed restrictions, have been implemented. This ROD addresses contaminated soil and sludge in the F-Area, as OU6. Future RODs will address the remaining ground water beneath the site. EPA investigations indicate that the previous RCRA closure of the site sufficiently has reduced the threat to human health and the environment; therefore, there are no contaminants of concern affecting this site. Future RODs will address the remaining OUs found at the site. SELECTED REMEDIAL ACTION: The selected remedial action for this site is no further action, with ground water monitoring. EPA has determined that the previous RCRA closure of the site has prevented the risk of physical exposure to site contaminants, reduced further migration of site contaminants to ground water, and that the site poses no threat to human health and the environment. However, as a condition of the RCRA Hazardous Waste Permit, post closure ground water monitoring is required to verify that no unacceptable exposures to potential hazards posed by conditions at OU6 occur in the future. There are no present worth or O&M costs associated with this no action remedy. PERFORMANCE STANDARDS OR GOALS: Not applicable. INSTITUTIONAL CONTROLS: Not applicable.

Remedy: The selected final action remedy involved the stabilization and placement of all contaminated materials under a low permeability cap. This remedy prevents physical exposure to contaminants and mitigates further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport.

No further action is necessary for the unit. However, as a condition of the RCRA Hazardous Waste Permit, post closure groundwater monitoring is required to verify that no unacceptable exposures to potential hazards posed by conditions at the operable unit occur in the future.

The major components of the preventive action included:
1) Elimination of free liquids by removing liquid waste and solidifying the remaining waste and residues,

2) Stabilization of the remaining wastes to a load bearing capacity sufficient to support the cover system,
3) Placement of a final cover over the surface impoundment. The cover consists of a layer of backfill, a nine inch sand layer, a two foot layer of compacted kaolin clay, a geotextile fabric, topped with two feet of topsoil to support a vegetative cover. (See below)
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4) The H -Area HWMF is being routinely inspected for a minimum of 30 years to verify the integrity of the cover system, fences, signs, etc. Any necessary repairs to the cap will be made as part of the maintenance program.
5) Access to the H-Area HWMF is restricted to authorized personnel with appropriate training on applicable requirements. The survey plat and records associated with deed restricted use of the H- Area HWMF have been filed with Aiken County, SC.

Text: Full-text ROD document follows on next page.

Text:
UNITED STATES DEPARTMENT OF ENERGY

SAVANNAH RIVER SITE

FINAL RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION

FOR

F-Area Hazardous Waste Management Facility (U)

Prepared by
WESTINGHOUSE SAVANNAH RIVER COMPANY
SAVANNAH RIVER SITE
AIKEN, SC 29802

PREPARED FOR THE US DEPARTMENT OF ENERGY UNDER

CONTRACT DE-AC09-89SR18035

DECLARATION FOR THE FINAL RECORD OF DECISION

Site Name and Location
F-Area Hazardous Waste Management Facility (HWMF)
Savannah River Site
Aiken County, South Carolina

Appendix H of the Federal Facility Agreement (FFA) lists this unit as the F-Area Hazardous Waste Management Facility (Building Numbers 904-41G, 90442G, and 904-43G).

Statement of Basis and Purpose

This document presents the selected final preventive action for the F-Area HWMF Unit at the Savannah River Site (SRS), which was developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this unit.

Description of the Selected Remedy

The selected final action remedy involved the stabilization and placement of all contaminated materials under a low permeability cap. This remedy prevents physical exposure to contaminants and mitigates further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport.

No further action is necessary for the unit. However, as a condition of the RCRA Hazardous Waste Permit, post closure groundwater monitoring is required to verify that no unacceptable exposure to potential hazards posed by

conditions at the operable unit occur in the future.

The major components of the preventive action included:
1) Elimination of free liquids by removing liquid waste and solidifying the remaining waste and residues, 2) Stabilization of the remaining wastes to a load bearing capacity sufficient to support the cover system, 3) Placement of a final cover over the surface impoundment. The cover consists of a layer of backfill, a two foot layer of compacted kaolin clay, a nine inch layer of sand, a geotextile fabric, topped with two feet of topsoil to support a vegetative cover. (See below)

4) The F-Area HWMF is being routinely inspected for a minimum of 30 years to verify the integrity of the cover system, fences, signs, etc. Any necessary repairs to the cap will be made as part of the maintenance program.

5) Access to the F-Area HWMF is restricted to authorized personnel with appropriate training on applicable requirements. The survey plat and records associated with deed restricted use of the F-Area HWMF have been filed with Aiken County, SC.

Declaration Statement

Previous action taken at the F-Area HWMF was under a RCRA Closure Plan approved by the state of South Carolina and was protective of human health and the environment. Therefore, no further remedial action is necessary under CERCLA. To ensure continued protection of human health and the environment, this remedial action will be reviewed every 5 years, consistent with the requirements of the NCP.

SUMMARY OF FINAL ACTION
REMEDIAL ALTERNATIVE SELECTION

FOR

F-Area Hazardous Waste Management Facility (U)

Prepared by
WESTINGHOUSE SAVANNAH RIVER COMPANY
SAVANNAH RIVER SITE
AIKEN, SC 29802

PREPARED FOR THE US DEPARTMENT OF ENERGY UNDER

CONTRACT DE-AC09-89SR18035

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IV. Scope and Role of Operable Unit within the Site Strategy

V. Summary of Operable Unit Characteristics

VI. Summary of Operable Unit Risks

VII. Explanation of Significant Changes

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A. References for Development of ROD Format

B. Responsiveness Summary

I. Site and Operable Unit Names, Locations, and Descriptions

The Savannah River Site (SRS) occupies approximately 300 square miles (483 km) adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina (Figure 1). SRS is a secured facility with no permanent residents. The site is approximately 25 miles (40 km) southeast of Augusta, Georgia, and 20 miles (32 km) south of Aiken, South Carolina. The average population density in the counties surrounding SRS ranges from 23560 people per square mile (60-1452 per square km) with the largest concentration in the Augusta, Georgia, metropolitan area. Based on 1980 census data, the population within a 50-mile (80 km) radius of SRS is approximately 555,100.

SRS is owned by the United States Department of Energy (DOE). Westinghouse Savannah River Company (WSRC) is the manager and operating contractor for DOE. SRS produces tritium, plutonium, and other special nuclear materials for national defense. The site also provides nuclear materials for the space program, and conducts medical, industrial, and research efforts. The F -Area HWMF is a source specific operable unit within the F-Area Fundamental Study Area. The F-Area HWMF consists of three unlined, earthen surface impoundments located in the center of SRS, west of Road C and opposite road E approximately 5 miles (8 km) from the nearest site boundary (Figure 2).

II. Operable Unit History and Compliance History

Operable Unit History

The F-Area HWMF (basins F-1, F-2, and F-3) operated from 1955 until November 7, 1988. During that time, the facility received waste effluents from F-Area chemical separation facilities processes such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads. The maximum operating dimensions and volumetric capacities of the F-Area HWMF basins were as follows: F-1: 90 ft x 280 ft x 10.7 ft, 1.6 million gallons F-2: 90 ft x 530 ft x 10.7 ft, 3.1 million gallons F-3: 310 ft x 720 ft x 11.2 ft, 15.8 million gallons

The three basins had a combined maximum operating capacity of 20.5 million gallons of wastewater.

These basins were closed by dewatering, physically and chemically stabilizing the remaining sludges and placing a protective multi-layer cover system (Figure 3) over them to reduce rainwater contact with basin bottoms.

Compliance History

RCRA preventive actions at the F-Area HWMF were conducted pursuant to the requirements of the Resource Conservation and Recovery Act (RCRA) per Settlement Agreement 87-27-SW. In 1988, a RCRA Closure Plan was submitted to the South Carolina Department of Health and Environmental Control (SCDHEC). The closure plan underwent several revisions prior to

approval by SCDHEC in 1989. Closure of the F-Area HWMF was begun in 1989 and completed in January 1991. The F-Area HWMF was certified closed in February 1991. In April 1991, the closure certification was accepted by SCDHEC as being in compliance with RCRA requirements. A RCRA Part B Permit Application for Post-Closure Care was submitted in December 1990 and a HazardousWaste Permit was effective November 1992.

Closure activities specifically included removal of standing water remaining in the basin; stabilization of the basin sludge with a layer of granite, limestone and blast furnace slag; construction of a low permeability cap over the basin; and restoration of the area.

RCRA preventive activities at the F-Area HWMF became subject to CERCLA when the entire SRS facility was placed on the National Priorities List (NPL) in December 1989. The F-Area HWMF is a source-specific operable unit within the F-Area Fundamental Study Area.

III. Highlights of Community Participation

The public comment period ran from 18 June 93 - 2 August 93. SCDHEC submitted comments on the Proposed Plans which have been incorporated into this ROD, where appropriate.

IV. Scope and Role of Operable Unit within the Site Strategy

The selected remedy involved the placement of all contaminated materials under a low permeability cap. The remedy prevents physical exposure to contaminants and mitigates further migration of contaminants from the F-Area HWMF to groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport.

V. Summary of Operable Unit Characteristics

Waste effluents from F-Area chemical separation facilities processes such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads were discharged to the F-Area HWMF. Significant amounts of nitrate and caustic were received. Radioactive releases to these basins were greater than 99% tritium. Several studies were conducted to characterize the subsoils. A 1984 soil coring study showed that approximately 90% of the radionuclides, cations, and anions were concentrated within the top 1 foot of basin soil. The constituents of concernat the F-Area HWMF are barium, cadmium, chromium, lead, mercury, tritium, copper, cyanide, nickel, tetrachloroethylene,

trichlorofluoromethane, zinc, gross alpha, gross beta, nitrate, radium-226, radium-228, tritium, americium-241, cesium-137, curium-234/244, curium-246, cobalt-60, strontium-90, technetium-99, uranium-233/234, uranium-238.

VI. Summary of Operable Unit Risks

Due to the previous F-Area HWMF RCRA preventive action, No Further Action under CERCLA is necessary for this source control operable unit. The RCRA preventive action is protective to human health and the environment and satisfies CERCLA requirements.

Contaminated sediments of the F-Area HWMF were stabilized in the basin during closure. The basin then was covered with a low permeability soil cap. Therefore, exposure through surface soil and sediment pathways is minimized because of this RCRA cap.

Preventive alternatives were developed for the F-Area HWMF based on effective technologies available at the time the RCRA Closure Plan was prepared. The RCRA Closure Plan was initially submitted to SCDHEC in early 1989 and was approved, following several revisions, in June 1989.

Options regarding the F-Area HWMF evaluated at that time included:
Alternative 1
No Action
Alternative 2
No Waste Removal, Waste Consolidation, Treatment, and Closure
Alternative 3
Waste Removal and Closure

Alternative 2 was selected within the RCRA closure process in 1988 as the most technically effective of the three alternatives for protection of human health and the environment. Closure of the F-Area HWMF was begun in 1989 and completed in 1991. The closure was certified in February 1991 and accepted by SCDHEC as being in compliance with RCRA and state requirements. The closure is considered a final action under CERCLA.

VII. Explanation of Significant Changes

There were no significant changes.

Appendix A

References for Development of ROD Format

Weeks, Victor, 1993. "Regarding Records of Decision, F-Area and HArea, Savannah River Site, Aiken, South Carolina", Letter to Goidell (DOE), Savannah River Site, Aiken, SC, April 14, 1993.

EPA, 1991. "Guide to Developing Superfund No Action, Interim Action, and Contingency Remedy RODs," OSWER Publication 9355.3-02FS-3, U.S. Environmental Protection Agency, Washington, D.C., April 1991.

WSRC, 1992. "Draft RCRA Facility Investigation/Remedial Investigation Program Plan," WSRC-RP-89-994, Rev. 1, Chapter 15, Westinghouse Savannah

River Company, Aiken, South Carolina, May 1992.

Appendix B

Responsiveness Summary

SCDHEC submitted comments. DOE concurs with these comments and they have been incorporated into this ROD, where appropriate. These comments are available for review in the Administrative Record File.

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 09/10/1993
Operable Unit: 07
ROD ID: EPA/ROD/R04-93/164

Media: None

Contaminant: None

Abstract: The USDOE Savannah River (Operable Unit 7) site is part of the 300square mile Savannah River Site facility located in Aiken, Barnwell, and Allendale Counties, South Carolina. Land use in the area is predominantly agricultural, with no residential uses. The Savannah River Site (SRS) is a secured, national defense-related facility, co-operated by the Westinghouse Savannah River Company, that produces tritium, plutonium, and other special nuclear materials. The site also provides nuclear materials for the space program, and conducts medical, industrial, and research efforts. From 1955 to 1988, the central area of the site, termed the H-Area, was used as a Hazardous Waste Management Facility (HWMF). The H-Area HWMF consists of four unlined, earthen surface impoundments located near the center of SRS. During its operation, the facility received waste effluents from HArea chemical separation facilities processes such as a nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads. In 1962, one of three basins was closed andreplaced by a fourth basin. The three remaining basins had a combined maximum operating capacity of 26.5 million gallons of wastewater. Significant amounts of nitrate and caustic were received from wastewater discharge into the H-Area HWMF basins, and these radioactive releases to the three basins were greater than 99% tritium. Several studies showed that 90% of the radionuclides, cations, and anions were concentrated within the top 1 foot of basin soil. In 1988, a RCRA closure plan for

the site was developed. The closure of the H-Area HWMF began in 1989, and was completed in early 1991. Closure activities included removing standing water remaining in the 3 original basins and in the basin added in 1962; stabilizing the basin sludge with a layer of granite, limestone, and blast furnace slag; constructing a low permeability multi-layer cap over the basins; and restoring the area. The site closure prevents physical exposure to contaminants and mitigates further migration of contaminants from the H-Area HWMF to ground water through rainwater percolation. The H-Area HWMF is being routinely inspected for a minimum of 30 years and institutional controls, including deed restrictions, have been implemented. This ROD addresses contaminated soil and sludge in the H-Area, as OU7. Future RODs will address the ground water beneath the site. EPA investigations indicate that the previous RCRA closure of the site sufficiently has reduced the threat to human health and the environment; therefore, there are no contaminants of concern affecting this site. Future RODs will address the remaining OUs at this site. SELECTED REMEDIAL ACTION: The selected remedial action for this site is no further action, with ground water monitoring. EPA has determined that the previous RCRA closure of the site has prevented the risk of physical exposure to site contaminants, reduced further migration of site contaminants to ground water, and that the site poses no threat to human health and the environment. However, as a condition of the RCRA Hazardous Waste Permit, post-closure ground water monitoring is required to verify that no unacceptable exposures to potential hazards posed by conditions at OU7 occur in the future. There are no present worth or O&M costs associated with this no action remedy. PERFORMANCE STANDARDS OR GOALS: Not applicable. INSTITUTIONAL CONTROLS: Not applicable.

Remedy: The selected final action remedy involved the stabilization and placement of all contaminated materials under a low permeability cap. This remedy prevents physical exposure to contaminants and mitigates further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport.

No further action is necessary for the unit. However, as a condition of the RCRA Hazardous Waste Permit, post closure groundwater monitoring is required to verify that no unacceptable exposures to potential hazards posed by conditions at the operable unit occur in the future.

The major components of the preventive action included:
1) Elimination of free liquids by removing liquid waste and

solidifying the remaining waste and residues,
2) Stabilization of the remaining wastes to a load bearing capacity sufficient to support the cover system,
3) Placement of a final cover over the surface impoundment. The cover consists of a layer of backfill, a two foot layer of compacted kaolin clay, a nine inch layer of sand, a geotextile fabric, topped with two feet of topsoil to support a vegetative cover. (See below)
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4) The F-Area HWMF is being routinely inspected for a minimum of 30 years to verify the integrity of the cover system, fences, signs, etc. Any necessary repairs to the cap will be made as part of the maintenance program.
5) Access to the F-Area HWMF is restricted to authorized personnel with appropriate training on applicable requirements. The survey plat and records associated with deed restricted use of the F-Area HWMF have been filed with Aiken County, SC.

Text: Full-text ROD document follows on next page.

Text:
UNITED STATES DEPARTMENT OF ENERGY

SAVANNAH RIVER SITE

FINAL RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION

FOR

H-Area Hazardous Waste Management Facility (U)

Prepared by
WESTINGHOUSE SAVANNAH RIVER COMPANY
SAVANNAH RIVER SITE
AIKEN, SC 29802

PREPARED FOR THE US DEPARTMENT OF ENERGY UNDER

CONTRACT DE-AC09-89SR18035

DECLARATION FOR THE FINAL RECORD OF DECISION

Site Name and Location
H-Area Hazardous Waste Management Facility (HWMF)
Savannah River Site
Aiken County, South Carolina

Appendix H of the Federal Facility Agreement (FFA) lists this unit as the H-Area Hazardous Waste Management Facility (Building Numbers 904-44G, 904-45G, 904-46G, and 904-56G).

Statement of Basis and Purpose

This document presents the selected final preventive action for the H-Area HWMF Operable Unit at the Savannah River Site (SRS), which was developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this unit.

Description of the Selected Remedy

The selected final action remedy involved the stabilization and placement of all contaminated materials under a low permeability cap. This remedy prevents physical exposure to contaminants and mitigates further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport.

No further action is necessary for the unit. However, as a condition of the RCRA Hazardous Waste Permit, post closure groundwater monitoring is required to verify that no unacceptable exposures to potential hazards posed by

conditions at the operable unit occur in the future.

The major components of the preventive action included:
1) Elimination of free liquids by removing liquid waste and solidifying the remaining waste and residues, 2) Stabilization of the remaining wastes to a load bearing capacity sufficient to support the cover system, 3) Placement of a final cover over the surface impoundment. The cover consists of a layer of backfill, a nine inch sand layer, a two foot layer of compacted kaolin clay, a geotextile fabric, topped with two feet of topsoil to support a vegetative cover. (See below)

4) The H -Area HWMF is being routinely inspected for a minimum of 30 years to verify the integrity of the cover system, fences, signs, etc. Any necessary repairs to the cap will be made as part of the maintenance program.

5) Access to the H-Area HWMF is restricted to authorized personnel with appropriate training on applicable requirements. The survey plat and records associated with deed restricted use of the H- Area HWMF have been filed with Aiken County, SC.

Declaration Statement

Previous action taken at the H-Area HWMF was under a RCRA Closure Plan approved by the state of South Carolina and was protective of human health and the environment. Therefore, no further remedial action is necessary under CERCLA. To ensure continued protection of human health and the environment, this remedial action will be reviewed every 5 years, consistent with the requirements of the NCP.

SUMMARY OF FINAL ACTION
REMEDIAL ALTERNATIVE SELECTION

FOR

H-Area Hazardous Waste Management Facility (U)

Prepared by
WESTINGHOUSE SAVANNAH RIVER COMPANY
SAVANNAH RIVER SITE
AIKEN, SC 29802

PREPARED FOR THE US DEPARTMENT OF ENERGY UNDER

CONTRACT DE-AC09-89SR18036

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V. Summary of Operable Unit Characteristics

VI. Summary of Operable Unit Risks

VII. Explanation of Significant Changes

Appendices

A. References for Development of ROD Format

B. Responsiveness Summary

I. Site and Operable Unit Names, Locations, and Descriptions

The Savannah River Site (SRS) occupies approximately 300 square miles (483 km) adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina (Figure 1). SRS is a secured facility with no permanent residents. The site is approximately 25 miles (40 km) southeast of Augusta, Georgia, and 20 miles (32 km) south of Aiken, South Carolina. The average population density in the counties surrounding SRS ranges from 23-560 people per square mile (60-1452 per square km) with the largest concentration in the Augusta, Georgia, metropolitan area. Based on 1980 census data, the population within a 50-mile (80 km) radius of SRS is approximately 555,100.

SRS is owned by the United States Department of Energy (DOE). Westinghouse Savannah River Company (WSRC) is the manager and operating contractor for DOE. SRS produces tritium, plutonium, and other special nuclear materials for national defense. The site also provides nuclear materials for the space program, and conducts medical, industrial, and research efforts. The H-Area HWMF is a source specific operable unit within the H-Area Fundamental Study Area. The H-Area HWMF consists of three unline, earthen surface impoundments located in the center of SRS, southwest of Road E and north of road 4 approximately 6 miles (10 km) from the nearest site boundary (Figure 2).

II. Operable Unit History and Compliance History

Operable Unit History
The H-Area HWMF operated from 1955 until November 7, 1988. The original H-Area HWMF consisted of basins H-1, H-2 and H-3 and operated from 1955 to 1962. In 1962 H-3 was replaced by H-4. The dimensions and volumetric capacity of the basins were as follows: H-1: 90 ft x 240 ft x 9 ft, 1.1 million gallons H-2: 110 ft x 460 ft x 9 ft, 2.8 million gallons H-3: 350 ft x 480 ft x 17 ft, 9.4 million gallons H-4: (130-430) ft x 2400 ft x 8 ft, 22.6 million gallons At the time of closure, the H-Area HWMF (basins H-1, H-2, and H-4) had a combined maximum operating capacity of 26.5 million gallons of wastewater.

The H-Area HWMF received waste effluents from H-Area chemical separation facilities processes such as the nitric acid recovery unit waste storage system evaporator overheads, and general purpose evaporator overheads.

The H-3 basin was not a RCRA regulated unit but was identified as a RCRA 3004(u) unit requiring investigation and remediation. It was decided to incorporate basin H-3 into the RCRA closure.

The four basins were closed by dewatering, physically and chemically stabilizing the remaining sludges and placing a protective multi-layer cover system (Figure 3) over them reduce rainwater contact with basin bottoms.

Compliance History

Preventive actions at the H-Area HWMF were conducted pursuant to the requirements of the Resource Conservation and Recovery Act (RCRA) per Settlement Agreement 87-27-SW. In 1988, a RCRA Closure Plan was submitted to the South Carolina Department of Health and Environmental Control (SCDHEC). The closure plan underwent several revisions prior to approval by SCDHEC in 1989. Closure of the unit was begun in 1989 and completed in May 1991. The H-Area HWMF was certified closed in July 1991. In October 1991, the closure certification was accepted by SCDHEC as being in compliance with RCRA requirements. A RCRA Part B Permit Application for Post-Closure Care was submitted in December 1990 and a Hazardous Waste Permit was effective November 1992.

Closure activities specifically included removal of standing water remaining in the basin; stabilization of the basin sludge with a layer of granite, limestone, and blast furnace slag; construction of a low permeability cap over the basin; and restoration of the area.

Preventive activities at the H-Area HWMF became subject to CERCLA when the entire SRS facility was placed on the National Priorities List (NPL) in December 1989. The H-Area HWMF is a source-specific operable unit within the H-Area Fundamental Study Area.

III. Highlights of Community Participation

The public review period that ran from 18 June 93 - 2 August 93. SCDHEC submitted comments on the Proposed Plans which have been incorporated into this ROD, where appropriate.

IV. Scope and Role of Operable Unit Within the Site Strategy

The selected remedy involved the placement of all contaminated materials under a low permeability cap. The remedy prevents physical exposure to contaminants and mitigates further migration of contaminants from the H-Area HWMF to groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport.

V. Summary of Operable Unit Characteristics

Waste effluents from H-Area chemical separation facilities processes such as the nitric acid recovery unit, waste storage system evaporator overheads,

and general purpose evaporator overheads were discharged to the H-Area HWMF. Significant amounts of nitrate and caustic were received. Radioactive releases to these basins were greater than 99% tritium. Several studies were conducted to characterize the subsoils. A 1984 soil coring study showed that approximately 90% of the radionuclides, cations, and anions were concentrated within the top 1 foot of basin soil. The chemicals of concern at the H-Area HWMF are arsneic, barium, cadmium, lead, mercury, cobalt-60, copper, nickel, vanadium, zinc, tetrachloroethylene, gross alpha, gross beta, nitrate, radium-226, radium-227, tritium, iodine-129, strontium-90, technetium-99, uranium-233/234, and carbon-14.

VI. Summary of Operable Unit Risks

Due to the previous H-Area HWMF RCRA preventive action, No Further Action under CERCLA is necessary for this unit. The RCRA preventive action is protective to human health and the environment and satisfies CERCLA requirements.

Contaminated sediments of the H-Area HWMF were stabilized in the basin during closure. The basin then was covered with a low permeability soil cap. Therefore, exposure through surface soil and sediment pathways is minimized because of this RCRA cap.

Preventive alternatives were developed for the H-Area HWMF based on effective technologies available at the time the RCRA Closure Plan was prepared. The RCRA Closure Plan was initially submitted to SCDHEC in early1989 and was approved, following several revisions, in June 1989.

Options regarding the H-Area HWMF evaluated at that time included:
Alternative 1
No Action
Alternative 2
No Waste Removal, Waste Consolidation, Treatment, and Closure
Alternative 3
Waste Removal and Closure

Alternative 2 was selected within the RCRA closure process in 1988 as the most technically effective of the three alternatives for protection of human health and the environment. Closure of the H-Area HWMF was begun in 1989 and completed in July 1991. The closure certification was accepted by SCDHEC in 1991 as being in compliance with RCRA and state requirements. The closure is considered a final action under CERCLA.

VII. Explanation of Significant Changes

There were no significant changes.

Appendix A

References for Development of ROD Format

Weeks, Victor, 1993. "Regarding Records of Decision, F-Area and H-Area, Savannah River Site, Aiken, South Carolina", Letter to Goidell (DOE), Savannah River Site, Aiken, SC, April 14, 1993.

EPA, 1991. "Guide to Developing Superfund No Action, Interim Action, and Contingency Remedy RODs," OSWER Publication 9355.3-02FS-3, U.S. Environmental Protection Agency, Washington, D.C., April 1991.

WSRC, 1992. "Draft RCRA Facility Investigation/Remedial Investigation Program Plan," WSRC-RP-89-994, Chapter 15, Westinghouse Savannah River Company, Aiken, South Carolina, May 1992.

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 09/23/1994
Operable Unit: 33
ROD ID: EPA/ROD/R04-94/187

Media: soil (no action)

Contaminant: Barium, chloroform, cadmium, 1, 1-DCE, vinyl chloride, trans-1, 2-D TCE, PCE, zinc, uranium

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The Savannah River Site (SRS) occupies approximately 310-square miles adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina. SRS is a secured U.S. government facility with no permanent residents. The population within 50-mile radius of SRS is 634,784. SRS is owned by the United States Department of Energy (USDOE). Westinghouse Savannah River Company (WSRC) is the managing and operating contractor for DOE. SRS produces tritium, plutonium, and other special nuclear materials for national defense. The site also provides nuclear materials for the space program, and conducts medical, industrial, and research efforts.

The Mixed Waste Management Facility (MWMF) is a source specific operable unit within the Burial Ground Complex Fundamental Study Area. The MWMF consists of 118 slit trenches, one Engineered Low Level Trench (ELLT-1), and a naval core mound. The MWMF operated from 1969 to 1986. The 58 acre

facility received low-level radioactive waste materials. Some of the materials are classified as mixed waste containing both hazardous and radioactive components under the Resource Conservation and Recovery Act (RCRA).

The Tank 105-C Hazardous Waste Management Facility (HWMF) is a source specific operable unit within the C-Area Fundamental Study Area. The Tank 105-C HWMF consists of one 8,400 gallon underground storage tank and ancillary piping. The Tank 105-C HWMF was installed in 1961 and was used as a temporary holding tank for liquid waste.

Previous remediation actions at the Tank 105-C HWMF were conducted pursuant to the requirements of the Resource Conservation and Recovery Act (RCRA) per Settlement Agreement 90-64-SW (September 5, 1994) USDOE, Savannah River Site, which is an agreement between the State of South Carolina Department of Health and Environmental Control (SCDHEC) and the Department of Energy to prepare and submit a closure plan. SRS received approval of the closure plan on January 16, 1991, with no revision required. The closure of the Tank 105-C was completed in September 1991. The entire SRS facility was placed on the National Priorities List (NPL) in December 1989.

This document presents the selected final action for the Tank 105-C HWMF Unit.

The closure activities involved the neutralization of waste from a pH of 13.2 to a pH of less than 12.5, removal of as much waste as reasonably possible, and shipment of the waste to an on-site storage/ disposal facility. All remaining waste and the tank void were stabilized in place with concrete. This remedy prevents physical exposure to contaminants (radionuclides) and mitigates potential migration of contaminants to the groundwater by stabilizing the liquid medium and minimizing the pathway for transport.

Remedy: The selected remedial action for this site is no further action since previous action was taken under a Resource conservation and Recovery Act (RCRA) Closure Plan, per Settlement Agreement 90-64-SW (September 5, 1990) USDOE, Savannah River Site. The previous action was approved by the State of South Carolina and is protective of human health and the environment.

Text: Full-text ROD document follows on next page.

Text:

PB94-964058
EPA/ROD/R04-94/187
September 1994

EPA Superfund
Record of Decision:

Savannah River Site,
(USDOE), SC,
9/23/1994

UNITED STATES DEPARTMENT OF ENERGY

SAVANNAH RIVER SITE

FINAL RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION

for

Tank 105-C Hazardous Waste Management Facility (U)

DECLARATION FOR THE FINAL RECORD OF DECISION

Site Name and Location

Tank 105-C Hazardous Waste Management Facility (HWMF)

Savannah River Site

Aiken County, South Carolina

Statement of Basis and Purpose

This document presents the selected final action for the Tank 105-C HWMF Unit and the immediately adjacent soils at the Savannah River Site (SRS), which was developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for this unit.

Description of the Selected Remedy

Previous action taken was under a Resource Conservation and Recovery Act (RCRA) Closure Plan, per Settlement Agreement 90-64-SW (September 5, 1990) USDOE, Savannah River Site, approved by the State of South Carolina and is protective of human health and the environment. Therefore, no further

action is necessary under CERCLA.

The selected final action remedy involved the neutralization of waste from a pH of 13.2 to a pH of less than 12.5, removal of as much waste as reasonably possible, and shipment of the waste to an onsite storage/disposal facility. All remaining waste and the tank void were stabilized in place with concrete. This remedy prevents physical exposure to contaminants (radionuclides) and

mitigates potential migration of contaminants to the groundwater by stabilizing the liquid medium and minimizing the pathway for transport.

The major components of the RCRA action already conducted include:

1) Waste (including organic, aqueous, and sludge phases) neutralization with the addition of a mixture of oxalic acid and water;

2) Removal of 37 gallons of oily substance using an oil skimmer,

3) Removal of 3,753 gallons of aqueous and sludge waste, including water added during neutralization and tank rinse activities; and shipment to an on-site storage/disposal facility;

4) Tank assessment, which included a tank tightness test using the Horner EZY Check II Method;

5) Removal of 8,000 gallons of secondary wastewater (generated during the tank tightness test) and shipment to an on-site storage/disposal facility;

6) Soil assessment, which consisted of 2 background samples and 18 samples from soil borings around the ancillary piping (excluding inaccessible ancillary piping beyond an adjacent wall/foundation) and Tank 105-C, and included visual observation, pH testing and radiological screening of soils;

7) Removal of 400 cubic feet of radiologically contaminated soil adjacent to the ancillary piping;

8) Removal of ancillary piping (90 cubic feet) followed by capping of ancillary piping stubs into the reactor area, pH testing of pipe sections, and removal/placement in 90 cubic foot containers for disposal or capped in place;

9) In place filling of tank (and residual waste) including two risers with concrete;

10) Capping risers above the tank with metal caps and epoxy;

11) Surface restoration (backfilling of piping, tank excavations, and

paving backfilled areas with asphalt); and

12) Restricting access to the Tank 105-C HWMF to authorized personnel with appropriate training on applicable requirements.

Declaration Statement

Previous action taken at the Tank 105-C HWMF was under a RCRA Closure Plan approved by the State of South Carolina and was protective of human health and the environment. Therefore, no further remedial action is necessary under CERCLA. To ensure continued protection of human health and the environment, this action will be reviewed every 5 years, consistent with the requirements of the NCP.

9/19/94
Date

Thomas F. Heenan
Assistant Manager for Environmental
Restoration & Solid Waste
U.S. Department of Energy

9-23-94
Date

John H. Hankinson, Jr.
Regional Administrator
U.S. Environmental Protection Agency
Region IV

SUMMARY OF FINAL ACTION
REMEDIAL ALTERNATIVE SELECTION

for

Tank 105-C Hazardous Waste Management Facility (U)

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I. Site and Operable Unit Names, Locations, and Descriptions

The Savannah River Site (SRS) occupies approximately 310 square miles adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina. (Figure 1) SRS is a secured U.S. government facility with no permanent residents. The Site is located approximately 25 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina. According to 1990 census data, the average population densities (in people per square mile) for the counties surrounding SRS range from 21 to 524 with the largest concentration in the Augusta, Georgia, metropolitan area. The population within a 50-mile radius of SRS is 634,784.

SRS is owned by the United States Department of Energy (DOE). Westinghouse Savannah River Company (WSRC) is the managing and operating contractor for DOE. SRS produces tritium, plutonium, and other special nuclear materials for national defense. The site also provides nuclear materials for the space program, and conducts medical, industrial, and research efforts. The Tank 105-C HWMF is a source specific operable unit within the C-Area Fundamental Study Area. The Tank 105-C HWMF consists of one 8,400 gallon capacity underground storage tank and ancillary piping located in C-Area, east of C Reactor 105-C and approximately 6 miles from the nearest site boundary (Figure 2). This tank and ancillary piping are the only aspects being addressed in this Record of Decision (ROD).

II. Operable Unit History and Compliance History

Operable Unit History

The Tank 105-C HWMF was installed in 1961 as part of an off-line heat exchanger repair program and was used as a temporary holding tank for liquid

<Figure>

Figure 1: Site Area Map

<Figure>

Figure 2: Tank 105-C HWMF General Area Map

solution. Sumps from the heat exchanger cleaning area drained into Tank 105-C. Oil in the tank was probably attributable to oil leaks into these sumps. The reacted or spent oxalic acid solution that resulted from the rinsing process was pumped into an above ground neutralization tank in the stack area of the reactor building. Potassium hydroxide (KOH) was then added and mixed to raise the solution pH to 8.0 or above. After neutralization, the waste was transferred to the underground storage Tank 105-C HWMF for temporary storage. It was common for the neutralization process to require additional pH adjustment inside Tank 105-C, accomplished by circulating the waste in the tank with a pump and adding more KOH to fine tune the pH. A permanent pump was set up to pump the waste into a waste trailer for transportation to a storage/disposal facility. The pump and circulation lines were disassembled in 1983.

The Tank 105-C HWMF was closed by neutralization of waste to a pH of less than 12.5, removal of as much waste as reasonably possible, and shipment of removed waste to an onsite storage/disposal facility. Any remaining waste and the tank void were stabilized with concrete. (Figure 3)

Compliance History

Previous remediation actions at the Tank 105-C HWMF were conducted pursuant to the requirements of the Resource Conservation and Recovery Act (RCRA) per Settlement Agreement 90-64-SW (September 5, 1994) USDOE, Savannah River Site, which is an agreement between the State of South Carolina Department of Health and Environmental Control (SCDHEC) and the Department of Energy to prepare and submit a closure plan in accordance with R.61-79.265 Subpart G. In October 1990, a RCRA Closure Plan was submitted

<Figure>

Figure 3: Tank 105-C HWMF

to the SCDHEC. SRS received approval of the closure plan on January 16, 1991, with no revision required. Revisions and subsequent approvals were made to the Closure Plan during closure activities. Closure of the Tank 105-C HWMF began in May 1991 and was completed in September 1991. The Tank 105-C HWMF was certified closed in November 1991. In December 1991, closure certification was accepted by SCDHEC as being in compliance with RCRA requirements.

Closure activities specifically included the neutralization of waste to a pH

of less than 12.5, removal of as much waste as reasonably possible, and shipment of removed waste to an onsite storage/disposal facility. Any remaining waste and the tank void were stabilized with concrete. RCRA activities at the Tank 105-C HWMF became subject to CERCLA when the entire SRS facility was placed on the National Priorities List (NPL) in December 1989. The Tank 105-C HWMF is a source-specific operable unit within the C-Area Fundamental Study Area.

III. Highlights of Community Participation

The public comment period for the Proposed Plan ran from August 1, 1994 to August 30, 1994. Comments were received on the Tank 105-C HWMF and are addressed in Appendix B of the Record of Decision in the Responsiveness Summary.

IV. Scope and Role of Operable Unit within the Site Strategy

The selected final action remedy involved the neutralization of waste from a pH of 13.2 to a pH of less than 12.5, removal of as much waste as reasonably possible, and shipment of the waste to an onsite storage/disposal facility. All remaining waste and the tank void were stabilized in place with concrete. This

remedy prevents physical exposure to contaminants (radionuclides) and mitigates potential migration of contaminants to the groundwater by stabilizing the liquid medium and minimizing the pathway for transport.

The No Further Action Decision action will be reviewed every five (5) years to assure continued protection by the RCRA corrective action of human health and the environment. While previous remediation actions did not involve action on the groundwater, future investigations of the C-Area will be made. A site wide risk assessment will be performed at the conclusion of the Savannah River cleanup to ensure that the site as a whole is protective of human health and the environment. Based on the results of this risk assessment, additional cleanup at the SRS may be required.

Due to the previous Tank 105-C HWMF RCRA corrective action, No Further Action under CERCLA is necessary for this source control operable unit. The RCRA corrective action provides the necessary protectiveness to human health and the environment to satisfy all CERCLA requirements.

V. Summary of Operable Unit Characteristics

Previous action taken was under a RCRA Closure Plan approved by the State of South Carolina and was protective of human health and the environment Therefore, no further action is necessary under CERCLA.

Prior to the RCRA closure, chemicals of concern at the Tank 105-C HWMF included tritium and other radionuclides (gross alpha and gross beta/gamma) in a characteristic hazardous waste with a pH of 13.2. Risks associated with these chemicals were addressed by the RCRA closure of the tank which

was consistent with the RCRA Closure Plan. Thus, the constituents no longer pose a

threat to human health and the environment. (Tank 105-C HWMF post closure chemicals of concern are residual minimal quantities of radionuclides solidified with concrete with a pH of less than 12.5.) Since the waste was neutralized, the solidified waste remaining in the tank is radioactive waste which has been immobilized.

VI. Summary of Operable Unit Risks

Due to the previous Tank 105-C HWMF RCRA action, No Further Action is necessary under CERCLA for this source control operable unit. The RCRA corrective action is protective of human health and the environment and satisfies CERCLA requirements.

Wastes remaining in the Tank 105-C HWMF were stabilized along with the tank void following treatment, removal of as much waste as reasonably possible, and shipment to an onsite storage/disposal facility. Additional contaminated soils adjacent to the ancillary piping were removed and shipped to an onsite storage/disposal facility. Therefore, exposure through surface soil and sediment pathways is minimized.

Preventive alternatives were developed for the Tank 105-C HWMF based on effective technologies available at the time the RCRA Closure Plan was prepared. The RCRA Closure Plan was initially submitted to SCDHEC in October 1990 and was approved in January 1991. Revisions and subsequent approvals were made to the Closure Plan during closure activities.

Options regarding the Tank 105-C HWMF evaluated at that time included:

Alternative 1

No Action

Alternative 2

No Waste Removal and Tank Closure

Alternative 3

Waste Removal and Tank Closure

Alternative 3 was selected within the RCRA closure process in 1990 as the most technically effective of the three alternatives for protection of human health and the environment. Closure of the Tank 105-C HWMF began in Ma 1991 and was completed in September 1991. The closure was certified in November 1991 and accepted by SCDHEC as being in compliance with RCRA and

state requirements in December 1991. The closure is considered a final action under CERCLA.

VII. Explanation of Significant Changes

There were no significant changes.

Appendix A

References for Development of ROD Format

Weeks, Victor, 1993. "Regarding Records of Decision, F-Area and H-Area, Savannah River Site, Aiken , South Carolina", Letter to Goidell (DOE), Savannah River Site, Aiken, SC, April 14, 1993.

EPA, 1991. "Guide to Developing Superfund No Action, Interim Action, and Contingency Remedy RODs," OSWER Publication 9355.3-02FS-3, U.S. Environmental Protection Agency, Washington, D.C., April 1991.

WSRC, 1992. "RCRA Facility Investigation/Remedial Investigation Program Plan," WSRC-RP-89-994, Rev. 1, Chapter 15, Westinghouse Savannah River Company, Aiken, South Carolina, May 1992.

Appendix B

Responsiveness Summary

DOE has received comments regarding the Tank 105-C HWMF and they have been addressed in this Responsiveness Summary. These comments are available for review in the Administrative Record.

A reviewer provided a comment on the Tank 105-C HWMF item in the SRS Environmental Bulletin volume 5 number 15 dated July 25, 1994. This comment referred to ambiguous wording which implied "...that the neutralized liquid and sludge must have been left in the tank..." and suggested revision of this paragraph. The issue raised in the SRS Environmental Bulletin has been addressed and is clearly stated in the Proposed Plan and the Record of Decision.

A reviewer provided comments on the Proposed Plan for the Tank 105-C HWMF (U), WSRC-RP-94-56, June 24, 1994. The introductory comment stated that "The RCRA closure of the tank appears to have been an adequate short-term measure but is premature to state, as this plan does that "no further remedial action is necessary under CERCLA." This specific ROD addresses only the tank and ancillary piping and is a final action. Specific comments are italicized followed by comment response.

C: "Until the contaminated soils around the tank and its piping have been

adequately characterized we do not agree that no further remedial actions under CERCLA are necessary.

R: This comment is outside the scope of this ROD. This specific ROD addresses only the tank and ancillary piping and is a final action. DOE will adequately address the contaminated soils surrounding the tank and ancillary piping as the C-Area operable unit is evaluated.

C: "SRS should describe the relationship between the decontamination and decommissioning goals and plans for the C-Area and the CERCLA requirements for the operable units in the C-area Fundamental Study Area. EPA and SCDHEC should describe their understanding and expectations of this relationship as well. It is important that the goals and standards of the RCRA/CERCLA and D&D efforts be compatible, resulting in a very similar level of environmental and public health protection."

R: This comment is outside the scope of this ROD. Buildings and areas contained within the C-Area Fundamental Study Area (FSA) are in the Site Evaluation program and will eventually be addressed per the schedules in Appendices D and E of the Federal Facility Agreement (FFA). Decontamination and decommissioning actions in the C-Area FSA will be addressed based on future evaluations.

C: "There should be a CERCLA risk assessment for the C-Area FSA that encompasses the 105-C HWMF, the other C-Area operable units, and the reactor buildings and other structures requiring decontamination and decommissioning. By consolidating the risk assessment, common assumptions about land use, demographics, and exposure pathways could be assessed to evaluate the consistency and adequacy of all remedial actions within the C-Area FSA."

R: CERCLA risk assessment will be performed for the contaminated soils and groundwater operable units associated with the C-Area FSA after they are characterized per the schedules contained in Appendices D and E of the FFA. The action for the tank and ancillary piping was performed under RCRA and no additional action is required on this unit.

C: "Although we concur that the closed tank does not present a near-term risk to the public health or the environment, SRS should acknowledge that it may be necessary to exhume the tank in order to meet land use objectives."

R: Based on future investigations at the C-Area FSA, DOE acknowledges that it may be necessary to exhume the tank.

FINAL RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION

FOR

Mixed Waste Management Facility (U

DECLARATION FOR THE FINAL RECORD OF DECISION

Site Name and Location

Mixed Waste Management Facility (MWMF)

Savannah River Site

Aiken County, South Carolina

Appendix H of the Federal Facility Agreement (FFA) lists this unit as the Mixed Waste Hazardous Waste Management Facility (Building Number 643-28G).

Statement of Basis and Purpose

This document presents the selected final preventive action for the MWMF Unit at the Savannah River Site (SRS), which was developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for this unit.

Description of the Selected Remedy

The selected final action remedy announced in this Record of Decision is no further action. As described below, a remedy under RCRA was completed for this unit in December 1990. This RCRA corrective action involved the precompaction and placement of all contaminated materials under a low permeability cap. This RCRA remedy prevents physical exposure to contaminants and mitigates further migration of contaminants to the groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport.

No further action is necessary for the unit. However, as a condition of the RCRA Hazardous Waste Permit, post closure groundwater monitoring is required to verify that no unacceptable exposures to potential hazardous posed by conditions at the operable unit occur in the future. This unit was closed by the requirements of a closure plan approved in December 1987 by the state of South Carolina under RCRA authority. The RCRA closure of MWMF began in

1988 and was completed in December 1990. MWMF was certified closed in 1991. In April 1991, the closure certification was accepted by the state of South Carolina as being in compliance with RCRA requirements.

The major components of the RCRA preventive action included:

1) Precompaction.

2) Initial backfill after compaction to level 5 feet below final cover elevations

3) Placement of a final cover over the trenches. The cover consists of a three foot minimum layer of compacted kaolin clay with a permeability of 1x10[-7] cm/sec or less, two feet of final cover and vegetative cover, cap drainage and stormwater conveyance system (See below).

<Figure>

4) The MWMF is being routinely inspected for a minimum of 30 years to verify the integrity of the cover system, fences, signs, etc. Any necessary repairs to the cap will be made as part of the maintenance program.

5) Access to the MWMF is restricted to authorized personnel with appropriate training on applicable requirements. The survey plat and records associated with deed restricted use of the MWMF have been filed with Aiken County, SC.

Declaration Statement

Previous action taken at the MWMF was under a RCRA Closure Plan, per NRDC et al. v. Herrington, Civ. Action No. 1:85-2583-6 (D.S.C. May 26, 1988), approved by the state of South Carolina and was protective of human health and the environment. Therefore, no further remedial action is necessary under CERCLA. To ensure continued protection of human health and the environment, this remedial action will be reviewed every 5 years, consistent with the requirements of the NCP.

9/19/94
Date

Thomas F. Heenan
Assistant Manager for Environmental
Restoration and Solid Waste
U.S. Department of Energy

9-23-94
Date

John H. Hankinson, Jr.
Regional Administrator
U.S. Environmental Protection Agency
Region IV

SUMMARY OF FINAL ACTION
REMEDIAL ALTERNATIVE SELECTION

FOR

Mixed Waste Management Facility (U)

DECISION SUMMARY
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I. Site and Operable Unit Names, Locations, and Descriptions

The Savannah River Site (SRS) occupies approximately 310 square miles adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina (Figure 1). SRS is a secured facility with no permanent residents. The site is approximately 25 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina. The average population density in the counties surrounding SRS ranges from 21-524 people per square mile with the largest concentration in the Augusta, Georgia, metropolitan area. Based on 1990 census data, the population within a 50-mile radius of SRS is approximately 634,784.

SRS is owned by the United States Department of Energy (DOE). Westinghouse Savannah River Company (WSRC) is the managing and operating contractor for

DOE. SRS produces tritium, plutonium, and other special nuclear materials for national defense. The site also provides nuclear materials for the space program, and conducts medical, industrial, and research efforts. The Mixed Waste Management Facility (MWMF) is a source specific operable unit within the Burial Ground Complex Fundamental Study Area. The MWMF consists of 118 slit trenches, 1 Engineered Low Level Trench (ELLT-1), and a naval core barrel mound and is located in the center of SRS, between F and H Areas (Figure 2).

<Figure>

Figure 1 Location of the Savannah River Site (SRS)

<Figure>

Figure 2 MWMF

II. Operable Unit History and Compliance History

Operable Unit History

The MWMF operated from 1969 until March 11, 1986. During that time, this facility, which comprises approximately 58 acres, received low-level radioactive waste materials produced at the SRS. Some of these materials are classified as mixed waste containing both hazardous and radioactive components under the Resource Conversation and Recovery Act (RCRA). These trenches were closed by precompacting and placing a protective multi-layer cover system (Figure 3) over them to reduce rainwater contact with trench bottoms.

Compliance History

RCRA preventive actions at the MWMF were conducted pursuant to the requirements of the Resource Conservation and Recovery Act (RCRA) per NRDC et al. v. Herrington, Civ. Action No. 1:85-2583-6 (D.S.C. May 26, 1988) which is an order from the court in settlement of the lawsuit for closure of the facility under RCRA. In 1985 a RCRA Closure Plan was submitted to SCDHEC. The closure plan underwent several revisions prior to approval by SCDHEC in 1987. Closure of the MWMF was begun in 1988 and completed in December 1990. The MWMF was certified closed in 1991. In April 1991, the closure certification was accepted by SCDHEC as being in compliance with RCRA requirements. A RCRA Part B Permit Application for Post-Closure Care was submitted in November 1992.

Mixed Waste Management Facility
Closure Cap Cross Section

<Figure>

Figure 3 MWMF Cap Cross Section

Closure activities specifically included precompaction; construction of a low permeability cap over the trenches; and restoration of the area.

RCRA preventive activities at the MWMF became subject to CERCLA when the entire SRS facility was placed on the National Priorities List (NPL) in December 1989. The MWMF is a source-specific operable unit within the Burial Ground Complex Fundamental Study Area.

III. Highlights of Community Participation

The public comment period ran from 01 August 94 - 30 August 94. All comments submitted on the Proposed Plan have been incorporated into this ROD, where appropriate and are addressed in the Responsiveness Summary (Appendix B).

IV. Scope and Role of Operable Unit within the Site Strategy

The selected RCRA remedy involved the placement of all contaminated materials under a low permeability cap. The remedy prevents physical exposure to contaminants and mitigates further migration of contaminants from the MWMF to groundwater by minimizing a liquid medium pathway (rainwater percolation) for transport.

V. Summary of Operable Unit Characteristics

Waste from SRS disposed in the form of job control waste such as rags, gloves and coveralls, soil, construction debris, failed equipment, spent air filters, spent lithium-aluminum targets, irradiated scrap metal, naval reactor hardware, lead shielding, waste oil, scintillation fluids, cadmium and silver coated beryl saddles, were sent to the MWMF. The constituents of concern at the MWMF are barium, chloroform, cadmium, 1,1-dichloroethane, vinyl chloride, trans-1,2 dichloroethylene, phenol, aluminum, iron, manganese, carbon-14, lead, tritium, nickel, tetrachloroethylene, trichloroethylene (TCE), zinc, uranium-234/235, uranium-238. The primary constituents of concern are tritium, lead, TCE, and uranium.

VI. Summary of Operable Unit Risks

Due to the previous MWMF RCRA preventive action, No Further Action under

CERCLA is necessary for this source control operable unit. The RCRA preventive action is protective to human health and the environment and satisfies CERCLA requirements.

The trenches were first compacted and then were covered with a low permeability soil cap. Therefore, exposure through surface soil and sediment pathways is minimized because of this RCRA cap.

Preventive alternatives were developed for the MWMF based on effective technologies available at the time the RCRA Closure Plan was prepared. The

RCRA Closure Plan was initially submitted to SCDHEC in November 1985 and was approved, following several revisions, in December 1987.

Options regarding the MWMF evaluated at that time included:

Alternative 1

No Action

Alternative 2

No Waste Removal, Waste Consolidation, and Closur

Alternative 3

Waste Removal and Closure

Alternative 2 was selected within the RCRA closure process in 1985 as the most technically effective of the three alternatives for protection of human health and the environment. Closure of the MWMF was begun in 1988 and completed in 1990. The closure was certified in April 1991 and accepted by SCDHEC as being in compliance with RCRA and state requirements. The closure is considered a final action under CERCLA.

VII. Explanation of Significant Changes

There were no significant changes made to the remedy decision since the publishing of the proposed plan on 01 August 1994.

Appendix A

References for Development of ROD Format

EPA, 1991. "Guide to Developing Superfund No Action, Interim Action, and Contingency Remedy RODs," OSWER Publication 9355.3-02FS-3, U.S. Environmental Protection Agency, Washington, D.C., April 1991.

WSRC, 1992. "Draft RCRA Facility Investigation/Remedial Investigation Program Plan," WSRC-RP-89-994, Rev. 1, Chapter 15, Westinghouse Savannah River Company, Aiken, South Carolina, May 1992.

Appendix B

Responsiveness Summary

DOE has received comments regarding the MWMF and they have been addressed in this Responsiveness Summary. These comments are available for review in the Administrative Record.

A member of the public provided comments on the MWMF item in the SRS Environmental Bulletin volume 5 number 15 dated July 25, 1994. This comment referred to adding a figure representing the amounts of hazardous waste in the facility and the approximate volume of compacted waste. The issue raised in the SRS Environmental Bulletin concerning the hazardous waste volumes has been addressed and is clearly presented in the Proposed Plan. The issue concerning the volume of compacted waste is clarified here. Compaction at this waste site was done in order to form a stable foundation for the kaolin clay cap; therefore, no measurement was conducted to determine the exact waste consolidation.

An interested party provided comments on the MWMF Proposed Plan in a letter to C. V. Anderson dated September 8, 1994. The specific comments and their responses are as follows:

C: SRS has not demonstrated the assertion that because of the RCRA closure at the MWMF "the unit poses no current or potential threat to human health or the environment" and, thus, "no further action is necessary under CERCLA." In ERF's July 9, 1993 letter to David Wilson at SCDHEC and Len Sjostrom at SRS we provided extensive comment and criticism on the RCRA post-closure risk assessment for the MWMF. We have never received a direct response from SRS. If there is a risk assessment to support a "no further remedial action" position under CERCLA then we request the opportunity to review it.

R: RCRA closure of a land disposal unit in which waste is left in place is protective of human health and the environment under RCRA and therefore, a risk assessment is not required. The actions taken at the MWMF under the RCRA/CERCLA program were completed within the requirements set forth by SCDHEC and the EPA.

C: Additionally, the decision to leave waste buried at MWMF and the other Burial Ground Complex facilities is a de facto decision about long-term land use. Given the long-lived nature of many of the wastes, the implied restriction goes far beyond the 30 and 100 year institutional control

projections which shaped the earlier risk assessments. If, in fact, unrestricted use of the site after 100 years is not going to be safe, then SRS and its regulators should acknowledge this and commit to some additional decision making.

R: These actions are protective of human health and the environment and will be reviewed every 5 years as required by CERCLA and the RCRA post closure care permit renewal process.

C: Until there is a meaningful land-use planning process at SRS involving stakeholders, the attainment of primary drinking water standards at the perimeter of the BGC should be a minimum requirement. It's not clear that SRS can meet these standards without additional source control at MWMF and the other BGC facilities. If additional source control is necessary to meet primary drinking water standards at the BGC perimeter, SRS and its regulators should work together to examine how to locate specific sources of contaminants within the BGC and what technology and/or research and development options are necessary to remedy the situations.

R: The MWMF groundwater is being addressed under RCRA which is a groundwater based program. Under RCRA, monitoring of the subsurface contamination is being conducted. Investigation of the groundwater contamination is currently ongoing and will be addressed under separate regulatory documentation. This MWMF Proposed Plan is for the source control operable unit only. All other source control units, including the groundwater operable unit, will be addressed under separate Proposed Plans and Records of Decision. DOE land use policy is being developed currently but until finalized, 5 and 30 year reviews will be maintained.

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 11/09/1994
Operable Unit: 29
ROD ID: EPA/ROD/R04-95/202

Media: soil, groundwater

Contaminant: Trichlorothylene (TCE), tetrachloroethylene (PCE), and carbon tetrachlroide. Trans-1,2-dichloroethylene, nitrate, mercury, gross alpha, lead, chromium

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The Savannah River Site (SRS) occupies approximately 300 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. SRS is a secured U.S. government facility with no permanent residents. The site is located approximately 25 miles southeast of Augusta, Georgia.

SRS is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided nuclear materials for the space program and for medical, industrial, and research efforts. Chemical and radioactive wastes are by-products of nuclear material production processes. Hazardous substances, as defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), are currently present in the environment at

SRS.

The TNX Area is located adjacent to the Savannah River in the southwestern portion of SRS. Pilot-scale testing and evaluation of chemical processes in the TNX Area included support of the Defense Waste Processing Facility, separations areas, and fuel and target manufacturing areas. Wastewater generated during support of the previously identifies initiatives was discharged to unlined earthen basins through a network of process sewers.

The TNX Area is one quarter of a mile east of the Savannah River, between Upper Three Runs Creek to the north and Fourmile Creek to the south, at an elevation of 150 feet above mean sea level. Local topography is relatively flat with a slope toward the east, away from the Savannah River.

Immediately west of the TNX area is a swamp adjacent to the Savannah River at 95 feet above msl. A small terrace divides the swamp and serves as the bank of the river during high stages. The terrace in the swamp is covered by bottomland hardwoods and the swamp west of the terrace has stands of cypress and tupelo typical of Savannah River swamps.

The TNX Area is a pilot scale test facility for the SRTC. The pilot scale facilities are used to provide technical support to various SRS production areas. From the 1953 to August 1988, wastewater generated by research performed in the TNX area was disposed of in seepage basins. In August 1988, wastewater was rerouted to the TNX Effluent Treatment Facility.

In 1980, the first series of groundwater wells was installed in the TNX area. The first series of monitoring wells was determined to be inadequate and were abandoned and replaced in 1984. The groundwater sampling data from the new wells indicated that seepage from the unlined basins, leakage from the process sewers, and leachate from other activities in the area resulted in soil and groundwater contamination throughout the TNX area.

Remedy: The selected remedial action for this site is one of interim action. This alternative includes the establishment of a hybrid groundwater corrective action will achieve the goals highlighted for this action and will serve as an incremental step in addressing environmental contamination within the TNX Fundamental Study Area and SRS. The hybrid groundwater corrective action system will stabilize the portion of the plume contaminated with TCE. However, if the area containing TCE levels exceeding 500/L has expanded, the area that will be intercepted will be expanded accordingly. Samples from existing monitoring wells as well as samples from the influent and effluent from the air strippers, air emissions from the air stripper, and the recirculation well will be used to monitor the performance of the interim action. The details of the monitoring will be discussed in the operating and maintenance plan for the hybrid groundwater corrective action system.

Text: Full-text ROD document follows on next page.

Text:

WSRC-TR-94-0375
Rev 1
October 1994

Interim Action Record of Decision Remedial Alternative Selection - TNX Area Groundwater Operable Unit (U)

Westinghouse Savannah River Company
.
Savannah River Site
Aiken, SC 29808

<IMG SRC 0495202>

SAVANNAH RIVER SITE

Prepared for the U.S. Department of Energy under contract no. DE-AC09-89SR18035

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Declaration for the Record of Decision

Unit Name and Location

TNX Area Groundwater Operable Unit CERCLA Unit
Savannah River Site
Aiken County, South Carolina

Appendix C of the Federal Facility Agreement (FFA) lists this Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit as Groundwater, TNX.

Statement of Basis and Purpose

This document presents the selected interim remedial action for the TNX Area Groundwater Operable Unit at the Savannah River Site (SRS), which was developed in accordance with CERCLA of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this specific CERCLA unit.

The State of South Carolina concurs with the selected interim action remedy.

Assessment of the Unit

The TNX Area is a pilot scale test facility for the Savannah River Technology Center (SRTC). The pilot scale facilities are used to provide technical support to various SRS pro-

duction areas. From 1953 to August 1988, wastewater generated by research performed in the TNX Area was disposed of in seepage basins. In August 1988, wastewater was rerouted to the TNX Effluent Treatment Facility.

In 1980, the first series of groundwater monitoring wells were installed in the TNX Area. The first series of monitoring wells were determined to be inadequate and were abandoned and replaced in 1984. The groundwater sampling data from the new wells indicated that seepage from the unlined basins, leakage from the process sewers, and leachate from other activities in the area resulted in soil and groundwater contamination throughout the TNX Area. Analysis of surface water samples collected from the swamp adjacent to the Savannah River indicate that groundwater contaminated with Chlorinated Volatile Organic Compounds (CVOCs) is outcropping in the swamp before it reaches the river. No contaminants from the plume were detected in the Savannah River. Actual or threatened releases from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), could present an endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

The TNX Area groundwater and the source areas contributing to contamination of the groundwater are in various stages of the CERCLA investigation and remedy selection process. This groundwater interim action will serve to mitigate the further migration of the groundwater plume hotspot while also removing contaminants from the groundwater. Fol-

lowing investigation and remedy selection for the source units in the TNX Area, the groundwater unit will be reassessed and appropriate final remedial alternatives will be developed.

The selected alternative to achieve the interim action goals is Alternative 2. Hybrid Groundwater Corrective Action (HGCA). The HGCA includes one recirculation well and a series of groundwater extraction wells with an air stripper. The conceptual design for the extraction system has three to five groundwater extraction wells with a combined flow rate of up to 60 gallons per minute. The target treatment level for trichloroethylene (TCE) in the extracted groundwater will be 5 æg/L prior to discharge to a NPDES outfall. The actual design of the remedial system will be addressed through the remedial design process.

Recirculation Wells

Recirculation wells are an emerging technology for in situ cleanup of CVOC contaminated groundwater. In recirculation wells, air is injected into a groundwater well. As the air rises to the surface in the well, it removes CVOCs from the water in the well by air stripping. Additionally, the air causes groundwater to flow upward in the well establishing a circulation system where water is drawn into the bottom of the well and discharged at the water table. The air is collected by a vacuum at the surface for treatment. The vacuum also recovers soil vapor from the unsaturated zone resulting in additional cleanup.

Extraction Wells with an Air Stripper

The migraton of the contaminated groundwater plume hotspot will be intercepted by a series of water wells known as extraction wells. The extraction wells are used to drawdown the water table and collect contaminated groundwater. Drawdown from the extraction wells produces a capture zone that prevents the further migration of contamination from the site. The contaminated groundwater that is collected by the extraction wells will be treated by an air stripper. Treated groundwater will be discharged to a permitted outfall. The air stripper can also be used to treat contaminated water from other cleanup activities, such as groundwater sampling. Air emission from the air stripper and recirculation well will be treated as necessary to comply with South Carolina Department of Health and Environmental Control (SCDHEC) air pollution regulations.

In addition to TCE, the main contaminant of concern, CVOCs, mercury, gross alpha, and nitrate will be monitored in the effluent from the treatment system to ensure that they do not exceed discharge limits. If they begin to exceed discharge limits, the well causing the exceedance will be identified through sampling, and discharges from that well will be treated using methods similar to ion exchange or reverse osmosis.

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Interim Action Record of Decision
WSRC-TR-94-0375
Remedial Alternative Selection

Declaration Statement

This interim action is protective of human health and the environment, complies with (or waives) Federal and South Carolina applicable or relevant and appropriate requirements (ARARs) for this limited scope action, and is cost-effective. ARA pertaining to aquifer restoration to Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) do not apply to this action because this limited scope interim action is part of an overall remedy that will attain (or waive) all ARARs for the final action. Although this interim action is not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action utilizes treatment and, accordingly, is in furtherance of that statutory mandate. Since this action does not constitute the final remedy for the TNX Area Groundwater Operable Unit, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, although partially addressed in this remedy, will be addressed by the final response action. Subsequent actions are planned to fully address the threats posed by the conditions at this unit. Because this remedy will result in hazardous substances remaining onsite above health-based levels, a review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment within five years after commencement of the

remedial action. Since this is an Interim Action Record of Decision, review of this unit and this remedy will be ongoing as the Department of Energy (DOE) continues to develop final remedial alternatives for the TNX Area Groundwater Operable Unit.

Date

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Assistant Manager
for Environmental
Restoration and
Waste Management
U.S. Department
of Energy

Date

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Deputy
Commissioner
Environmental
Quality Control
South Carolina
Department of Health and
Environmental
Control

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Interim Action Record of Decision
WSRC-TR-94-0375
Remedial Alternative Selection

I. Site and Operable Unit Names, Locations, and Descriptions

The Savannah River Site (SRS) occupies approximately 300 square miles adjacent to the Savannah River, principally in Aiken and Barnwell counties of South

Carolina (Figure 1).

SRS is a secured facility with no permanent residents. The Site is approximately 25 miles southeast of Augusta Georgia and 20 miles south of Aiken, South Carolina. According to 1990 census data, the average population densities (in people/square mile) for the surrounding South Carolina counties are 111 for Aiken County, 36 for Barnwell County, and 28 for Allendale County and for the surrounding Georgia counties, 228 for Columbia County, 524 for Richmond County, 25 for Burke County, and 21 for Screven County. The population within a 50-mile radius of SRS is 634.784 people.

SRS is owned by the U.S. Department of Energy (DOE). Westinghouse Savannah River Company (WSRC) provides management and operating services for DOE. SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. The Site has also provided nuclear materials for the space program and medical, industrial, and research efforts. Chemical and radioactive waste are by-products of nuclear material production processes. Hazardous substances, as defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), are present in the environment at SRS. Appendix C, RCRA/CERCLA Units List, of the Federal Facility Agreement (FFA, 1993) lists the TNX Area Groundwater Operable Unit.

The TNX Area is located adjacent to the Savannah River in the southwestern portion of SRS (see Figure 2). Pilot-scale testing and evaluation of chemical processes in the TNX Area included support of the Defense Waste Processing Facility, separations areas, and fuel and target manufacturing areas. Wastewater generated during support of the previously identified initiatives was discharged to unlined earthen basins through a network of process sewers.

The TNX Area is one quarter of a mile east of the Savannah River, between Upper Three Runs Creek to the north and Fourmile Creek to the south, at an elevation of 150 feet above mean sea level (MSL). Local topography is relatively flat with a slope toward the east, away from the Savannah River.

Immediately west of the TNX Area is a swamp adjacent to the Savannah

River at 95 feet above MSL (see Figure 2). A small terrace divides the swamp and serves as the bank of the river during high stages. The terrace in the swamp is covered by bottomland hardwoods, and the swamp west of the terrace has stands of cypress and tupelo typical of Savannah River swamps. Typical fauna for bottomland hardwood forests includes, but is not limited to, salamanders, frogs, snakes, bats, squirrels, raccoons, skunks, weasels, and foxes. Large mammals include white-tailed deer and feral pigs. No endangered or threalenecl species have been identified in the vicinity of the TNX facility from previous surveys, nor do habita exist there for the American alligator, red-cockaded woodpecker, the wood stork, or the short-nosed sturgeon.

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Remedial Alternative Selection

II. Operable Unit History and Compliance History

Operable Unit History

The TNX Area is a pilot scale test facility for the SRTC. The pilot scale facilities are used to provide technical support to various SRS production areas. From 1953 to August 1988, wastewater generated by research performed in the TNX Area was disposed of in seepage basins. In August 1988, wastewater was rerouted to the TNX Effluent Treatment Facility.

In 1980, the first series of groundwater monitoring wells was installed in the TNX Area. The

first series of monitoring wells was determined to be inadequate and were abandoned and replaced in 1984. The groundwater sampling data from the new wells indicated that seepage from the unlined basins, leakage from the process sewers. and leachate from other activities in the area resulted in soil and groundwater contamination throughout the TNX Area. Anal- ysis of surface water samples collected from the swamp adjacent to the Savannah River indi- cates that groundwater contaminated with CVOCs is outcropping in the swamp before it reaches the river. No contaminants from the plume were detected in the Savannah River. An environmental impact statement addressing groundwater contamination caused by site oper- ations was submitted for public comment in 1987 (DOE, 1987).

Compliance History

On December 21, 1989, SRS was placed on the National Priorities List (NPL). A site placed on the NPL comes under the jurisdiction of CERCLA. In accordance with Section 120 of CERCLA, DOE negotiated a Federal Facility Agreement (FFA, 1993) with the U.S. Envi- ronmental Protection Agency (EPA) and SCDHEC to coordinate cleanup activities at SRS into one comprehensive strategy that fulfills Resource Conservation Recovery Act (RCRA) Section 3004(u) and CERCLA assessment, investigation, and response action requirements. The FFA lists the TNX Area Groundwater Operable Unit as a CERLCA unit requiring fur- ther evaluation using the CERCLA Remedial Investigation (RI) process to determine the actual or potential impact to human health and/or the environment. Public participation requirements are listed in Sections 113 and 117 of CERCLA. These requirements include the establishment of an Administrative Record File which documents the selection of cleanup alternatives and provides for review and comment by the public. The SRS Public Involvement Plan (PIP)(WSRC, 1991) is designed to facilitate public involvement in the decision making processes for permitting, closure, and selection of reme- dial alternatives. The PIP addresses the requirements of RCRA, CERCLA. and the National Environmental Policy Act (NEPA). Section 11.7(a) of CERCLA. 1980. as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. requires the preparation

of a proposed plan as part of the site remedial process. The Interim Action Proposed Plan for the TNX Area Groundwater Operable Unit, which is part of the Administrative Record File, highlights key aspects of the assessment and investigation phases of the remediation process and identifies the preferred interim action alternative for remediation of the TNX Area Groundwater Operable Unit.

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III. Highlights of Community Participation

The Administrative Record File, which contains the information upon which the selection of the response action was made, is available at the following locations:

U.S. Department of Energy Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29802
(803) 777-4866

Similar information is available through the following repositories:

Reese Library
Augusta College
2500 Walton Way
Augusta, Georgia 30910
(404) 737-1744

Asa H. Gordon Library
Savannah State College
Tompkins Road
Savannah, Georgia 31404
(912) 356-2183

Groundwater Operable

sent to more than

the Aiken Standard, the

People-Sentinel, the

Interim Action Pro-

comments are dis-

included a means

proposed interim action.

As a result of the

to October 13, 1994,

The public was notified about the comment period for the TNX Area Unit through mailings of the SRS Environmental Bulletin, a newsletter 1400 citizens in South Carolina and Georgia, and through notices in Allendale Citizen Leader, the Barnwell County Banner, the Barnwell North Augusta Post, The State, and The Augusta Chronicle newspapers. The 30-day public comment period began on August 15, 1994, for the posed Plan for the TNX Area Groundwater Operable Unit. Responses to cussed in the Responsive Summary (see Appendix A). The proposed plan for requesting a public meeting to discuss the TNX Area and the A public hearing was requested during the initial public comment period. request for a public hearing, the public comment period was extended and a public hearing was held on October 11, 1994.

only requested a

for the treatment sys-

Two written comments were received on the IAPP. One of the comments public hearing, and the other comment pertained to permitting issues tem.

IV. Scope and Role of Operable Unit within the Site Strategy

Past operations within the TNX Area led to the contamination of the area's groundwater. Several source units have been identified in the TNX Area which contributed to the groundwater contamination. These units include the Old TNX Seepage Basin, the New TNX Seepage Basin, and the TNX Burying Ground. Operations associated with these units, as well as leakage from process sewers and leachate from other site activities, contributed to the groundwater contamination.

The areas contributing to the groundwater contamination will be investigated pursuant to the requirements of the NCP and the FFA. Following investigation of these areas, appropriate cleanup alternatives will be developed.

The groundwater system in the TNX Area has been adequately characterized to identify the need for a limited scale action and support the design and implementation of a system to begin controlling and remediating groundwater contamination. Final cleanup alternatives for the groundwater will be developed following remedy selection for the source units.

A limited scale interim action is desired to control the further migration of the groundwater contamination hotspot, prevent the further degradation of the groundwater system, and begin contaminant mass removal from the groundwater contamination hotspot. An interim action addressing the most contaminated groundwater at the TNX Area through plume stabilization and contaminant removal will be protective of human health and the environment, will not be inconsistent with potential future cleanup activities, and reduce the scope of future final actions.

V. Summary of Operable Unit Characteristics

TNX is underlain by two aquifer systems-a deep aquifer system and a

shallow aquifer system. The systems are separated by a thick layer of clay and silt with thin sand lenses approximately 50-feet thick (see Figure 3). The clay and silt layer greatly reduces flow between the aquifer systems. An upward gradient between the deep aquifer system and the shallow aquifer system equals about 55 feet of water (24 psi). The upward gradient results in upward groundwater flow from the deep aquifer system to the shallow aquifer system. Domestic and process water for the TNX Area is produced from the deep aquifer system. Lateral groundwater flow in the deep and shallow aquifers beneath TNX is to the west-northwest direction towards the Savannah River.

The shallow aquifer system is composed of a water table aquifer and a semi-confined aquifer. Depth to the water table varies from zero to 50 feet in the area of groundwater contamination. Groundwater flow in the shallow aquifer system is toward the Savannah River. The water table aquifer crops out in the swamp between the Savannah River and the TNX Area (see Figure 4), Groundwater contamination at TNX was detected only in the water table aquifer in the shallow aquifer system.

Groundwater monitoring wells in the TNX Area are sampled and analyzed for a wide range of parameters. The parameters analyzed include indicators of water quality (pH, alkalinity, specific conductivity, gross alpha, nonvolatile beta, etc.) and specific chemical constituents. The chemical constituents include organic compounds, specific radionuclides. and non-radiological inorganic species. Shallow groundwater at TNX has low ionic strength, is slightly to moderately acidic, aerobic, and has a small amount of total dissolved solids. This general groundwater chemistry is consistent with the local aquifer materials, specifically, highly leached sand with some silt and lesser amounts of clay. The groundwater contamination can be divided into two categories, organic and inorganic contamination.

The water table aquifer at TNX is contaminated with CVOCs. primarily trichloroethylene (TCE), tetrachloroethylene (PCE), and carbon tetrachloride (see Table 1). The CVOC contamination underlays eight acres, has a maximum thickness of 20 feet, and contains approx-

imately six gallons of TCE. Trans-1,2-dichloroethylene, a product of natural aerobic biodegradation of TCE and PLY, has been measured in some of the wells with TCE. The absence of vinyl chloride in the groundwater suggests that the biodegradation is following an aerobic pathway. A concentration map for TCE illustrates the lateral extent of CVOC migration (see Figure 5). 1,1,1-trichloroethane and chloroform were also detected in elevated concentrations, but did not exceed Primary Drinking Water Standards (PDWS).

At one time, benzene was detected above the PDWS. A replicate analysis by the same laboratory yielded a result of 3 æg/L and both results from a replicate analysis performed by an independent laboratory on a split sample were below detection of 1 æg/L. The replicate and duplicate analyses provide strong evidence to suggest that the one reported value, which exceeds the PDWS, was not representative of the field conditions.

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Table 1. List of Constituents Detected Above the Primary Drinking Water Standard in Groundwater at TNX Area from 3Q88 to 1Q92

Constituent	Primary Drinking Water Standard	Value	Result	Maximum Date	Result (e)	Most Current Well	Date
Trichloroethylene	5	4800	TBG5	9/18/90	1100	3/16/91	
Tetrachloroethylene	5	110	XSB1D	3/27/89	5.25	2/5/92	
Carbon Tetrachloride	5	750	TBG4	7/3/89	270	3/15/91	
Chloroform	100a	221	XSB1D	3/27/89	LT 1	2/5/92	
Benzene	5	97	TBG7	12/5/89	LT 1	2/3/92	

Lindane	0.2	0.28b	TNX2D	3/7/91	LT 0.005	2/5/92	
Endrin	0.2	0.63b	TNX2D	3/7/91	LT 0.006	2/5/92	
Mercury	2	4.39	TBG4	9/9/89	3.7	3/15/91	
Gross Alpha (pCi/L)	15	80	TBG3	6/14/89	5.70	9/4/91	
Nitrate as Nitrogen	10000	98600	TBG4	12/10/90	43200	3/15/91	
Lead	15	37.5c	XSB5A	3/6/90	10.2	2/3/92	
Chromium	100	197d	XSB2D	3/11/90	LT 4	2/4/92	

All units are æg/L unless noted otherwise.

a The level for trihalomethanes is set as 100 æg/L. Because brominated methane is rarely detected in SRS groundwater, it is presumed that most of the trihalomethanes present are chloroform.

b An insufficient number-of detected results is available to determine if this is a representative value.

c Values have not been above PDWS since 1Q91.

d This value is not believed to be representative of the maximum concentration because of laboratory error. Historical groundwater monitoring data confirms that chromium is not present at levels that exceed PDWS.

LT = less than

e Most current result for well in "Maximum" Summary.

Five inorganic constituents have been detected above PDWS: nitrate, mercury, gross alpha, lead, and chromium. Results from groundwater monitoring analyses show that nitrate is present in concentrations that exceed PDWS in several wells at TNX. Large quantities of industrial-grade nitric acid were used in the operations at TNX. Nitric acid dissociates into hydrogen and nitrate ions in water. Since nitrate is stable in aerobic groundwater, relatively mobile in groundwater, and was used throughout the TNX Area, it can be used as an indicator of the extent of groundwater contamination at TNX. Figure 6 is a concentration map for nitrate.

Mercury concentrations from monitoring well TBG4 consistently exceed PDWS. Very low pH (<4.2) and high nitrate concentrations have also been observed at well TBG4, indicating that the mercury was probably part of a spent nitric acid solvent solution disposed of at TNX. A solvent containing nitric acid and mercury was used at TNX in research on the chemical separations processes used at SRS.

Groundwater from monitoring well TBG4 also has elevated calcium, magnesium, and silica. which are the result of the dissolution of clay minerals in the sediments by very low pH water. The dissolution of clay minerals buffers the low pH water and is a natural chemical response to the addition of acid. The low pH conditions in the immediate vicinity of monitoring well TBG4 increase the solubility of mercury and reduce the number of sites available for mercury adsorption by occupying them with hydrogen ions. Since the groundwater is aerobic and contains chloride, the dissolved mercury is probably in the form of chloride

complexes. As groundwater migrates downgradient away from the low pH mercury source-term, the concentration of mercury complexes is diluted and the groundwater pH increases. As the mercury complexes are diluted, they become unstable and break down, setting free the ionized mercury for adsorption to the soil. Soil downgradient of TBG4 has more sites available for mercury adsorption because of the increased pH. The groundwater monitoring data suggest that these natural processes prevent mercury from migrating very far from the source-term (see Figure 7).

Gross alpha, an indicator of contamination by alpha-emitting radionuclides, is persistently elevated in two monitoring wells, TBG3 and TBG4, located immediately downgradient of the TNX Burying Ground (see Figure 8). Specific alpha emitters in the groundwater were identified by alpha spectroscopy; they were Ra-226, Th-228, 230, and 232, U-233, 234, 235, and 238, Pu-238, 239, 240, and 242, Am-241 and 243, and Cm-242, 243, 244, and 246. Isotopes of radium (Ra) and thorium (Th) are natural decay products of uranium (UL which is also naturally present in sediments. U is a raw material used in several processes at SRS, but it occurs as a natural constituent in sediments as well. Plutonium

(Pu) americum (Am), and curium (Cm), commonly referred to as transuranics, do not occur naturally and are the result of artificial nuclear reactions such as the ones used at SRS. Ra-226 is the main contributor to gross alpha in groundwater throughout the TNX Area (see Figure 8).

Monitoring well XSB5A is the only well that has had lead concentrations that exceed PDWS. Lead concentrations have been steadily decreasing at this well and have not exceeded PDWS since the beginning of 1991. The lead probably comes from the galvanized steel screen in well XSBS, which is located less than ten feet upgradient of well XSB5A. The low pH (<5) of the groundwater in the vicinity of these wells leached lead from the galvanized screen when well XSB5 was active. The decreasing lead concentrations may indicate that the lead source was reduced by the abandonment of well XSB5.

Chromium (Cr) concentrations that exceeded PDWS at TNX were reported during one quarter of analysis and were not elevated prior to or following the quarter of suspect data. The suspect chromium analyses were conducted by the same laboratory and analyst.

Endrin and lindane (pesticides) have been occasionally (<50% of the time) above the PDWS at TNX.

Groundwater samples from the semiconfined aquifer at TNX have not exceeded the PDWS. The relative amounts of major ions in the semiconfined aquifer are different from the unconfined aquifer: iron, magnesium, calcium, sulfate, and HCO3 concentrations are higher in the semiconfined aquifer, and sodium, chloride, and NO3 are lower.

Tritium is below detection limits in the semiconfined aquifer as compared to the overlying unconfined aquifer, which has 2-4 pCi/mL. (Average tritium levels in rainfall at TNX are 2-4 pCi/mL (Murphy, et. al., 1993): the PDWS for tritium is 20 pCi/mL). The low tritium levels in the semiconfined aquifer at TNX indicate that groundwater in the unconfined aquifer is not migrating into or impacting the semiconfined aquifer (Nichols, 1992).

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VI. Summary of Operable Unit Risks

This interim action will serve an incremental step in addressing contamination in the TNX Area and is not intended as a final action. As required by CERCLA, development and selection of final cleanup activities will depend upon the extent of vadose zone contamination. the effectiveness of this interim action, and the results of the Baseline Risk Assessment. The Baseline Risk Assessment will evaluate the current and potential risks to human health and the environment from contamination in the TNX Area. Based upon the results of that assessment, appropriate cleanup alternatives will be developed to fully address site risks.

Contaminated Media

Contaminated media at the TNX Area includes groundwater, surface

water, and the soil above the water table. The focus of this interim action is the contaminated groundwatcr.

Contaminants of Concern

As reflected in Table 1, a number of contaminants have been detected in the groundwater system at levels exceeding health-based standards. The primary contaminant of concern for this interim action is TCE. While carbon tetrachloride and nitrates also appear to be migrating offsite, the plume distributions of TCE and carbon tetrachloride coincide, but the concentrations of carbon tetrachloride are significantly lower than TCE concentrations. The concentration of nitrates leaving the TNX Area is at or slightly exceeds health-based standards and does not pose as significant a threat as TCE. The chemicals of concern will continue to be evaluated for this unit as this interim action is implemented and further investigations in the TNX Fundamental Study Area are conducted.

Interim Risks

The TNX Groundwater Interim Risk Evaluation (IRE) was performed to determine current risks to human health and the environment and to determine if the risk was high enough (greater than 1 x 10-4) to require immediate remedial action. Results of the IRE indicate that the contaminant responsible for the largest portion of the risk to the onsite worker is TCE (see Figure 9). The largest risk to the onsite worker is through contact with contaminated soil and water at the groundwater outcrop in the swamp during sampling. The IRE shows that under current conditions, the onsite worker is not exposed to contaminants at concentrations that will produce an unacceptable risk to human health (see Figure 10).

While the contaminants in the groundwater system exceed SDWA drinking water standards, the contaminated groundwater is not being used, nor is it planned to be used while the site is controlled by DOE. Use of this groundwater as a drinking water source would present unacceptable risk levels. The goals of this action are to mitigate the migration of contaminants and prevent the further degradation of the groundwater system. These goals are consistent with the expectations of the NCP and EPA guidance on addressing

groundwater contamina-
tion.

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VII. Description of Alternatives

Interim action alternatives developed for the TNX Area Groundwater Operable Unit include:

Alternative 1

No Interim Action. Maintain Existing Institutional Controls

Alternative 2

Hybrid Groundwater Corrective Action, the hybrid groundwater corrective action includes groundwater extraction wells with an air stripper and a recirculation well.

Alternative 1 - No Interim Action, Maintain Existing Institutional Controls

Alternative 1 would include no interim cleanup activities. Under the no action alternative. existing groundwater contamination would gradually be reduced with time and distance through attenuation processes, such as biodegradation or dispersion. Contaminated ground-water would continue to migrate west toward the swamp and the Savannah River.

Treatment Components

No treatment would be implemented under Alternative 1.

Engineering Controls

No engineering controls would be executed under this alternative.

Institutional Controls

Access to SRS is controlled at primary roads by continuously manned barricades. Other roads entering the site are closed to traffic by gates or barriers. The entire SRS facility is sur-

rounded by an exclusion security fence, except along the Savannah River. SRS is posted against trespassing under Federal and state statutes.

Implementation Requirements

This alternative is readily implementable.

Estimated Construction and Operation and Maintenance Costs

Costs associated with Alternative 1 include groundwater monitoring and annual reporting. Groundwater monitoring and reporting is estimated to be $20.000/year.

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ARARs Associated with the Considered Alternative

Applicable or Relevant and Appropriate Requirements (ARARs) are Federal and state environmental regulations that establish standards that remedial actions must meet. There are three types of ARARs:

- chemical-specific
- location-specific
- action-specific

No Action-specific ARARs are associated with Alternative 1. The only potential location-specific ARAR associated with Alternative 1 is related to the Clean Water Act.

Alternative 2-Hybrid Groundwater Corrective Action

Alternative 2, the Hybrid Groundwater Corrective Action, includes groundwater extraction wells with an air stripper and a recirculation well. The extraction wells and air stripper would be used to remove and treat the groundwater exceeding the cleanup goal in the TNX Area Groundwater Operable Unit. A recirculation well installed upgradient of the extraction wells would provide in situ treatment of contaminated groundwater and may stimulate the natural soil bacteria to degrade some of the contamination while in

the aquifer. Air emissions from the air shipper and recirculation well will be treated as necessary to comply with SCDHEC air pollution regulations.

Treatment/Engineering Controls

Recirculation Wells

Recirculation wells are an emerging technology for in situ cleanup of CVOC contaminated groundwater. In recirculation wells, air is injected into a groundwater well. As the air rises to the surface in the well, it removes CVOCs from the water by air snipping. Additionally, the air causes groundwater to flow upward in the well establishing a circulation system where water is drawn into the bottom and discharged at the water table. The air is collected by a vacuum at the surface for treatment (see Figure 11). The vacuum also recovers soil vapor from the unsaturated zone resulting in additional cleanup.

Extraction Wells with an Air Stripper

The flow of contaminated groundwater is intercepted by a series of water wells known as extraction wells. The extraction wells are used to drawdown the water table and collect contaminated groundwater. Drawdown from the extraction wells produces a capture zone that prevents the further migration of contamination from the site (see Figure 12). The contaminated groundwater that is collected by the extraction wells will be treated by an air stripper. Treated groundwater will be discharged to a permitted outfall. The air snipper can also be used to treat contaminated water from other cleanup activities such as groundwater sampling. Air emission from the air stripper and recirculation well will be treated as necessary to comply with SCDHEC air pollution regulations.

Mercury, gross alpha, and nitrate will be monitored in the effluent from the treatment system to ensure that they do not exceed discharge limits. If they begin to exceed discharge limits,

the well causing the exceedance will be identified through sampling, and discharges from that well will be treated using methods similar to ion exchange or reverse osmosis.

Performance Objectives

The performance objectives of the interim action are to:

Stabilize the operable unit and prevent the further degradation of the groundwater system by containing the portion of the plume with >500 æg/L TCE. This concentration level was selected based upon calculations performed associated with the IRE and technical considerations for well placement and system performance. Controlling the portion of the plume with >500 æg/L TCE will also control and treat the area with the highest con-centrations of other CVOCs and nitrates.

Maintain risks associated with potential exposure pathways within acceptable limits.

Implement an action that will not be inconsistent with and facilitate potential future cleanup efforts.

The interim action cleanup goal was developed using a risk-based approach to protect humans in the interim exposure scenario with the highest risk of cancer, the onsite worker. In the IRE, the onsite worker was exposed to 930 æg/L of TCE in the groundwater outcrop. The cleanup goal of the interim action is to reduce the maximum TCE concentration in the plume to ó500 æg/L ensuring that the concentrations at the seep do not present a risk to human health and the environment. The 500 æg/L concentration for TCE was selected based on the results of the IRE and the concentration of TCE that is admissible in a solid waste (TCLP level) before it is considered a hazardous waste. This remedy will provide protection of human health by ensuring that the most highly exposed person in the IRE does not receive a dose of TCE that results in an unacceptable cancer risk. CVOC concentration in the recovery wells, TNX monitoring wells, air shipper influent and effluent, and air stripper offgas will be monitored to evaluate system Performance.

Benefits

In the Hybrid Groundwater Corrective Action, the advantages of one technology addresses the disadvantages of the other resulting in a robust cleanup system. The benefits of the Hybrid Groundwater Corrective Action are listed below.

Recirculation Well

- in situ treatment of contaminated groundwater
- in situ biodegradation reduces cleanup times
- conserves groundwater resources during cleanup
- potential for cleaning up the unsaturated zone using soil vapor extraction

Pump and Treat

- stops migration of contaminated water exceeding interim cleanup goals
- collects and treats contaminated water
- provides infrastructure for handling secondary waste associated with cleanup
- enhances transport of nutrients from recirculation well for in situ cleanup

Institutional Controls

Public access to SRS is controlled by existing security personnel and security equipment, as discussed under Alternative 1. The existing SRS security controls will be maintained as part of normal SRS operations.

Implementation Requirements

The implementation requirements for the Hybrid Groundwater Corrective Action will include the following:

- installing groundwater recovery wells to capture the portion of the plume with >500 æg/L TCE
- constructing the air stopper to treat the TCE and other CVOCs in

the recovered ground-
water
installing a recirculation well to enhance the natural in situ biocegradation of TCE and
other CVOCs in the groundwater

Standard drilling techniques for unconsolidated sediments will be used when possible. The recirculation well uses a larger than normal borehole and may require special materials to drill the well. The air stripper and components of the recirculation well are standard industrial equipment and are readily available. The air lift recirculation well is a relatively new remediation technique and will require some startup testing to evaluate the optimal operating conditions.

Estimated Construction and Operation and Maintenance Costs

The costs for Alternative 2 are estimated to be $600,000. Costs include construction, monitoring, and maintenance of the recirculation well and pump and treat system.

ARARs Associated with the Considered Alternative

The ARARs for the Hybrid Groundwater Corrective Action are listed in Table 2. The National Primary Drinking Water Standards (MCL/MCLGs) will not be ARARs because they are beyond the scope of the interim action.

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The Hybrid Groundwater Corrective Action is designed to stabilize the groundwater contamination through containment of the most contaminated groundwater. Containment of the portion of the plume with >500 æg/L TCE will be accomplished using 3-5 recovery wells cumulatively pumping up to 30 gallons per minute. A recirculation well will be installed in the most contaminated portion of the groundwater being contained by the recovery wells to accelerate the reduction of contamination levels. The bottom of the recirculation well recovers groundwater and the top of the recirculation recharges the contaminated aquifer with treated groundwater containing nutrients to stimulate in situ cleanup of the contamination downgradient of the recirculation well. As the water rises in the recirculation well, the nutrients in the air, used to treat the contaminants dissolve into the water (see Figure 11). The recovery wells can be used to direct the recharge from the recirculation well to expand the zone of in situ cleanup. The hypothetical capture zone above was developed a simplified model of the groundwater flow at TNX based on data from monitoring wells and pumping tests.

Figure 12. Capture Zone of a Hypothetical Hybrid Groundwater Corrective Action for TNX

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Table 2. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for the Hydraulic Containment of Offsite Groundwater

Actions	Requirements	Prerequisites	Federal citation	South Carolina Code of Laws
CHEMICAL-SPECIFIC				
Treatment of contaminated groundwater	Discharge must not exceed DCGs for radionuclides: discharge of radionuclides must not exceed 1 rad/day for protection of aquatic organisms	Direct discharge of groundwater to a surface water body	DOE Order 5400.5	TBC guidance
Air Stripping	Environmental Permits to con-	Discharge of toxic air		

pollutants SC - R. 61-62.1.
struct and operate (trichloroethylene and
tetrachoro- SC - R. 61-62.5.
ethylene) - Substantive
require- Standard Number
ments are applicable
8

Protection of the general public from all sources of radiation
The general public must not receive an effective dose equivalent greater than 100 mrem/year
DOE Order 5400.5
Dose received by the public from all sources of radiation exposure at DOE facility - TBC guidance

All releases of radionctive material must be "as low as reasonably achievable" (ALARA)
DOE Order 5400.5
Releases of radioactive material from DOE activities - TBC guidance

Protection of the general public from all sources of air emissions
No member of the general public shall receive an effective dose equivalent greater than 10 mrem/year
40 CFR 61.92: DOE Order 5400.5
Emissions of radionuclides to the ambient air from DOE facilities - Applicable

Worker protection
Maintain worker exposures to ALARA
DOE Order 5480.11
Internal and external sources of continuous exposure to occupational workers at a DOE facility - TBC guidance

Maximum exposure to occupational workers: 5 rem/year (stochastic); 50 rem/year (nonstochastic) effective dose equivalent
DOE Order 5480.11
Internal and external sources of continuous exposure to occupational workers at a DOE facility - TBC guidance

ACTION-SPECIFIC

Erosion Control
Develop a plan for erosion sediment control
SC 72-300
Land disturbing activities - Applicable

Well Construction
Construction by a certified driller
SC R.61-71
Drilling water wells - Applicable

is required

Standards for construction, main- Drilling water wells - Applicable SC R.61-71
tenance, and operation of all
wells

Standards for construction of Construction injection well (recir- 40 CFR 144-147 SC R.61-87
injection wells culating wells) - Applicable

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Table 2. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for the Hydraulic Contain-
ment of Offsite Groundwater

Actions	Requirements	Prerequisites	Federal citation	South Caro-lina Code of Laws
Discharge of treated groundwa-ter to stream	Discharge must comply with the effluent limitation of the NPDES permit SC 0000175	Point sources discharge to of the United States - Applicable	40 CFR 122	SC R 6I-9
	Discharges to streams must meet the established water quality standards	Discharges to surface waters of the State - Applicable		SC R.61-68
Air Stripping	State of S.C. requites a permit to build and operate a wastewater facility	Construction and operation of an industrial wastewater treatment facility - substantive require-ments and applicable		S.C. Pollution Control Act Title 48-1-110
	A NESHAP evaluation to deter-	Radionuclides other than radon	40 CFR 61.96	

	mine if source of radionuclide emission requires EPA approval	from DOE facilities. Substantive requirements are applicable

Acronyms used in Table 2

TBC = to be considered
DCGs = derived concentration guide
CFR = Code of Federal Regulations
DOE = Department of Energy
EPA = Environmental Protection Agency
NPDES = National Pollutant Discharge Elimination System
NESHAP = National Emissions Standards for Hazardous Air Pollutants

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VIII. Summary of Comparative Analysis of Alternatives

Each interim response alternative was evaluated using nine criteria developed by the EPA. The criteria were derived from statutory requirements of CERCLA. Section 121. The results of the evaluation are presented in Table 3.

Descriptions of Nine Evaluation Criteria

Overall Protection of Human Health and the Environment. This addresses whether a remedy provides adequate protection and describes how risks posed through each path-way are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Long-Term Effectiveness and Permanence. This refers to the magnitude of residual risk and the ability of a remedy to maintain reliable protection of human health and the envi-ronment over time once cleanup goals are met.

Short-Term Effectiveness. This refers to the speed with which the remedy achieves pro-tection, as well as the potential for a remedy to create adverse effects on human health and the environment that may result during the construction and implementation period.

Reduction of Toxicity, Mobility, or Volume through Treatment. The

remedial alternatives
are assessed based on the degree to which they employ treatment
that reduces toxicity,
mobility, or volume, including how treatment is used to address the
principal threats
posed by a media-specific operable unit.
Implementability. This refers to the technical and administrative
feasibility of a remedy,
including the availability of materials and services that may be
used to implement the
chosen solution.
Compliance with Applicable or Relevant and Appropriate Requirements
(ARARs). This
criterion addresses whether a remedy will meet the ARARs of other
Federal and state
environmental statutes.
Cost. This includes capital, operation, and maintenance costs.
State Acceptance. Based on its review of the proposed interim
action, this indicates
whether the state concurs with, opposes, or has no comment on the
preferred alternative.
Community Acceptance. Acceptance by the surrounding community will
be assessed in
the Record of Decision following a review of the public comments
received on the pro-
posed interim actions.

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Table. 3 Evaluation of Interim Response Actions

Alternatives

(2) Hybrid Groundwater Corrective
Evaluation Criteria (1) No action
Action

Overall Protection of Human Minimal
High
Health and the Environment

Compliance with ARARs This alternative will not be in compliance
The water treatment plant (air stripper) will
with the Safe Drinking Water Act in the
be constructed and operated in full compli-

	ance with wastewater treatment plant regulations. Treated groundwater will meet NPDES requirements and offgas from the treatnment system will meet Clean Air Act regulations.	following areas: contaminant concentrations in the groundwater and local surface water exceeds PDWS surface water concentrations in local seeps do not meet NPDES requirements
Long-term effectiveness and permanence	Same as no action.	This evaluation criterion does not apply to Interim Actions.
Reduction of toxicity, mobility, or volume through treatment	Air stripping removes the contaminants from the recovered groundwater, reducing its toxicity. Volume of groundwater that may pose a risk to onsite workers will be reduced through reduction of contaminant mass in the portion of the plume exceeding the interim goal.	None
Short-term effectiveness	Groundwater recovery will immediately begin to reduce the amount of contaminant remaining in the subsurface and control the migration of contaminated groundwater into the swamp.	This alternative does not provide a short-term remedy for preventing discharges of contaminate groundwater to the swamp.
Implementability	All of the technologies in this alternative are currently available. Air stripping is extremely efficient and requires minimal maintenance. This system has a wide range of operating conditions and as result, reme-	This alternative is already in place.

diation system upgrades can be easily

incorporated.

	Cost (for comparison only)	Capital Cost: $0
Capital Cost: $600,000		
		Operation and Maintenance (O&M)
Operation and Maintenance (O&M)		
		Costs: approximately $20,000 per year
Costs: approximately $100,000		
		Months to Implement: already in place
Months to Implement: 18-24		
	State acceptance	This alternative is not acceptable to
This alternative is acceptable to SCDHEC.		
		SCDHEC.
	Community acceptance	See responsiveness summary.
See responsiveness summary.		
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IX. Selected Remedy

Alternative 2 is the selected alternative for this interim action. This alternative will provide the best balance between the need for prompt action for groundwater remedial actions and the current site conditions and exposure scenarios. The hybrid groundwater corrective action will achieve the goals highlighted for this action and will serve as an incremental step in addressing environmental contamination within the TNX Fundamental Study Area and SRS.

The hybrid groundwater corrective action system will stabilize the portion of the plume with >500 æg/L TCE as it is generally depicted in Figure 5. However, if the area containing TCE levels exceeding 500 æg/L has expanded, the area that will be intercepted will be expanded accordingly. Samples from existing monitoring wells as well as samples from the influent and effluent from the air strippers, air emissions from the air

stripper, and the recirculation well will be used to monitor the performance of the interim action. The details of the monitoring will be discussed in the operating and maintenance plan for the hybrid groundwater corrective action system.

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X. Statutory Determination

The National Contingency Plan (40 CFR 300.430(e)(9)) sets forth nine evaluation criteria that provide the basis for evaluating alternatives and subsequent selection of a remedy. The selected alternative, Alternative 2, was evaluated with respect to the five statutory findings, as required for interim actions under CERCLA. The results of the evaluation are as follows:

Protection of Human Health and the Environment. Alternative 2 will mitigate the risks of exposure to contaminated surface water by stopping the migration of groundwater containing CVOCs above the interim cleanup goal before it reaches the swamp and utilizing existing administrative controls. Additionally, removing CVCOC-contaiminated groundwater will reduce the future risk of exposure to contaminated groundwater through ingestion.

Attainment of ARARs. All ARARs pertaining to the treatment and disposal of contaminated groundwater will be met by the selected alternative (Table 2). The selected alternative will clean up the contaminated groundwater to meet the interim cleanup goals.

Cost Effectiveness. The recovery well system is a cost- effective method of providing hydraulic containment of the groundwater contamination beneath an operating facility where physical barriers are not practical. The recovery system also provides an advantage over the physical barriers due to the benefits of contaminant removal. Air stripping is an efficient method for removing CVOCs from groundwater and is a well

established treatment method for contaminated groundwater.

Recirculation wells are new technology for cleaning up CVOCs and there is little data on the cost-effectiveness of the technology. Cost-effective methods such as air lift pumping and air stripping play a major role in recirculation wells. The cost-effective components along with potential for in situ groundwater cleanup indicate that recirculation wells will be economically feasible.

Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable. The proposed alternative relies heavily on treatment technologies to remove CVOCs from the groundwater. Treatment is a principal element of this interim action and is achieved through enhanced in situ biodegradation and air stripping of groundwater contaminated with VOCs. However, this action is an interim action and is not designed or expected to be final. The selected remedy represents the best balance of tradeoffs with respect to pertinent criteria given the limited scope of the action.

Preference for Treatment as a Principal Element. The principal threat in the TNX Groundwater Operable Unit is trichoroethylene. The selected alternative uses treatment as a principal element of the Hybrid Groundwater Remediation System. Specifically, the selected alternative uses air stripping and in situ bioremediation to treat the principal threat. Furthermore, the selected alternative does not include any element that requires storage of waste. Although this statutory preference is partially addressed in this remedy, the preference for treatment as a principal element will be addressed by the final response action for this unit.

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XI. Explanation of Significant Changes

There were no significant changes to the IAPP as a result of the public comments.

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XII. References

DOE (U.S. Department of Energy), 1987, Final Environmental Impact Statement-Waste Management Activities for Groundwater Protection Savannah River Plant, Aiken, South Carolina, DOE/EIS-0120, Savannah River Plant Operations, Aiken, SC 29808.

FFA, Federal Facility Agreement for the Savannah River Site, Administrative Docket No 09-05-FF, Effective Date: August 16, 1993.

Nichols. R. L., 1992, Characterization of Shallow Groundwater at TNX (U) WSRC.TR-92-508, Rev, 0.

WSRC, 1991b, SRS Public Involvement Plan, WSRC-RP-91-445, Rev 2, September 8, 1992, Westinghouse Savannah River Site, Aiken, SC 29802.

WSRC, Assessment of Tritium in the Savanna River Site Environment (U), WSRC-TR-93-214, October 1993, Westinghouse Savannah River Site, Aiken, SC 29802.

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Appendix A

Responsiveness Summary

General Response

During the 30 day comment period, a request for a public meeting was received. The public comment period was extended an additional 30 days so the public meeting could be held. The public information meeting was held on October 11, 1994, in Aiken, South Carolina.

The public meeting was divided into three main segments: a general introduction section, a discussion about the proposed TNX groundwater interim action, and a discussion about the proposed D-Area Oil Seepage Basin interim action. The TNX discussion was broken into a general information and background segment, a discussion and question/answer session about the proposed interim action, and finally, an opportunity for formal commenting. No formal comments were received at the public meeting.

During the public comment period, limited written comments were received. In general, comments concerning the proposed action for the TNX groundwater unit addressed techni- cal details regarding treatment of the extract groundwater. No comments were received which opposed the proposed action. During the public information meeting, several ques- tions were raised regarding selection of the interim action goals and general information on the contaminants present at the site. No comments were received which opposed the pro- posed action. The minutes of the public meeting are available in the administrative record file.

During the public information meeting, suggestions were received from the Energy Research Foundation on potential improvements to the meeting format. These comments will he evaluated, and to the extent possible, the recommendations will be followed.

Written comments were received from members of the public and the Energy Research Foundation.

Specific Comments

Comment

A series of public meetings should be held.

Response

A public meeting was held on October 11, 1994, in Aiken, SC, to discuss the proposed interim action. In general, the Department of Energy plans to conduct periodic public information meetings to review the general status of significant cleanup operations, solicit public input on specific remedial actions, and provide an opportunity for the public to discuss cleanup issues with DOE and the regulators.

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Comment

Energy Research Foundation
Columbia, SC

... The phrase "treated as necessary" on page 11 begs further definition as to whether the air will be routinely treated, or whether it will be treated only when it goes above a certain monitoring threshold. If so, what is the threshold, and is it consistent with the State and Federal regulations? However, air emissions will be monitored to ensure compliance with applicable regulations.

Response

The treatment threshold is set by the State and Federal air regulations, Discussions with the State and Federal regulators about the anticipated air emissions from the TNX treatment system indicate that no treatment of air emissions will be required.

Comment

Energy Research Foundation
Columbia, SC

Further, SRS should certify that it has the treatment capability for each of the contaminants that may be present in groundwater that is pumped to the surface for treatment and discharge via the "permitted outfall." The permitted outfall is,

presumably, to be a NPDES permitted stream. NPDES permits don't include radioactive materials though, and it's not clear what "discharge limits" SRS will apply. Any surface water discharge that exceeds Federal drinking water standards would not be acceptable - not because it wouldn't be illegal, but because it is probably increasing the risk to the public.

Response

A wastewater construction permit must be issued by the SCDHEC before the construction of the wastewater treatment plant can begin. All chemical constituents in the groundwater that require treatment prior to discharge at a permitted NPDES outfall in the TNX area will he addressed by the treatment system. SCDHEC does not issue water construction permits unless all necessary treatment is provided for in the permit application. SRS will meet discharge requirements for radionuclides in compliance with DOE Order 5400.5, which is soon to be 10 CFR 834. The contaminant of concern in the interim has been identified in the IAPP as trichloroethylene. Stabilization and remediation of the portion of the plume with the highest concentrations of TCE will also address the portion of the plume with the highest concentrations of other contaminants that do not pose an unacceptable health risk during the interim remediation period.

Comment

Energy Research Foundation
Columbia, SC

Questions about the combined effects of pumping, treating, and releasing contaminated groundwater should be answered before a decision is made.

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	Response
and releasing contam-	All questions pertaining to the combined effects of pumping, treating,
a question to the	inated groundwater were answered in the public hearing. Specifically,
form of mercury is	mobilization of mercury as a result of pumping was asked. The mobile
contamination is highly	not stable in groundwater at TNX, and as a result the mercury
	localized

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SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 02/13/1995
Operable Unit: 35
ROD ID: EPA/ROD/R04-95/215

Media: groundwater, surface water, sediments

Contaminant: Cesium-137

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The Savannah River Site (SRS) occupies approximately 300 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties in South Carolina. SRS is a secured U.S. government facility with no permanent residents. The site is located approximately 25 miles southeast of Augusta, Georgia.

SRS is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided nuclear materials for the space program and for medical, industrial, and research efforts. Chemical and radioactive wastes are by-products of nuclear material production processes. Hazardous substances, as defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), are currently present in the environment at SRS. The Par Pond unit, consisting of the Par Pond Reservoir, the series of pre-cooler ponds and canals, and Lower Three Runs Creek,

is listed as a CERCLA unit in Appendix C of the Federal Facility Agreement. For the purposes of this interim action, the operable unit addressed consists of the approximately 1340 acres of sediments at the periphery of the Par Pond Reservoir that were exposed as a result of the drawdown of the reservoir.

Par Pond is a 2640 acre man-made reservoir located in the eastern portion of SRS. Par Pond was created in 1958 by constructing an earthen dam across Lower Three Runs Creek. The three main arms of the reservoir follow the uppermost portion of Lower Three Runs Creek and its tributaries.

Par Pond was built to augment the cooling water requirements of two on site reactors, called the P and R Reactors. R Reactor began operations in 1953. Prior to construction of Par Pond, R Reactor received cooling water directly from the Savannah River and discharged cooling water directly into Lower Three Runs Creek in an area that is now the Hot Arm of Par Pond. P Reactor received cooling water directly from the Savannah River and discharged cooling water directly into Steel Creek.

During the late 1950s, an effluent pathway was constructed from R Reactor to Par Pond. The pathway consisted of the R Canal and Pond B. This effluent pathway was used for R Reactor discharge from 1961 until the reactor was shut down in 1964. Since the shutdown of R Reactor in 1964, R Canal and Pond B have remained mostly undisturbed.

Releases in the form of process leaks, purges, and makeup cooling water have contaminated Par Pond with cesium-137 and other radioactive and nonradioactive contaminants. Between 1954 and 1964, approximately 222 curies (Ci) of cesium-137 were released from R Reactor into Par Pond or Lower Three Runs Creek. All radioactive isotope releases ceased following the shutdown of R Reactor in 1964. No measurable cesium-137 was released into Par Pond from P Reactor. Concentrations of radioactive isotopes in Par Pond have decreased due to the cessation of reactor releases, decay of the isotopes, dilution from groundwater seepage, and seepage losses from the basin. Since most of the radionuclide releases to Par Pond occurred during the 1950 to 1960 era, and the half life of cesium-137 is approximately 30 years, more than half of this radionuclide has decayed. The current estimated inventory of cesium-137 associated with all sediments within the Par Pond reservoir is approximately 43 Ci, of which 9 Ci are present in the 1340 acres of exposed sediments. The remaining 68 Ci of cesium-137 inventory in the Par Pond system is located in the

sediments of the pre-cooler canal/pond system and Lower Three Runs Creek.

Par Pond has been inspected every other year since 1980. During an inspection of the Par Pond Dam in March 1991, a small surface depression was noted on the downstream face. Based on the inspection report, DOE ordered a detailed structural investigation into the cause of the depression and simultaneously initiated a precautionary drawdown of the reservoir. From June through September 1991, the level of Par Pond was lowered from 200 feet to 181. The 181 ft level was chosen to reduce the risk and consequences, in the unlikely event of a dam failure, of potential flooding in downstream communities.

Lowering the surface water level elevation of Par Pond from a full pool of approximately 200 ft to 181 ft resulted in a reduction of the reservoir's surface area and volume by approximately 50 and 65 percent, respectively. This action caused many changes in what had been a formerly hydrogeologically stable and biologically productive ecosystem. The drawdown of the reservoir had two major repercussions: the elimination of the previous shore zone and its sediments contaminated with radiocesium and mercury. All components of the Par Pond ecosystem are continuing to undergo a period of disequilibrium associated with a readjustment of new conditions within the basin. The ecosystem is recovering, but at much reduced population sizes compared to a full pool.

The loss of approximately two-thirds of the original volume of Par Pond and exposure of 1,340 acres of lakebed sediment resulted in temporary impacts to the reservoir's water quality. Effects of the increased erosion and sediment resuspension from the exposed lakebed caused an increase in turbidity of the reservoir's water column. Erosion gullies up to approximately 11 inches deep were cut by individual rainstorm events during the fall of 1991 and the winter of 1991-1992 because of the initial lack of vegetative cover on the exposed lakebed. However, colonization of the former lakebed by terrestrial and semi-aquatic species has stabilized much of the exposed sediment and runoff. As a result of this reduction in the sediment load into the basin, the turbidity has decreased significantly compared to that immediately following the drawdown, and water clarity is presently similar to pre-drawdown conditions. Certain SRS activities have required Federal operating or post-closure permits under the Resource Conservation and Recovery Act (RCRA). SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control (SCDHEC) on September 30, 1987.

For an interim action and as requested by EPA, DOE evaluated interim action remedial alternatives to reduce potential risks associated with cesium-137 in the exposed sediments. Based on current data, the most critical concerns for evaluation of interim remedial alternatives for the Par Pond sediments are the control of risks due to cesium-137 contamination. An evaluation of alternatives to support a final action will be conducted following completion of this interim action and a Remedial Investigation/Feasibility Study (RI/FS) for the entire waste unit.

Remedy: The preferred interim alternative consists of refilling and maintaining Par Pond to its original level following repair of the Par Pond Dam. Based on comments on the Interim Action Proposed Plan for the operable unit, the preferred alternative has been modified to include maintenance of the reservoir at the 200-ft water level until a National Environmental Protection (NEPA) evaluation can be accomplished of the environmental impacts from reduced flow to Lower Three Runs Creek, fluctuating reservoir water level, and the discontinuance of providing river water, through pumping, to the reservoir.

The preferred alternative is an interim action. A final action will be evaluated following implementation of the preferred action alternative according to the FFA schedule. The interim action provides the most timely reduction of risk to human health and the environment through submergence of the sediments with a layer of water upon restoration of the Par Pond water level. The water level would attenuate gamma radiation emitted from the decay of cesium-137 and minimize the potential for sediments to become airborne. Also, of significance to the environment, the interim action would allow for a gradual recovery of the reservoir to essentially pre-drawdown ecological conditions.

Text: Full-text ROD document follows on next page.

Text:

United States Department of Energy

Savannah River Site

Interim Action Record of Decision
Remedial Alternative Selection (U)

Par Pond Unit

WSRC-RP-93-1549
Revision 0
January 26, 1995

Westinghouse Savannah River Company
Savannah River Site
Aiken, South Carolina 29808

<IMG SRC 0495215>

SAVANNAH RIVER SITE

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY UNDER CONTRACT DE-AC09-89-SR18035

WSRC-RP-93-1549, REV. 0
JANUARY 26, 1995

INTERIM ACTION RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

Par Pond Unit

Savannah River Site
Aiken County, South Carolina

Prepared by:

U.S. Department of Energy
Savannah River Operations Office
Aiken, South Carolina

DECLARATION FOR THE INTERIM ACTION RECORD OF DECISION

Unit Name and Location

Par Pond Unit
Savannah River Site
Barnwell County, South Carolina

The Par Pond unit, consisting of the Par Pond Reservoir, the series of pre-cooler ponds and canals, and Lower Three Runs Creek, at the Savannah River Site (SRS), is listed as a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA).

Statement of Basis and Purpose

This document presents the selected interim remedial action for the Par Pond operable unit, defined as the approximately 1340 acres of sediments at the periphery of the Par Pond Reservoir that were exposed as a result of the drawdown of the reservoir from 200 ft to 181 ft mean sea level (msl). The interim action was developed in accordance with CERLCA of 1980, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this specific CERCLA unit.

Assessment of the Unit

Par Pond is a 2640-acre man-made reservoir constructed to augment the cooling water requirements of both P and R Reactors of SRS. Releases in the form of process leaks, purges, and makeup cooling water have contaminated Par Pond sediments with cesium-137 and other radioactive and nonradioactive contaminants. During an inspection of Par Pond Dam in March 1991, a small surface depression was noted on the downstream face. Based on the inspection report, the U.S. Department of Energy (DOE) ordered a detailed structural investigation into the cause of the depression and simultaneously initiated a precautionary drawdown of the Par Pond Reservoir from the original 200 ñ 1 ft to 181 ft msl. The 181-ft level was chosen to reduce the risk and consequences, in the unlikely event of a dam failure, of potential flooding in downstream communities. The drawdown resulted in exposure of approximately 1340 acres of previously submerged sediments contaminated with cesium-137 and other radioactive and nonradioactive contaminants.

Remedial alternatives were developed for interim remediation of the exposed sediments caused by the reservoir drawdown. The alternatives developed are based on limited existing information regarding the physical and chemical characteristics of the sediments of Par Pond and the hazardous substances within the sediment. DOE is conducting ongoing investigations of the Par Pond waste unit. The additional information being obtained is essential in developing technically effective remedial alternatives that would address all contaminated media and risk. Regarding the remediation/restoration of Par Pond, DOE is scoping a phased approach to identify the optimal sequence of investigative activities and unit actions. An interim action is initially being

proposed to
remediate the immediate potential risks caused by exposure of contaminated sediments due to reservoir drawdown including associated efforts upon the reservoir, due to erosion of exposed sediments. A CERCLA Remedial Investigation (RI) characterization is currently planned according to the FFA schedule.

Description of the Selected Remedy

The preferred interim alternative consists of refilling and maintaining Par Pond to the original 200
ñ 1-ft level following repair of the Par Pond Dam. Based on comments on the Interim Action Proposed Plan for the operable unit, the preferred alternative has been modified to include

maintenance of the reservoir at the 200-ft water level until a National Environmental Protection Act
(NEPA) evaluation can be accomplished of the environmental impacts from reduced flow to Lower Three Runs Creek (the creek below Par Pond Dam), fluctuating reservoir water level, and the discontinuance of providing river water, through pumping, to the reservoir.

The preferred alternative is an interim action. A final action(s) will be evaluated following implementation of the preferred interim action alternative according to the FFA schedule. The interim action provides the most timely reduction of risk to human health and the environment through submergence of the sediments with a layer of water upon restoration of the Par Pond water
level. The water layer would attenuate gamma radiation emitted from the decay of cesium-137 and minimize the potential for sediments to become airborne. Also, of significance to the environment,
the interim action would allow for a gradual recovery of the reservoir to essentially pre-drawdown
ecological conditions.

Declaration Statement

The interim action remedy is protective of human health and the environment, complies with Federal and South Carolina applicable or relevant and appropriate requirements (ARARs) directly associated with this limited scope action, and is cost-effective. This interim action utilizes permanent solutions and alternative treatment (or resource recovery) technologies, to the maximum
extent practicable, given the limited scope of the action. Because this action does not constitute the
final remedy for the Par Pond unit, the statutory preference for remedies that employ treatment that
reduces toxicity, mobility, or volume as a principal element, although partially addressed in this
remedy, will be addressed by the final response action(s). Subsequent actions are planned to address fully the threats posed by the conditions at the Par Pond unit. Since this is an Interim

Action Record of Decision, review of this unit and of this remedy will be ongoing through implementation of the Remedial Investigation and Feasibility Study process required in accordance
with the terms of the FFA as DOE, the U.S. Environmental Protection Agency, and the South Carolina Department of Health and Environmental Control continue to develop final remedial alternatives for the Par Pond unit.

Date

Frank R. McCoy
Assistant Manager for Environment,
Safety, Health, and Quality

Date

John H. Hankinson, Jr.
Regional Administrator
U.S. Environmental Protection Agency
Region IV

Date

R. Lewis Shaw
Deputy Commissioner
Environmental Quality Control
South Carolina Department of Health and
Environmental Control

DECISION SUMMARY
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Appendix

A. Responsiveness Summary

WSRC-RP-93-1549, REV. 0
JANUARY 26, 1995

DECISION SUMMARY
INTERIM ACTION
REMEDIAL ALTERNATIVE SELECTION

Par Pond Unit

Savannah River Site
Aiken County, South Carolina

Prepared by:

U.S. Department of Energy
Savannah River Operations Office
Aiken, South Carolina

I. Site and Operable Unit Name, Location, and Description

The Savannah River Site (SRS) occupies approximately 300 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina (Figure 1). SRS is a secured U.S. government facility with no permanent residents. The Site is located approximately 25 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina. According to 1990 census data, the average population densities (in people/square mile) for the surrounding South Carolina counties are 111 for Aiken County, 36 for Barnwell County, and 28 for Allendale County, and for the surrounding Georgia Counties are 228 for Columbia County, 524 for Richmond County, 25 for Burke County, and 21 for Screven County. The population within a 50-mile radius of SRS is 635,000 people.

SRS is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided nuclear materials for the space program and for medical, industrial, and research efforts. Chemical and radioactive wastes are by-products of nuclear material production processes. Hazardous substances, as defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), are currently present in the environment at SRS. The Par Pond unit, consisting of the Par Pond Reservoir, the series of pre-cooler ponds and canals, and Lower Three Runs Creek, is listed as a CERCLA unit in Appendix C of the Federal Facility Agreement (FFA, 1993). For the purposes of this interim

Par Pond was created in 1958 by constructing an earthen dam across Lower Three Runs Creek. The three main arms of the reservoir follow the uppermost portion of Lower Three Runs Creek and its former tributaries, Poplar Branch and Joyce Branch (Wilde and Tilly, 1985). Prior to drawdown, the elevation of Par Pond was 200 ñ 1 ft msl. The current elevation after drawdown is 181 ft msl. Prior to drawdown, Par Pond had a mean depth of approximately 20 ft, a maximum depth of approximately 60 ft near the Par Pond Dam, reservoir length of approximately 38 miles (Wilde, 1985).

The easternmost shore of Par Pond lies approximately 1.5 miles from the eastern SRS boundary. The southern shore of the reservoir lies approximately 200 ft north of Road B. Par Pond discharges through controlled releases into Lower Three Runs Creek, which in turn discharges into the Savannah River. The length of Lower Three Runs Creek from the outfall of Par Pond to the Savannah River is approximately 20 miles.

II. Operable Unit History and Compliance History

Operable Unit History

Par Pond was built to augment the cooling water requirements of both P and R Reactors (Wilde, 1985). R Reactor began operations in 1953. Prior to construction of Par Pond, R Reactor received cooling water directly from the Savannah River and discharged cooling water directly into Lower Three Runs Creek in an area that is now the Hot Arm of Par Pond (Figure 2). P Reactor began operations in 1954. Prior to construction of Par Pond, P Reactor received cooling water directly from the Savannah River and discharged cooling

action, the operable unit addressed consists of the approximately 1340 acres of sediments at the periphery of the Par Pond Reservoir that were was exposed as a result of the drawdown of the reservoir from 200 ft to 181 ft mean sea level (msl). for

reactor Par Pond is a 2640-acre man-made reservoir located northeast of P Area and east of R Area in the eastern portion of SRS (refer to Figure 1).

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<IMG SRC 0495215B>

also served as a heat exchange/cooling fish reservoir for P Reactor until 1988. Heated higher water from P Reactor was released through a series of manmade canals and smaller impoundments into the pre-cooler Pond C. The effluent from Pond C passed through a investigating concrete culvert below an earthen dam (the Pond C Dam) and was funneled by gravity into the Hot Arm of Par Pond.

Releases in the form of process leaks, purges, these and makeup cooling water have contaminated Par Pond with cesium-137 and other radioactive and nonradioactive contaminants. Between 1954 and 1964, approximately 222 curies of cesium-137 were released from R Reactor into Par Pond or Lower Three Runs Creek (before the creation of the reservoir in water directly into Steel Creek.

During the late 1950s, an effluent pathway constructed from R Reactor to Par Pond. The pathway consisted of the R Canal and Pond B (Figure 2). This effluent pathway was used R Reactor discharge from 1961 until the was shut down in 1964. Since the shutdown of R Reactor in 1964, R Canal and Pond B have remained mostly undisturbed. Par Pond

Since 1989, concentrations of mercury in fish collected at all locations onsite have been higher than fish collected from the Savannah River (WSRC, 1991a). Therefore, concentrations of mercury may not be totally attributable to offsite sources. SRS is currently possible causes for these increased concentrations.

Since 1980, the Par Pond Dam has been inspected every other year. In addition to these inspections, wet areas near the downstream slope of the embankment have been inspected annually (DOE, 1992). During an inspection of the Par Pond Dam in March 1991, a small surface depression was noted on the downstream face. Based on the inspection report, DOE ordered a detailed structural

1958). All radioactive isotope releases ceased depression
following the shutdown of R Reactor in 1964.
No measurable cesium-137 was released into
Par Pond from P Reactor (Wilde, 1987).
Pond
Concentrations of radioactive isotopes in Par
Pond have decreased due to the cessation of risk
reactor releases, decay of the isotopes, dilution
from groundwater seepage, and seepage losses
from the basin. Since most of the radionuclide
releases to Par Pond (directly or indirectly)
occurred during the 1950 to 1960 era, and the
half-life of cesium-137 is approimately 30 continuing
years, more than half of this radionuclide has
decayed. The current estimated inventory of
cesium-137 associated with all sediments
within the Par Pond reservoir is approximately
43 Ci (Winn, 1993), of which 9 Ci are present of
in the 1340 acres of exposed sediments. The 200
remaining 68 Ci of cesium-137 inventory in the the
Par Pond system is located in the sediments of
the pre-cooler canal/pond system and Lower respectively.
Three Runs Creek.
Mercury has been detected in fish from the
Savannah River and SRS waterbodies since the et
analyses began in 1971, with comparable had
concentrations measured in onsite and offsite elimination of
fish (WSRC, 1991a). It had been assumed that
much of the mercury detected in onsite fish exposure
reflected mercury present in Savannah River
water which originated primarily from
industrial releases upriver from SRS. This
water has been used as cooling water in site associated
facilities and then discharged to SRS streams
and lakes.
at

full

investigation into the cause of the

and simultaneously initiated a precautionary
drawdown of the reservoir. From June
through September 1991, the level of Par

was lowered from 200 ñ 1 ft to 181 ft msl.
The 181-ft level was chosen to reduce the

and consequences, in the unlikely event of a
dam failure, of potential flooding in
downstream communities.

Limited studies have been conducted to
evaluate the ecological effects of the

drawdown of Par Pond (DOE, 1993). Results
of these ongoing studies are summarized
below.

Lowering the surface water level elevation

Par Pond from a full pool of approximately

ft to 181 ft msl resulted in a reduction of

reservoir's surface area and volume by
approximately 50 to 65 percent,

This action caused many changes in what had
been a formerly hydrologically stable and
biologically productive ecosystem (Whicker

al., 1993). The drawdown of the reservoir

two major repercussions: (1) the

the previous littoral (shore) zone and its
interrelated communities, and (2) the

of sediments contaminated particularly with
radiocesium and mercury. All components of
the Par Pond ecosystem are continuing to
undergo a period of disequilibrium

with a readjustment to new conditions within
the basin. The ecosystem is recovering, but

much reduced population sizes compared to

pool.

The loss of approximately two-thirds of the original volume of Par Pond and exposure of 1340 acres of lakebed sediment resulted in temporary impacts to the reservoir's water quality. Effects of the increased erosion and sediment resuspension from the exposed lakebed caused an increase in turbidity of the reservoir's water column. Erosion gullies up to approximately 11 inches deep were cut by individual rainstorm events during the fall of 1991 and the winter of 1991-1992 because of the initial lack of vegetative cover on the exposed lakebed (Whicker et al., 1993). However, colonization of the former lakebed by terrestrial and semi-aquatic plant species has stabilized much of the exposed sediment, thereby reducing the impacts of erosion and runoff. As a result of this reduction in the sediment load into the basin, the turbidity has decreased significantly compared to that immediately following the drawdown, and water clarity is presently similar to pre-drawdown conditions.

The dissolved ion concentrations in Par Pond were historically maintained as a result of a history of recirculation, evaporation, and Savannah River water inputs. The termination of pumping make-up water from the Savannah River has resulted in a decrease of ions to the Par Pond ecosystem. The conductivity of the surface waters was reduced from approximately 80-100 æmhos/cm to 30 both rapid and extensive. The revegetation in the protected coves was more extensive than open, wave-washed areas. Most of the new shoreline was colonized by either emergent or submergent aquatic vegetation. Eurasian watermilfoil, water-lily, slender naiad, and cattail were the four most common species (Whicker, 1992a).

The exposed sediments have exhibited a rapid descending vegetative colonization similar to that in some new shoreline habitats. The most common terrestrial plant species, in order of percent cover, are bog rushes, maidencane, bulrush, dog fennel and a sedge species (Whicker, 1992a). The colonizing vegetation on the exposed sediment is a mix of wetland and old-field plants, depending on soil moisture. Moisture varies with distance from the new shoreline, topography, soil type, and the presence of seeps.

Garden plot studies involving the propagation of cultivated plants on the exposed sediments were undertaken to evaluate the rate of radiocesium mobilization into food crops. Based on these studies, the uptake of radiocesium is extremely high for the amounts of that radionuclide available in the soil. This also would be expected to be reflected in the tissues of those animals species which forage on this successional vegetation (Whicker, 1992a; 1992b).

æmhos/cm by the drawdown. After the drawdown, the relatively large influence of groundwater and natural surface inputs, which are very low in dissolved ions, began to dominate the water chemistry of the basin (Whicker et al., 1993). Associated with these reduced dissolved ion concentrations, increased levels of radiocesium have been found in muscle of largemouth bass suggesting increased biological mobility of radiocesium and possibly other contaminants in the reservoir (Whicker, 1991; DOE, 1993).

Approximately 1.5 square miles of submergent/emergent wetland vegetation were lost as an loss of immediate result of the drawdown of Par Pond. However, a number of species of aquatic plants have colonized the new littoral zone and shallow areas of the reduced area of the reservoir. This vegetation reestablishment was

One of the most noticeable impacts resulting from the exposure following the drawdown of the reservoir was the decimation of many beds of freshwater mussels and clams (Whicker, 1991; DOE, 1992). However, current observations on Par Pond indicate that these populations appear to be recovering in the reduced area reservoir.

Par Pond fish populations were temporarily reduced as a result of the drawdown. The absence of an established littoral zone was expected to have the potential for a total loss of recruitment, because of reduced spawning and nursery habitat. In general, although recruitment was reduced during 1992, limited sampling data indicate that most species, including some short-lived forage species, experienced some recruitment. This occurred

in spite of the loss of the original littoral zone and probable intense predation. Although concern

As noted previously, the conductivity of the water in the Par Pond Reservoir has decreased from a following the drawdown and termination of the in pumping of make-up water from the Savannah River. As the potassium ion decreases in availability, organisms take up more radiocesium, which is a potassium analog and will can be more readily available in this now potassium-poor water. The impact of this has been uptake observed in the increasing body burden of foraging on the exposed lakebed; however, these body burden levels do not pose a risk for human consumption at this time.

Although there is no evidence of harm to wildlife from uptake of Cs-137 or mercury, there has been a noticeable increase in the uptake of cesium in some of the animals and vegetation on the sediments. The uptake levels have not yet reached a dose level where harm to wildlife will occur. The longer wildlife is exposed or can be exposed to the sediments, the greater the uptake of contaminants will be and the greater the risk of physiological harm becomes. Wildlife

radiocesium in Par Pond largemouth bass. Other fish species would be expected to have similar concentrations (Whicker et al., 1993).

There is no evidence that the drawdown adversely affected the winter survival of adult alligators in Par Pond. Unfavorable conditions for nesting, and habitat conditions (lack of cover) that have undoubtedly resulted in the low survival of juveniles, have probably been the most important impacts of the reservoir drawdown on this resident alligator population.

In general, the waterfowl use of Par Pond during the wintering season has been reduced due to the physically smaller area and reduced food resources. The numbers of birds overwintering on the reservoir during the second year following the drawdown had increased compared to the winter of 1991; however, these numbers are still below pre-drawdom levels. This increase in the waterfowl numbers is at least in part due to the recovered levels of the aquatic macrophyte and invertebrate populations in the basin. In addition, the radiocesium body burdens in the ducks increased during the second winter with forty percent of the adult birds having measurable levels of radiocesium.

Substantial numbers of mourning dove have been observed foraging on the vegetation which has colonized the exposed lakebed. Concern for the potential off-site transport of contaminants by these birds prompted an analysis of birds found feeding on the terrestrial plants inhabiting the old lakebed versus birds collected off-site. These studies have shown that there are detectable levels of both mercury and radiocesium in the birds monitoring will continue.

Par Pond has been and continues to be the location where most sightings of bald eagles on the SRS takes place (Mayer et al., 1985; 1986; WSRC, 1993). Observations of both adult and immature birds on Par Pond have continued to be infrequent but persistent. In general, the use of the reservoir by bald eagles has been for both foraging and roosting activities. The drawdown has had no noticeable impact on the bald eagle use of Par Pond. It is assumed that most of the prey obtainedby breeding adults and newly-fledged immatures is obtained in and around Par Pond. The impact of the use of Par Pond prey (primarily largemouth bass) by both adult and immature bald eagles is unknown at this time.

The sightings of golden eagles on the SRS continue to be a rare event. There have been no more observations of this species using Par Pond since the sightings during the winter of 1991 (WSRC, 1993).

Compliance History

At SRS, waste materials are managed which are regulated under the Resource Conservation and Recovery Act (RCRA). Certain SRS activities have required Federal operating or post-closure permits under RCRA. SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control (SCDHEC) on September 30, 1987. Part V of the permit mandates that SRS establish and implement a RCRA Facility Investigation (RFI) Program, to fulfill the requirements specified in Section 3004(u) of the Federal permit. On December 21, 1989, SRS was

placed on the National Priorities List (NPL). A additional site placed on the NPL comes under the alternatives jurisdiction of CERCLA. In accordance with Section 120 of CERCLA, DOE has negotiated a FFA with the U.S. Environmental Protection Agency (EPA) and SCDHEC to coordinate cleanup activities at SRS into one compre- hensive strategy that fulfills RCRA Section 3000(u) and CERCLA assessment, investi- (COC) gation, and response action requirements. The Par Pond unit is listed as a CERCLA unit in the have FFA.

and On July 17, 1991, DOE notified EPA-Region IV and SCDHEC that possible dam failure at Par Pond could be an imminent and substantial endangerment to public health, safety, and the EPA - environment under CERCLA, Section 104 (WSRC, 1991). DOE and EPA viewed the risks drawdown of Par Pond as a removal action under Section 300.415 (d)(3) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Subsequent sediments evaluations indicated that repair activities to stabilize the dam were necessary (Bechtel, alternatives to 1991). As a result, DOE determined that the appropriate action to ensure safety was to and maintain the reservoir at the 181-ft elevation. This action would facilitate repairs and reduce potential for impacts to downstream communities in the unlikely event of a dam failure. Repair of the dam was approved under a CERCLA 106 Abatement Action Letter in (WSRC, 1991). In conjunction with the technical evaluation of needs for the dam, DOE assessment identified potential for exposure and the need to evaluate for reducing that exposure. In addition, an assessment of environmental risks based on existing information was also performed (WSRC, 1992; DOE, 1993).

In addition to cesium-137, mercury has also been identified as a chemical of concern in Par Pond exposed sediments although the concentrations and extent of contamination not been fully assessed. Ecological studies indicate potential threats from cesium-137 and mercury in the sediments to animal receptor species (WSRC, 1992).

For an interim action and as requested by Region IV, DOE evaluated interim action remedial alternatives to reduce potential associated with cesium-137 in the exposed sediments. Based on current data, the most critical concerns for evaluation of interim remedial alternatives for the Par Pond are the control of risks due to cesium-137 contamination. An evaluation of support a final action will be conducted following completion of this interim action an RI/FS for the entire waste unit.

III. Highlights of Community Participation

Public participation requirements are listed Sections 113 and 117 of CERCLA. These requirements include the establishment of an

performed several environmental analyses the
including a Special Environmental Analysis for provides
Par Pond at the Savannah River Site (DOE, those
1992), to comply with National Environmental plan
Policy Act (NEPA) requirements and
commitments, which evaluated the impacts of
drawdown, repair of the dam, and refill back to of
the 200-ft level. As of July 1, 1994, the Par
Pond Dam has been repaired and is considered of
safe to maintain the reservoir at pre-drawdown
water levels.

An agreement was reached with EPA - Region as
IV for SRS, under the site evaluation process of Interim
CERCLA, to conduct a limited, qualitative
human heath risk assessment concerning the
sediments exposed from the drawdown of Par
Pond (WSRC, 1992). This human health risk

Administrative Record File that documents

selection of cleanup alternatives and

for review and comment by the public of

alternatives. The SRS public involvement

(DOE, 1994) is designed to facilitate public
involvement in the decision-making processes
for permitting, closure, and the selection

remedial alternatives. The SRS public
involvement plan addresses the requirements

RCRA, CERCLA, and the National
Environmental Policy Act (NEPA). Section
117(A) of CERCLA, 1980, as amended,
requires the preparation of a proposed plan

part of the site remedial process. The

Action Proposed Plan for the Par Pond Unit
(IAPP) (WSRC, 1994), which is part of the
Administrative Record File, highlights key
aspects of the assessment and investigation

phases of the remediation process and identifies oral
the preferred interim action alternative for
remediation of the Par Pond unit.

The Administrative Record File, which contains
the information pertaining to the selection of the
response action, was made available at the EPA-
Region IV office and at the following locations:

only

of

U.S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway

selected interim action remedy. Written and

comments were accepted during this meeting.
These comments are addressed in the
Responsiveness Summary (Appendix A).

IV. Scope and Role of Operable Unit within the Site Strategy

This interim action operable unit addresses

the remediation of approximately 1340 acres

sediments on the periphery of the Par Pond
reservoir that were exposed as a result of
reservoir drawdown (Figure 3). The overall
strategy of remediating the Par Pond waste
unit, consisting of the Par Pond reservoir,

the
Aiken, South Carolina 29801
(803) 641-3465

herein;
Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208
risk
(803) 777-4866

Similar information was made available through evaluate and
the following repositories: identifled

described
Reese Library
Augusta College
2500 Walton Way
cooler
Augusta, Georgia 30910
(404) 737-1744
constitutes

would
Asa H. Gordon Library
Savannah State College
would
Tompkins Road
caused
Savannah, Georgia 31404
(912)356-2183

providing
The public was notified of the comment period for the IAPP through mailings of the SRS Environmental Bulletin, a newsletter sent to more that 1400 citizens in South Carolina and Georgia, and through notices in local gamma
newspapers including the Aiken Standard, The 137
State, and the Augusta Chronicle.

The public comment period began on December Also, of
1, 1994 for the IAPP and ended on January 6, 1995. Responses to comments are discussed in the Responsiveness Summary (Appendix A).

A public meeting was held on December 14, 1994 in Aiken, South Carolina to discuss the

series of pre-cooler ponds and canals, and Lower Three Runs Creek, is to: (1) perform the proposed interim action described

(2) further characterize the waste unit delineating the nature and extent of contamination and identifying the media of concern; (3) perform a quantitative baseline

assessment to evaluate media of concern, chemicals of concern, exposure pathways and characterize potential risks; and (4)

perform a final action to remediate the

media of concern. The operable unit

in this Interim Action Record of Decision (IROD) does not include the submerged sediments in Par Pond, the series of pre-

ponds, or Lower Three Runs Creek. The discrete action of this operable unit

the first of the proposed strategies which

address the immediate threats posed by the overall waste unit. The interim action

remediate the immediate potential risks

by exposure of contaminated sediments due to reservoir drawdown. The action fulfills the qualitative interim remedial goals by

the most timely reduction of risk to human health, and the environment through submergence of the sediments with a layer of water upon restoration of the Par Pond water level. The water layer would attenuate

radiation emitted from the decay of cesium-

and minimize the potential for contaminated sediments to become airborne or to become further redistributed through erosion.

significance to the environment, the interim action would allow for a gradual recovery of the reservoir to essentially pre-drawdown ecological conditions. Following the performance of this interim action, further

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characterization, and performance of the risk assessment, a final action(s) will be evaluated which would address residual risk or contamination for the entire waste unit.

V. Summary of Operable Unit Characteristics

The lowering of Par Pond from 200 ft to 181 ft exposed approximately 1340 acres of sediment on the periphery of the reservoir contaminated with radionuclides and nonradioactive contaminants. Data are limited for evaluation of human health and environmental risks associated with the exposed sediments. Sampling locations for data used in the limited, qualitative risk assessment of Par Pond sediments are identified in Figure 4. The limited, qualitative risk assessment identified 68 16 nonradioactive constituents in Par Pond sediments (Table 1). The risk assessment pre-screening process resulted in the selection of five of these constituents, barium, beryllium, cadmium, chromium, and mercury, for further evaluation in the human health risk assessment. These chemicals generally exceeded background concentrations and thus warranted a risk evaluation. For the ecological risk assessment, mercury was selected as the focus because the levels of mercury found in the associated with the exposed sediments pose primary external radiation exposure route. In addition, exposed sediments containing cesium-137 (and other radionuclides) could potentially become airborne through wind or other natural activities. Inhalation of airborne sediments is also considered a potentially significant exposure route.

Since most of the radionuclide releases to Par Pond (directly or indirectly) occurred during the 1950 to 1960 era, and the half-life of cesium-137 is approximately 30 years, more than half of this radionuclide has decayed. The current estimated inventory of cesium-137 associated with all sediments within the Par Pond reservoir is approximately 43 Ci (Winn, 1993), of which 9 Ci are present in the 1340 acres of exposed sediments. The remaining 68 Ci of cesium-137 inventory in the Par Pond system is located in the sediments of the cooler canal/pond system and Lower Three Runs Creek. The maximum concentration of cesium-137 in exposed Par Pond sediments is 656,640 pCi/kg (WSRC, 1992). The exposed sediments are contained in an area of approximately 1340 acres on the periphery of the Par Pond reservoir. The majority of the contamination is within the top one foot of sediment (Whicker, 1991). This gives a

sediments suggested a potential hazard to biota living on the exposed sediments and in the cubic
associated aquatic communities, and because of its bioaccumulation and bioconcentration potential.

Four radionuclides, cesium-137, cobalt-60, plutonium-238, and plutonium-239, were detected in Par Pond sediments (Table 1). All of these radionuclides were considered as chemicals of potential concern in the human outside
health risk assessment. However, for the ecological risk assessment, only cesium-137 was evaluated because it comprised the largest percentage of the radioisotope inventory, was present in the greatest concentration in the Pond.
sediments, and because it has a tendency for bioaccumulation and bioconcentration. include

Decay of cesium-137 is by beta particle emission (7%) and through barium-137 X-rays (low-energy gamma radiation, 85%). The X- of
rays resulting from the decay of cesium-137

volume of sediment potentially requiring remediation of approximately 2.2 million

yards.

VI. Summary of Operable Unit Risks

Human Health Risks

Existing human populations that potentially may be exposed to operable unit-related contaminants include residents living

but near the eastern boundary of SRS or downstream in the Lower Three Runs Creek and Savannah River watersheds, trespassers who may enter the Par Pond area, and workers involved with ongoing activities at Par

Exposure pathways through which human receptors could potentially be exposed

external exposure to radiation from exposed sediments, inhalation of airborne sediment particulates, and dermal contact with and ingestion of sediments. Lowering the level

Par Pond to 181 ft has exposed approximately

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Table 1. Maximum Concentrations of Chemicals in Par Pond Sediments Compared to Background Levels

Contaminant	Maximum Concentration	Background Levels
Aluminum	22,400 mg/kg	10,000-300,0001 mg/kg
Barium	500 mg/kg	1102 mg/kg

Beryllium	3.99 mg/kg	0.6222 mg/kg
Cadmium	2.37 mg/kg	<0.00012 mg/kg
Calcium	2040 mg/kg	7000-500,0001 mg/kg
Chromium	49.3 mg/kg	8.442 mg/kg
Copper	10.2 mg/kg	2-1001 mg/kg
Iron	30,500 mg/kg	7000-550,0001 mg/kg
Lead	9.33 mg/kg	2-2001 mg/kg
Magnesium	608 mg/kg	600-60001 mg/kg
Manganese	297 mg/kg	20-30001 mg/kg
Mercury	0.614 mg/kg	0.2892 mg/kg
Nickel	5.69 mg/kg	5-5001 mg/kg
Silver	0.0713 mg/kg	0.2932 mg/kg
Sodium	17.0 mg/kg	750-75001 mg/kg
Zinc	43.1 mg/kg	10-3001 mg/kg
Cesium- 137	656,640 pCi/kg	<20002 pCi/kg
Cobalt-60	770.0 pCi/kg	<40002 pCi/kg
Plutonium-238	4.09 pCi/kg	NA3
Plutonium-239	38.0 pCi/kg	NA3

Source: WSRC, 1992

1 Lindsay, W.L., Chemical Equilibria in Soils
2 Meyer's Branch Data
3 NA = Not available

1340 acres of sediments that were previously not calculated for residential exposure

(outside
under water. If no remedial action is taken, this sediment would remain exposed. A limited risk assessment was conducted (WSRC, 1992), based on limited existing data to address the human health risks resulting from these exposed sediments and forms the basis of the current understanding of human risk for the remedial action alternatives.

is
The data were not collected to fulfill the strict data quality assurance and quality control requirements of a CERCLA baseline risk refilling the
assessment (WSRC, 1992). Therefore this risk assessment evaluates the data by identifying current and future exposure at
conditions which provide a range of potential minute
risks from exposure to Par Pond contaminants. In addition, the risk assessment only evaluates the contaminants identified from the existing data. Other contaminants may be present in the Par Pond sediments, but without a South
comprehensive sampling and analysis effort, the risks resulting from exposure to all the
contaminants cannot be adequately assessed.

emphasis
Because of the qualitative nature of the risk assessment, attempts to model contaminant transport were considered inappropriate. Extrapolation of exposure point concentrations the
using data that were of a quantity and quality inappropriate for model input, was considered to introduce an unacceptable level of uncertainty in the modeling results. An before
exception to this approach was made regarding resuspension to air of sediments no longer covered by surface water, which was considered the pathway most likely to transport appreciable quantities of contaminants from Par Pond during the drawdown condition. For this pathway, modeling was conducted using existing data to estimate exposure con- cesium-
centrations of cesium-137 for current off-Par Pond unit locations (Hamby 1991b; Marter and SRS boundaries) through ingestion of surface water containing resuspended sediments. However, estimates of the annual dose equivalent of cesium-137, noted during the drawdown of Par Pond, suggested that risk from this pathway would be negligible. Introduction of cesium-137 to Lower Three Runs Creek and the Savannah River through erosion of exposed sediments during refill

not likely to exceed the amount that was introduced during drawdown. The Par Pond Dam Reservoir Refill Plan calls for refilling the

Par Pond by pumping water from the Savannah River to the Par Pond, using the existing P-Reactor intake piping and discharge canal, at

rates of 80,000 to 160,000 gallons per minute

(gpm). The plan will transfer 50,000 gpm down P-Discharge Canal to the Hot Arm, and the remainder will be pumped by reversal of normal flow through the Par Pond Pump House Station, located at the head of the South

Arm (Figure 5). The potential for remobilization of contaminated sediments in the

Par Pond drainage during refill has been calculated (Chen, 1994). Particular

has been given to the potential for loss of contaminated sediments from Par Pond into Lower Three Runs Creek. Calculations show that sediments would not be resuspended at the

Pond C Dam (Hot Dam) outlet to the Par Pond. Sediments would be resuspended around the Par Pond Pump Station area. However, most of the suspended sediment would settle before

reaching the Par Pond Dam. A very small quantity of sediment might remain in suspension. Although some sediment may be released, the downstream impact from cesium-137 will be far less than that experienced during the drawdown. During drawdown, water was released at 240,000 gpm (versus 10,000 during refill) and the amount of cesium-

137 and suspended solids amounted to a maximum of 8 percent of the drinking water

Carlton, 1991).

Carcinogenic risks from inhalation of airborne current
sediment particulates by residents outside SRS
boundaries were found to not be a concern, as
the estimated risk is less than the EPA target established
risk range of 1 x 10-6 (one excess cancer in one pathway
million people). As stated above, risks were

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target risk range. By managing work
conditions and duration, this risk can be greatest
minimized.

Carcinogenic risks calculated for the hypo-
thetical future Par Pond unit worker and future
Par Pond unit resident exposed to Par Pond
sediments indicate that risks exceeding the concern
EPA-established target range of 1 x 10-4 to 1 x
10-6 are likely for these scenarios. Because of
the hypothetical nature of the Par Pond unit
resident scenario, the additional pathways that
are identified by this scenario are not likely to
be of concern in the immediate future.
However, the results of this scenario do assessment:
identify additional pathways of concern should
the Par Pond unit resident conditions become a
possibility.
alligator

actual
The limited risk assessment indicated no can
adverse noncarcinogenic human health effects
are likely from exposure to Par Pond

standards.

Carcinogenic risks calculated for the

land use scenario indicate only one pathway,
external exposure from sediment to the Par
Pond unit worker, exceeds the EPA-

target risk of 1 x 10-6; the risk for this

is calculated to be 4 x 10-5, within the EPA

Cesium-137 comprised the largest percentage
of the radionuclide inventory, had the

concentration in the sediments, and has a
known propensity for bioaccumulation and
bioconcentration. There were 16 non-
radioactive constituents identified in the
sediments of Par Pond, of which only mercury
was chosen as a chemical of potential

due to its tendency for bioaccumulation and
bioconcentration.

Of the species known to inhabit or visit the
exposed sediments of Par Pond and the Par
Pond aquatic ecosystem, the following were
chosen as receptor species for the

Rare, threatened, or endangered species
[bald eagle, wood stork, American

(due to similarity of appearance to an

threatened or endangered species which

be considered threatened or endangered by
comparison)]

sediments.

Environmental Risks

A limited, qualitative ecological risk assessment (WSRC, 1992) was conducted to determine the (water
potential effect of exposure to contaminated water
sediment on the newly emerging (early-successional) terrestrial community inhabiting the 1340 acres exposed from the drawdown of Par Pond to 181 ft. Because the exposed contaminated sediments can erode into Par Pond, potential risks to the aquatic community also were addressed. The ecological risk assessment investigated only current conditions at Par Pond. Neither the impact from the drawdown on the Par Pond ecosystem nor the potential effect from selected remedial alternatives were evaluated.

Two biotic communities were assessed for exposure to contaminants in the exposed Par Pond sediments, an early-successional terrestrial community and the aquatic Par Pond community potentially exposed from erosion of the exposed sediments into the reservoir. Biota from both populations are potentially exposed to radionuclides and non-radioactive constituents. Of the four radionuclides known to be present in Par Pond sediments, only cesium-137 was addressed in this assessment.

Potentially affected sport or commercial species (white-tailed deer, ring-necked duck, largemouth bass, bluegill, loblolly pine)
Species that represent obvious and known toxicological endpoints for exposure

lotus, water lilies, wild pig, brown

snake, slider turtle, American coot, bufflehead, horned grebe, lesser scaup, ring-necked duck, and ruddy duck)
Species that control the community structure and function through predation (American alligator, largemouth bass, and wild pig)
Species that demonstrate marked productivity and abundance (blackberry briar and rush)

All selected terrestrial animal species may experience possible ecological effects from exposure to cesium-137. In addition, the American alligator may experience adverse ecological effects from mercury exposure (WSRC, 1992).

All selected aquatic animal species may experience adverse ecological effects from exposure to mercury, while the bald eagle, wood stork, and American alligator also may experience possible adverse effects from cesium-137 exposure.

Results of the limited risk assessment indicate around
that cesium-137 and mercury levels in the exposed sediments potentially threaten the animal receptors that inhabit the Par Pond range
shoreline with maintenance of the reservoir at the 181-ft msl water level. However, little or no effects to either terrestrial or aquatic

the lakebed sediments by the wild pigs

Par Pond began immediately after the drawdown and continues to be extensive. The drawdown appears to have facilitated the

expansion of the SRS wild pig population in the area of Par Pond. This range expansion would be expected to result in damage to

areas
vegetation are expected to occur. Effects of cesium-137 and mercury contamination from the exposed sediments that are transported to these
the reservoir in runoff will be specific for each increasing
receptor species depending upon such factors as diet and metabolism. If significant loading of sediment to the reservoir was to occur, effects from cesium-137 are expected to be minimal. However, enhanced mercury loading into the basin, in addition to causing the potential for increased methylation processes, health
poses threats to the identified aquatic receptor species and the Par Pond ecosystem. This is especially true for the fish-eating protected species (i.e., bald eagle, wood stork, osprey, The
and American alligator).

Based on observations and field evidence (e.g., tracks and scats), the use of the exposed lakebed by a few species of mammals has continued since the drawdown. This primarily includes the wild pig and white-tailed deer. Both of these species are harvested during the ft
fall public hunts on the SRS. Because of this, these mammals are a concern associated with the uptake of contaminants (e.g., radiocesium) unit
through the human consumption of animals Pond
taken in the area around Par Pond. Increased levels of radiocesium concentrations in wild pig muscle over pre-drawdown levels has for
the contaminated sediments. Although higher consists
than observed prior to the drawdown, these levels do not currently pose a concern for the
human consumption. Although there is no the
evidence of harm to wildlife from uptake of Cs-137 or mercury, there has been a noticeable increase in the uptake of cesium in some of the animals and vegetation on the sediments. The uptake levels have not yet reached a dose level where harm to wildlife will occur. The longer wildlife is exposed or can be exposed to the efforts

which had not previously been subjected to depredation by this non-native spectes. In addition, it also brings the distribution of

animals closer to the SRS boundary,

the potential for the off-site transport of contaminants and harvest by local residents.

VII. Description of Alternatives

Remedial alternatives were developed for the Par Pond unit for the reduction of human

and environmental risk from cesium-137 contamination in the exposed sediments. In accordance with the NCP, the No Action Alternative was set forth as a baseline.

alternatives are as follows:

Alternative 1
No Remedial Action and Maintain Par Pond at the 181-ft Level

Alternative 2
Refill and Maintain Par Pond at the 200 ñ 1-

Level

The preferred alternative for the Par Pond unit
is Alternative 2 - Refill and Maintain Par Pond

at the 200 ñ 1-ft Level

ALternative 1 involves no remedial action

the exposed sediments. Alternative 1

of leaving Par Pond at the 181-ft level. Alternative 2 involves refilling Par Pond to

original 200 ñ 1-ft level and maintaining

reservoir at that level.

Alternative 1 - No Remedial Action and Maintain Par Pond at the 181-ft Level

Under Alternative 1, Par Pond sediments would be left in place and no remedial

sediments, the greater the uptake of contaminants will be and the greater the risk of physiological harm becomes. Wildlife monitoring will continue. Extensive rooting in

would be conducted. Par Pond would remain at the 181-ft level, leaving 1340 acres of contaminated sediments exposed. Currently, approximately 10 cubic feet per second of reservoir water is discharged to Lower Three

Runs Creek to maintain biota communities in the creek. Because of current access controls at SRS, the potential human health impacts would be to Par Pond unit workers from external exposure to radionuclides in the sediments; ingestion of and dermal contact with the sediments; and inhalation exposure to airborne particulates inside SRS boundaries. These potential impacts can be controlled by management of work conditions and duration. Also, ongoing revegetation of the exposed sediments result in reduction in particulate materials becoming airborne. The wetland and aquatic habitats of the Par Pond ecosystem would not recover to pre-drawdown conditions. Instead, terrestrial habitat would eventually become fully established on the approximately 1340 acres of exposed sediment. Exposure of animal receptors to the contaminated sediments would continue. Further description of this alternative appears below.

Treatment Components. No treatment would be implemented.

expected for implementation of this alternative.

Dam repair costs are not addressed in this IAPP. Maintenance costs include pumping/ discharge costs to maintain the water level in Par Pond at the 181-ft level. This cost is estimated to be $280,000 annually. The cost is an incremental (estimated) cost (part of the total cost) associated with the operation of the Site Cooling Water Distribution System (river water system) that maintains water to Par Pond, L Lake, and the reactors. The river water system will remain in service, at this time, regardless of the action chosen for Par Pond. Therefore, SRS would still incur the cost associated with the operation of the pumps. A review of remedy must be conducted every five years, as required under the Superfund Amendments and Reauthorization Act (SARA). Costs include estimates of meetings with EPA every five years using current overhead, wages, and expenses. A present worth factor is applied to the cost at a discount rate of five percent. Inflation is considered to be zero percent.

The present worth costs for pumping/discharge to maintain the reservoir water level and remedy

Engineering Controls. No engineering controls would be required.

Institutional Controls. Access to SRS is controlled at primary roads by continuously manned barricades. Other roads entering the site are closed to traffic by gates or barriers. The entire SRS facility is surrounded by an that
exclusion fence, except along the Savannah River. The Site is posted against trespassing under state and Federal statutes. No specific, and
additional/new controls would be instituted. forth

Ouantity of Waste. The contaminants are primarily located within the top one foot of sediments. Under Alternative 1, approximately 1340 acres of sediment would remain exposed 1.
until final action(s) is evaluated. Considering that the depth of contamination does not exceed one foot, the volume of contaminated sediment is approximately 2.2 million cubic yards.

bring
Implementation Requirements. This alternative their
is readily implementable.

Interior
Estimated Construction and Operation and that
Maintenance Costs. No remedial costs are

review extended over a 30-year period would be, respectively, approximately $4,300,000 and $280,000, or a total of approximately $4,600,000.

ARARs Associated with the Considered Alternative. Applicable or Relevant and Appropriate Requirements (ARARs) are Federal and state environmental regulations

establish standards which remedial actions must meet. There are three types of ARARs: (1) chemical-specific, (2) location-

(3) action-specific. This section sets

major ARA associated with the remedial alternative.

There are no chemical-specific or action-specific ARARs associated with Alternative

The single location-specific ARAR associated with Alternative 1 is the Endangered Species Act (16 USC 1531 et seq.). The Act is intended to prevent the further decline of endangered and threatened species and to

about the restoration of these species and

habitats. Section 7 of the Act requires consultation with the Department of the

regarding any action of a Federal facility

may impact endangered or threatened species.

The Department of Interior is a Natural sediments
Resources Trustee for SRS. As such, their habitats
advice is continuously sought and they are kept informed on environmental issues, including the proposed interim action at Par Pond. The

level, submerging currently exposed

with water. The wetland and aquatic

of the Par Pond ecosystem would eventually recover to essentially pre-drawdown conditions. Because of the access controls

at
Endangered Species Act is applicable to the interim action since endangered (bald eagle) and threatened [American alligator (due to similarity of appearance to an actual threatened or endangered species)] species utilize Par inhalation
Pond. These predator species utilize the reservoir and could be adversely affected by the increased loading of contaminated sediments from runoff into the basin and subsequent uptake and accumulation by prey species (WSRC, 1992). Both species also can be adversely affected by preying on terrestrial disturbance
animals living on the exposed contaminated spite of
sediments. The wood stork is not considered to be impacted by the interim action as this species does not regularly utilize Par Pond. During the initial stages of reservoir drawdown, wood storks were seen feeding on prey isolated in shallow pools formed along the shoreline by receding waters. However, subsequently as the water level dropped and the isolated pools dried out, the sloping shoreline became steeper in gradient and the habitat became unsuitable for use by wood storks. levels.
This species requires a shallow water habitat such as found in nearby Kathwood Lake. The Endangered Species Act is the only law or chemical
regulation that includes the potential impacts to individual organisms from exposure to chemicals in the exposed sediments. Other laws or regulations that deal with potential impacts to natural resources relate to physical accumulated
disturbance rather than chemical effects. The extent,
proposed interim action does not include inputs of
physical disturbance, and, accordingly are not ARARs. Floodplain management and wetlands protection regulations are not ARARs because the Par Pond reservoir is not itself a jurisdictional wetland. Jurisdictional wetlands are present in the original streambed of Lower Three Runs Creek below the Par Pond Dam effectively
(COE, 1987).
the

SRS, the only temporary exposure pathway would be to workers at the Par Pond unit directly exposed to the sediments. External exposure to radionuclides, ingestion of and dermal contact with sediments, and

of airborne sediments would cease with the refilling of Par Pond.

Since its construction in 1958, the Par Pond reservoir on the SRS has historically been a highly productive and diverse ecosystem benefiting from the protection from

afforded by its location on the SRS. In

contaminants introduced from SRS production reactor effluents (e.g., heat, radionuclide discharges) and Savannah River water (e.g., mercury), the reservoir ecosystem has shown high biological diversity and has been an important regional resource for waterfowl. Primary production in the reservoir has been stimulated by inputs of nitrogen and phosphorus from Savannah River water that was used to replace seepage and evaporative losses, and to maintain constant water

The historic inputs of Savannah River water have resulted in the accumulation of

constituents in the basin. Mercury accumulation has been documented, and, while not documented, nitrogen and phosphorus accumulations are also expected to have occurred. These constituents have

primarily in sediments and, to a lesser

in biota in the ecosystem. Similarly,

radionuclide releases from R Reactor have accumulated primarily in the sediments.

The refilling of Par Pond will significantly mitigate the risks associated with direct exposure from contaminated sediments. Once refilled, the overlying water will

shield the gamma radiation emissions from

cesium-137. Additionally, potential risks

from
Alternative 2 - Refill and Maintain Par low,
Pond at the 200 ñ 1-ft Level on
Alternative 2 involves refilling the Par Pond to its
reservoir and maintaining at the 200 ñ 1-ft

resuspension by wind, although currently
will be eliminated. The rate at which this
mitigation is achieved is solely dependent
the time at which the reservoir is refilled
historic water level of 200 ft msl.

The refilling of the reservoir will represent a
significant additional change for the Par Pond
ecosystem and will have both transient and
permanent effects, relative to current and
previous conditions. The refilling action will
result in three immediate stresses to the Par
Pond ecosystem. Additional nutrients
(nitrogen and phosphorus) will be introduced
into the basin with Savannah River water.
Significant portions of the nutrients currently in
the exposed sediments and the vegetation
growing on these sediments will also be
remobilized into the water column following
inundation. This influx of nutrients is expected
to result in eutrophic to hypereutrophic
conditions in the reservoir (i.e., exceptionally
high algal abundance and possible shifts to
undesirable algal species). Introduction of
nutrients during the spring and summer months
is expected to result in worse conditions than if
these nutrients are introduced during the fall
and winter months when water temperatures

historic conditions. This littoral zone supports
aquatic plant, aquatic invertebrate, and fish
communities that are dependent upon this
shallow water habitat. Of particular importance
is the use of this habitat for fish spawning and
as a nursery area for juvenile fish. This habitat
will be lost during the refill and full
reestablishment of the littoral zone habitat will
require several years following refill of the
reservoir and stabilization of water levels.

Some mitigation of the potential impacts on fish
populations can be obtained by stabilizing
water levels during the fish spawning and
nursery periods. By maintaining relatively
stable water levels during the spring and
summer, fish are expected to complete
spawning and recruitment. Should the
reservoir not achieve its final pool level during
the initial period of refilling, the reservoir water
level will be stabilized to maximize the chances
for successful spawning during 1995. This

and light intensity are lower. The presence of nutrients introduced during the winter months and mobilization of nutrients from sediments and decaying vegetation during the growing season makes the development of eutrophic to hypereutrophic conditions unavoidable, but minimization of nutrient input during the spring and summer months may afford some mitigation for this condition.

A second stress will result from inundation of the vegetation on the exposed sediments. Decay of this vegetation will deplete dissolved oxygen in the overlying water. To the extent that the inundation and initial decay occurs during the winter months, this stress may be somewhat mitigated because decomposition rates will be lower, more oxygen will be available in the colder water, and oxygen requirements by fish and other aquatic organisms will be lower. Nevertheless, it is anticipated that the zone of oxygenated water will be significantly reduced during at least the first year following reservoir refill from late spring through early fall.

The third stress resulting from the refill will be habitat disruption. Over the three years of the drawdown, the littoral (shore zone) community has become reestablished in the reservoir, although at a much reduced size compared to

will require careful attention to water inputs from the river water system because the ability to release water from the reservoir at intermediate water levels is severely limited when the reservoir is thermally stratified. Refill will occur during the fall and winter using both river water inputs and natural inputs from rainfall and groundwater. River water inputs will be reduced or eliminated as necessary to ensure that dam safety requirements are not exceeded. Until the reservoir is refilled, discharges will be minimized throughout the year to those outputs required to maintain acceptable flows in Lower Three Run Creek (approximately 10 cubic feet per second); only under conditions where dam safety is jeopardized will discharges be increased above this rate. River water inputs may be restricted during the spring and summer months as dictated by ecological conditions. During heavy rainfall events in the spring and summer, modest increases in water level are not expected to have adverse ecological consequences. The minimum water level to be maintained through the spring and summer is approximately that attained in early April. Following this approach, it is possible, and the intent is, that the reservoir will be refilled during the first winter and the risk minimized.

Should that not be the case, a significant reduction in risk associated with the cesium-137 contaminated sediments will still be achieved because the most highly contaminated canal of the exposed sediments will be inundated. If radionuclides only a partial refill is achieved during the first winter, a relatively short period during the These following fall should be required to complete into the refill.

The potential for remobilization of by contaminated sediments in the Par Pond drainage during refill has been considered. canal Particular emphasis has been given to the potential for loss of contaminated sediments from Par Pond into Lower Three Runs Creek. The potential for significant transport from the reservoir is considered to be low. During the introduction refilling operation, water will be pumped into the through the river water distribution system to majority of the Par Pond pumphouse and released into Par matter Pond. There is no reason to expect that significant radionuclide contamination exists in subsequent the piping system of the river water distribution system, so no radionuclide resuspension is small expected to occur prior to release of this water into Par Pond. The intake structure at the canal pumphouse is configured with a concrete slab extending the width of the intake structure and approximately 100 ft into the reservoir beyond the headwall of the intakes (Wilde, 1985). be a This concrete slab is at elevation 190 ft msl and and is therefore submerged at the current water level. The slab extends into the pumphouse at not the discharge pipe at the dam.

The other major source of water for the Par Pond refill is releases into the P Reactor system. The primary releases of into Par Pond occurred through drainages associated with the R Reactor drainages. included a natural drainage from R Area Pond C and the R Reactor canal system through Pond B into the north arm of Par Pond. These drainages will not be affected flows associated with the refill action. Secondary contamination of the P Reactor canal system occurred as a result of cesium-137 mobilization by chemical cycling processes within Par Pond and the intake of P Reactor cooling water with low level contamination. The last significant radionuclide Par Pond system occurred in 1963-64. It is reasonable to assume that the resuspendable contaminated particulate introduced into the P Canal system has been flushed from the system during the nearly 20 years of high flows through the system from P Reactor. Therefore, only amounts of contaminated resuspendable particles are expected to occur in the system.

The entry point of the P Canal into Pond C represents a depositional area. This could be a point of historic radionuclide accumulation and a potential source of resuspendable contaminated particles. As this area has

the same elevation at least as far as the pump intakes. Consequently, water that is released into the pumphouse flowing toward the reservoir encounters a run of great than 100 ft of flat concrete prior to entering the reservoir proper. It is anticipated that prior to encountering the contaminated reservoir sediments, most of the turbulent energy of this water will have dissipated, thereby reducing or eliminating its erosive potential. Should any contaminated sediments be resuspended near the pumphouse, the flow path from the pumphouse to the dam is approximately 2.5 miles. It is reasonable to assume that flow velocities are low over this flow path, and that flow is essentially laminar (as opposed to turbulent). Consequently, any sediments eroded near the pumphouse should be redeposited in the reservoir prior to reaching The

been evaluated for soil types or contamination levels, it should be assumed that resuspension of contaminated particles could occur at this area. The flow path from this area to the Hot Dam culvert is approximately 1/3 mile and it can assumed that this flow is non-turbulent, thereby facilitating settling of particles. However, the culvert from Pond C to Par Pond pulls bottom water from Pond C. Particles settling to the bottom of Pond C near the culvert can be assumed to remain in suspension passing through the Hot Dam because of the expected high water velocities and turbulence. Once entering Par Pond from Pond C, however, these particles should settle relatively rapidly. After an initial episode of high turbulence following exit from the Hot Dam culvert, it can be assumed that flow velocities are low and flow is essentially laminar.

flow path from the Hot Dam to the cold dam release intake is approximately 2.7 miles. It is anticipated that, even with bottom release, most of the particles should have settled over this flow course. Monitoring of the response of the dam to rises of non-

Water quality monitoring at the Par Pond discharge is currently conducted bi-weekly using composite samples collected over that period. Water samples from Lower Three Runs Creek are analyzed for gross-alpha, volatile beta, and tritium; strontium analyses are conducted on a monthly basis. Monitoring

in water level will be conducted as well as ecological conditions in the reservoir and when monitoring of water quality of discharges from will be the reservoir to Lower Three Runs Creek. suspended

Monitoring of ecological conditions will occur continue at four locations in the reservoir that have been used in previous monitoring efforts. Water significantly elevated samples will be collected in the reservoir at two detected, week intervals with analyses for ammonia, longer nitrate, total Kjeldahl nitrogen, total daily phosphorus, orthophosphate, chlorophyll-a, dissolved oxygen, and temperature. Top and the bottom samples will be collected for all added) chemical analyses except as noted. any of Chlorophyll-a analyses will only be conducted approach for surface waters. Temperature and dissolved water oxygen measurements will be conducted at the approximately 1 m intervals from the surface to it can the bottom. Water samples will be qualitatively concentrations screened to determine relative proportions of major algal taxa. Water quality monitoring will continue into the early fall after most, or all, of appears the reservoir filling is completed.

Fish sampling will be conducted at least three this times: prior to initiation of refill, in the spring the during the refill, and in the fall following refill. maintenance of Electrofishing will be the primary collection This technique with data analyzed to evaluate fish the community structure and recruitment. Fish

water immediately downstream from the Par Pond Dam will be modified at the time refill is initiated. Daily grab samples collected and analyzed for total suspended solids, gross alpha, non-volatile beta, tritium, and cesium-137. This sampling will continue for a period of two weeks following the initiation of refill. Should significantly elevated concentrations of radionuclides be detected, daily monitoring will be continued for a longer period of time. Following cessation of daily monitoring, bi-weekly sampling will be resumed with the same parameters as in the current program (cesium-137 will be added) being analyzed. Should the values for any of the monitored radiological parameters approach or exceed 50 percent of the drinking water standard during the refill, releases from the reservoir will be reduced or ceased until it can be determined that these target concentrations will not be exceeded.

Further description of this alternative appears below.

Treatment Components. The treatment in this alternative would be the submergence of the sediments with the refilling and maintenance of the reservoir at the 200 ñ 1-ft level. This would allow the radioactive isotopes in the sediments to decay naturally, and would

samples will be collected for mercury and limited
cesium-137 analyses; water and sediment layer
samples will also be collected at the time of fish would
sampling for mercury analyses. contaminated

DOE, through an interagency agreement with
the U.S. Geologic Survey (USGS), maintains to
a water level stage recorder in Par Pond and a
stream flow monitoring station immediately 200 ñ 1
downstream from Road B on Lower Three
Runs Creek. Par Pond discharges will be
monitored at, or near, SRS Road B, (see Figure Alternative 2,
1) immediately downstream from the Par Pond through
dam to test for radionuclide releases from the areas
reservoir during refill. security

minimize human health risks because of

access to the sediments under water. The

of water would provide shielding which

attenuate radiation and prevent

sediments from becoming airborne.

Engineering Controls. Controlled pumping

and discharge from Par Pond would be
required to maintain the water level at

ft.

Institutional Controls. Under

remaining risk would be controlled

institutional controls. Public access to

within SRS is controlled by existing

personnel and security equipment as discussed Accordingly,
under Alternative 1. No additional/new
controls would be instituted under this
alternative.

Quantity of Waste. Considering that the depth
of contamination does not exceed one foot and
the area of exposed sediments is 1340 acres,
the volume of waste is approximately 2.2
million cubic yards.
basis for

remedy.
Implementation Requirements. No implement-
ability concerns are associated with Alternative 2.
the

Estimated Construction and Operation and

distributed under this alternative.

over the long term, adverse effects on
endangered and threatened species would be
more similar to pre-drawdown conditions.

VIII. Summary of Comparative
Analysis of Alternatives

The NCP [40 CFR 300.430 (e)(9)] sets forth
nine evaluation criteria that provide the

evaluating alternatives and selecting a

The criteria are:

overall protection of human health and

environment
compliance with ARARs

Maintenance Costs. Implementation of this alternative requires pumping for refilling and maintaining the reservoir at the 200 ñ 1-ft level. Annual pumping costs for refilling and maintaining Par Pond at the 200 ñ 1-ft level are estimated to be $360,000. The cost is an incremental (estimated) cost (part of the total cost) associated with the operation of the Site Cooling Water Distribution System (river water system) that maintains water to Par Pond, L Lake, and the reactors. The river water system will remain in service, at this time, regardless of the action chosen for Par Pond. Therefore, SRS would still incur the cost associated with the operation of the pumps. The pumping cost extended over a 30-year period at a discount rate of five percent would be approximately $5,500,000. Since the waste would remain in place, a review of remedy would be required every five years under SARA. Total present worth costs for implementing this alternative, including pumping and remedy review, are estimated to be approximately $5,800,000 over a 30-year period.

ARARs Associated with the Considered Alternative. There are no chemical-specific or action-specific ARARs associated with Alternative 2. Concerning location-specific ARARs, as with Alternative 1, the Endangered Species Act (16 USC 1531 et seq.) is applicable to Alternative 2. Refilling Par Pond will eliminate the additional accumulation of contaminated sediments in deeper basin areas caused by surface runoff on the exposed areas. Contaminant concentrations in basin sediments would be expected to be more evenly The

long-term effectiveness and permanence
reduction of toxicity, mobility, or volume through treatment
short-term effectiveness
implementability
cost
state acceptance
community acceptance

Overall Protection of Human Health and the Environment. Alternative 1 would not achieve any reduction in human health risks posed by the drawdown of Par Pond. Alternative 2 would provide a reduction in carcinogenic risk due to the shielding provided by the overlying surface water after refilling of the pond. In addition, Alternative 2 would eliminate direct exposure to the contaminated sediments.

Under Alternative 1, the ecosystem alteration and instability resulting from Par Pond drawdown would continue as the ecosystem adjusts to drawdown conditions. Alternative 1 would result in continued exposure to contaminated sediments and would permanently eliminate approximately 1340 acres of wetland and aquatic habitat present prior to drawdown of the reservoir. Implementation of Alternative 2 would result in eventual re-establishment of the aquatic habitat and wetlands to essentially pre-drawdown conditions.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs). No chemical-specific or action-specific ARARs associated with either Alternatives 1 or 2.

Endangered Species Act is the location-specific terrestrial ARAR associated with the alternatives. Alternative 1 allows for the potential of increased adverse effects to endangered and threatened species through increased potential for sediment loading to the reservoir and subsequent uptake of accumulation in prey toxicity species. With implementation of Alternative 2, Par Pond will more closely resemble conditions attenuation for these endangered and threatened species that existed before drawdown.

Long-Term Effectiveness and Permanence. be The magnitude of risk associated with Alternative 1 will decrease over time due to the natural decay of cesium-137. The ecosystem would eventually adjust to conditions of the 181-ft drawdown water level; however, the habitat on the majority of the 1340 acres of exposed sediments would be permanently for altered to a terrestrial structure.

The magnitude of risks under Alternative 2 will essentially remain unchanged for the time may required for dam repair and water level restoration. Upon completion of restoration of the water level under Alternative 2, risk due to direct exposure and inhalation of contaminated sediments would be minimized. The eco-system would recover to essentially pre-drawdown conditions (wetlands and aquatic of habitat) under Alternative 2, as compared to Alternative 1, maintaining the water level at the 181-ft level. additional

Reduction of Toxicity, Mobility, or Volume. Alternative 1 would not reduce the mobility of the waste constituents. Contaminant uptake by mobile terrestrial animal species could result in addition, offsite migration through animal movements would be precluded. However, contaminant mobility through migration of waterfowl and predator animal species feeding on contaminated flora and animal prey could continue with both alternatives. As with Alternative 1, the and volume of cesium-137 would be reduced through radioactive decay. Gamma attenuation would occur through restoration of the water level.

Short-Term Effectiveness. Alternative 2 can be implemented immediately without increased risk to the community or workers. The alternative itself poses no adverse environmental impacts. In comparison to Alternative 2, Alternative 1 will not reduce risks from exposure to Par Pond sediments or provide lessening of environmental impacts for the effects of drawdown.

Implementability. Alternative 1 is readily implementable. Refill under Alternative 2 may need to be conducted in stages over time to prevent rapid sediment resuspension and decreases in dissolved oxygen content of the water column.

Cost. Repair of the dam was completed on July 1, 1994, conducted under the auspices of the Atomic Energy Act (AEA), and is not included in the evaluation of costs for the alternatives. Alternative 1 requires no additional remediation cost; however, maintenance costs include pumping costs (approximately $280,000 annually) to maintain Par Pond at the 181-ft level and a remedy review every five years (estimated at $280,000 over a 30-year

migration of contamination away from Par Pond. The toxicity (in terms of radioactivity) and volume of cesium-137 would decrease over time by the natural radioactive decay process. Cesium-137 has a half-life of 30 years. Accordingly, the activity has decreased to approximately one-half the original concentration resulting from the process releases that occurred in the 1950s and 1960s. The activity will continue to decrease at this rate.

Alternative 2 would mimmize the airborne mobility of the contaminated sediments. In

period) for a total present worth cost of approximately $4,600,000 over a 30-year period. Alternative 2 requires costs for pumping to maintain the water level at 200 ñ 1 ft (estimated at $360,000 annually) and remedy review every five years for a total present worth cost of $5,800,000 over a 30-year period.

State Acceptance.

South Carolina as well as EPA have accepted the preferred alternative for the proposed action.

Community Acceptance.

Comments from the public have been incorporated in the IROD. Please see Section XI, Explanation of Significant Changes, and the Responsiveness Summary for details.

IX. Selected Remedy

Alternative 2 is the preferred interim action alternative. Alternative 2 consists of restoring and maintaining the water level in Par Pond to the 200 ñ 1-ft level following repair of the Par Pond Dam. As a result, exposed sediments would be submerged under a layer of water. The water layer would provide a reduction in risk due to attenuation of radiation and would preclude contaminated sediments from becoming airborne. The ecosystem of Par Pond would eventually recover to essentially pre-drawdown conditions following implementation

planned to fully address the principal threats posed by the Par Pond unit.

Since this is an IROD, review of this unit and of this remedy will be ongoing through implementation of the Remedial Investigation and Feasibility Study process required in accordance with the terms of the FFA as DOE, the EPA, and SCDHEC continue to develop final remedial alternatives for the Par Pond unit.

XI. Explanation of Significant Changes

Comments received during the public comment period suggested that SRS should not maintain the pond at full pool but let it fluctuate naturally. The reasons expressed for this actual/potential option were cost and the incompleteness of the data available to determine the risk of the waste unit.

of Alternative 2.

Within 15 days of the signing (approval) of the the
IROD, SRS will submit an outline for the post- outlined in
IROD documents; the Remedial Design/
Corrective Measures Design and Remedial at
Action/Corrective Measures implementation Environmental
Plans. The post-IROD documents will be
submitted within 30 days after the outline is Once
approved by EPA and SCDHEC. The interim
remedial action will begin after the post-IROD
documents are approved. naturally

X. Statutory Determination

This interim action remedy is protective of
human health and the environment, complies
with Federal and state applicable or relevant
and appropriate requirements directly is
associated with this action, and is cost- the
effective. This interim remedial action utilizes the
permanent solutions and alternative treatment
(or resource recovery) technologies, to the
maximum extent practicable, given the limited as
scope of the action. Because this interim
remedial action does not constitute the final
remedy for the Par Pond unit, the statutory
preference for remedies that employ treatment
that reduces toxicity, mobility, or volume as a the
principle element will be addressed by the final documentation
response action. Subsequent actions are

Based on the impact from the public and
discussions with the regulatory agencies,

preferred alternative (Alternative 2)

the IAPP is being modified by this IROD to
include refill and maintenance of the pond

200 ft msl ñ 1 ft until a National

Policy Act (NEPA) evaluation of this
modification alternative can be evaluated.

the NEPA documentation is completed and
assuming the proposed action is acceptable,
SRS will allow the pond to fluctuate

until the final CERCLA action is complete.

DOE is required through NEPA regulation (10
CFR PART 1021) and DOE Order 5440.1E to
assess the environmental impacts of any
proposed action which may potentially have
significant effects on the environment. DOE

committed through the regulation to follow

letter and spirit of NEPA, fully comply with

Council on Environmental Quality (CEQ)
requirements, and apply NEPA early in the
planning phases of a proposed action, such

the evaluation of the potential impacts of
fluctuating water levels on Par Pond. CEQ
required DOE to prepare a Special
Environmental Analysis to assess the impacts
of the drawdown, repair, and refill back to

200 ft. level. Additional NEPA

will be required to evaluate the potential

environmental impacts associated with the fluctuation of the water level from full pool.

Appropriate NEPA documentation will be prepared to evaluate the potential environmental impacts, and any associated mitigation measures, of allowing Par Pond's water level to fluctuate naturally. This proposed action would include the discontinuation of pumping from the Savannah River once the Pond has been refilled to the 200 ft. (ñ 1 ft) level. The NEPA documentation will focus on the
Carolina.
potential impacts of reduced and/or fluctuating water levels on the ecology, potential impacts on the ecosystem from reduction of nutrients as Savannah
a result of discontinuing pumping from the Carolina.
Savannah River, and assessment of the Pond's water level in balance with maintaining minimum flow in Lower Three Runs Creek. It is estimated that the NEPA evaluation will be completed in 1996 or 1997.

Based on recent studies and modeling conducted by various internal and external organizations, PAR Pond will fluctuate naturally between 190 to 200 ft. msl. This means that at different times, between 0 and 800 acres of contaminated sediment will be above the water line. The pond will loose the nutrients that have been provided from the Savannah River water for the past 33 years. While most natural lakes and ponds maintain a fairly constant level, except in extreme conditions, the equilibrium point of PAR Pond under
is unknown and the level will probably
G-
fluctuate more than a natural lake since the pond is man-made. Personnel access to PAR Pond sediments will remain restricted.

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APPENDIX A

RESPONSIVENESS SUMMARY

Responsiveness Summary

During the public comment period for the proposed interim action for the PAR Pond operable unit, a public information meeting was held to discuss the proposed action with interested members of the public. The meeting was held on December 14, 1995 in Aiken South Carolina. Approximately 35 people attended the meeting (including the SRS and regulatory agency personnel).

The public meeting was divided into three main segments: 1) a general introduction section, 2) a discussion about the proposed PAR Pond interim action and 3) a question and answer session. A transcript of the meeting is available in the Administrative Record File for the PAR Pond unit.

During the public comment period, several letters were submitted from individuals and groups regarding the proposed interim action. Questions raised during the discussion included general information questions regarding the physical state of the unit, how SRS was planning to refill the pond, dam safety issues, the accuracy of the costs and the method of determining the cost estimate, impacts (potential risks) to workers, residents and wildlife. This Responsiveness Summary addresses the general comments and concerns from the public meeting and specifically addresses the written comments received. The summary is divided into two sections: 1) general responses and discussions to significant issues raised during the meeting, including modification of the proposed action, and 2) specific responses to the written comments received. Please note, some of the specific comments will be addressed by the general response section due to common

questions and concerns. Also, some comments were received about the meeting format. These comments will be taken under consideration for future public meetings.

General Responses:

Modification to the preferred alternative: Alternative #2 - Refill and maintain PAR Pond a 200
ft (ñ1 ft) msl.

Some comments received suggested that SRS should not maintain the pond at full pool but let it fluctuate naturally. The reasons expressed for this option were cost and the incompleteness of the
data available to determine the actual/potential risk of the waste unit. One written comment and one
voiced at the meeting recommended SRS implement the no action alternative, i.e. maintain the pond at the 181 ft. msl. The written comment expressed a major concern regarding the cost to maintain the pond and the voiced comment focused on a concern for dam safety.

The preferred alternative (alternative 2) in the IAPP will be modified to state that SRS will refill and maintain the pond at 200 ft msl ñ 1 ft until a National Environmental Policy Act (NEPA) evaluation of a reduced flow to Lower Three Runs creek (the creek below PAR Pond Dam), fluctuating pond water level and the ecological impacts of not continuing to provide river water, through pumping, to PAR Pond can be evaluated. If the NEPA evaluation indicates that a fluctuating water level is acceptable, the appropriate post-ROD CERCLA documentation will be prepared to support the decision.

DOE is required through the National Environmental Policy Act regulation (10 CFR PART 1021) and DOE Order 5440.1E to assess the environmental impacts of any proposed action which may potentially have significant effects on the environment. DOE is committed through the regulation to follow the letter and spirit of NEPA, fully comply with CEQ regulations, and apply NEPA early in the planning phases of a proposed action, such as the evaluation of the potential impacts of fluctuating water levels on Par Pond. CEQ required DOE to prepare a Special Environmental

Analysis to assess the impacts of the drawdown, repair, and refill back to the 200 ft. level. Additional NEPA documentation will be required to evaluate the potential environmental impacts associated with the fluctuation of the water level from full pool.

Appropriate NEPA documentation must be prepared to evaluate the potential environmental impacts, and any associated mitigation measures, of allowing Par Pond's water level to fluctuate naturally. This proposed action would be the discontinuation of pumping from the Savannah River once the Pond has been refilled to the 200 ft. (ñ 1 ft) level. The NEPA documentation will focus on the potential impacts of reduced and/or fluctuating water levels on the ecology, potential impacts on the ecosystem from reduction of nutrients as a result of discontinuing pumping from the Savannah River, and assessment of the Pond's water level in balance with maintaining minimum flow in Lower Three Runs Creek.

Once the NEPA documentation is completed and assuming the proposed action is acceptable, SRS will allow the pond to fluctuate naturally until the final CERCLA action is complete. The appropriate CERCLA documentation will be prepared prior to allowing the pond to fluctuate. It is estimated that the NEPA evaluation will be completed in 1996 or 1997.

Based on recent studies and modeling conducted by various internal and external organizations, PAR Pond water level will fluctuate naturally between 190 to 200 ft. msl. This means that at different times, between 0 and 800 acres of contaminated sediment will be above the water line. The pond will loose the nutrients that have been provided from the Savannah River water for the past 33 years. While most natural lakes and ponds maintain a fairly constant level, except in extreme conditions, the equilibrium point of PAR Pond is unknown and the level will probably fluctuate more than a natural lake since the pond is man-made. Personnel access to PAR Pond sediments will remain restricted.

Cost Estimat

The costs provided in the IAPP and IROD are for performing the remedial actions - refilling and maintaining the pond and the 5 year remedy reviews. The cost includes the estimated annual pumping costs and O&M costs associated with the operation of the pumps. The cost is an incremental (estimated) cost (part of the total cost) associated with the operation of the Site Cooling Water Distribution System (river water system) that maintains water to PAR Pond, L Lake and the reactors. The river water system will remain in service, at this time, irregardless of the action chosen for PAR Pond. Therefore SRS would still incur the cost associated with the operation of the pumps. The remedial costs presented were addressed per EPA guidance. The Superfund program recommends that the present worth be calculated at a 5% discount rate (interest) before taxes and after inflation be assumed (discount rate applied prior to taxes and after inflation). The thirty year time frame is the maximum allowable per the regulations, thus resulting in the maximum cost estimate (OSWER 9355.3-01 pg. 6-12). It is used for estimating an comparison purposes only. A time frame of ten years could have been used. It does not mean that SRS plans to maintain this interim action for thirty years.

Present worth analysis is used to evaluate expenditures that occur over different time periods by discounting all future costs to a common base year, usually the year in which the estimate is prepared. This allows the cost of remedial action alternatives

to be compared on the basis of a single figure representing the amount of money that, if invested in the base year and distributed as needed, would be sufficient to cover all costs associated with the remedial alternative. In other words, in every investment, it needs to be recognized that a dollar invested today is worth more than a dollar tomorrow because of the interest cost which is related to all expenditures which occur over time. Dollar benefits which accrue in the future cannot be compared directly with investments made in the present because of the time value of money. Discounting is a technique for converting various cash flows occurring over time to equivalent amounts at a common point in time. It is recommended by the Office of Management and Budget (OMB) that costs in future years should not be escalated to account for general price inflation, except where there is a reasonable

basis for predicting differences in the relative escalation of costs (or benefits) associated with the project (i.e. if the operating costs will be increasing). Otherwise, the estimation should use constant (base period) dollars. OMB recommends a discount rate of 10%, which represents "the average rate of return on private investments, before taxes and after inflation" (OMB, circular A-94). In other words, inflation is accounted for in the discount rate:

$$P=A\left[\frac{\{1+i\}n-1}{i\{1+i\}n}\right]$$

P - present worth
A - annual payment/yearly disbursement
i - interest rate/discount rate

The present worth of the preferred alternative is approximately $5.5 MM. This is the present worth of $360,000 for 30 years using a present worth factor (discount rate/interest rate) of 5%. The total present worth cost also includes the 5 year remedy reviews as required by the regulations. Present worth can be viewed as the amount of money that will be needed now in order to fund a future outlay(s). In this case a uniform series of $360K/yr. The 5% discount rate does not mean that the cost is reduced by 5% each year, it is actually increased 5% a year. Specifically, $360K in the first year is equal to $378K the second year. Using the present worth discount rate allows a comparison/evaluation the total lifetime cost(s) in present dollar value. The future value (value spent at the end of the lifetime in future dollars) is not $10.8MM ($369K x 30 yrs) but rather $23MM.

Maintaining the pond at the 181 foot level also has an annual O&M cost associated with it. In order to maintain the pond at 181 ft. discharging of water from the pond is required. Also, at times some pumping (and discharging) is required to maintain flow to Lower Three Runs. The river water system is being maintained to pump and discharge water from PAR Pond to maintain the lower water level and also to provide water to L Lake and other systems that use the water. It was estimated from the operating department, that it takes a slightly less level of effort to maintain the pond at 181 ft. than at full pool. The cost to maintain the pond at the 181 foot level was estimated to be $280,000/yr.

The annual $360K/yr. O&M cost to maintain the pond at full pool is the best estimate available from the operating department. This is what has been budgeted. This figure may vary annually depending upon pump usage. During the initial refill, the cost could be as high as $500K to $700K, depending upon pump usage (average pumping rate versus maximum pumping), natural inputs, maintenance problems etc.

By the same token, the annual cost could be lower if it is a wet year. This annual cost is part of the normal annual operating budget for river water system. If this CERCLA action had not occurred (i.e. drawdown and refill), these moneys would be spent maintaining the pond regardless.

This analysis can also be used to support the proposed change to the preferred alternative. The best way to minimize the costs would be to eliminate pumping and/or siphoning. In other words, letting the pond fluctuate naturally. No true cost saving, though, would be realized until the Site Cooling Water Distribution System (river water system) is completely shut down.

Verbal comment from the meeting: Mr. David Christianson - "...it appears to be that w drew down the water to its current level in order to repair the dam, that its present low level is more of a stable condition than full pool. And, in that case, it would appear to me that the cheapest, most cost effective scenario to maintain the PAR Pond at that depressed level while we are doing other studies to determine its configuration. And that is -- that's all I really wanted to say, that it appears to me that it's a stable configuration right now, more stable than if it were full, and I believe that we should maintain it at that until we determine its ultimate destination."

Response:

The design for the repair of the uncontrolled seepage problem at PAR Pond Dam was reviewed by the US Army Corps of Engineers, the Bureau of Reclamation, and the Federal Energy Regulatory Commission (FERC). All parties agreed that the designed repair would return the dam to a safe condition. The repair was completed to the specifications in the design documents. The FERC conducted periodic inspections during the construction phase of the repair. These inspections reported that the observed work appeared to be in accordance with approved plans and specifications. Their final inspection will be performed after the reservoir is returned to full pool (El. 220 ft.).

Since the repair of the dam is not part of this CERCLA action, details of the dam repair will not be added to the IAPP or IROD. For the purposes of this proposed action, the dam will be in a safe condition for refilling the pond. This is stated in the LAPP and IROD.

Written Comments Received on the Par Pond Interim Action Proposed Plan

Taxpayers for Responsible Infrastructure Management (TRIM)
Jackson, South Carolina

"TRIM is a grassroots organization devoted to the effective management of our federal lands and resources. We believe that risk management should be utilized to focus the scarce funding for environmental restoration where it will contribute the most to the environment. We choose to participate in this process via written comments. We feel that our method of participation preserves the working relationships of our members with DOE, Federal and State regulators, and their contractors.

We have read the available material related to Par Pond, and attended the meeting on December 14th in Aiken. There are many issues that we feel compelled to comment on, and these are captured in Attachment 1.

We would like to propose and additional alternative, herein referred to as "Alternative 3", to be considered: fill the pond, and let the level vary with rainfall just like a natural lake. Attachment 2 is a draft of proposed Alternative 3. We believe Alternative 3 is safe, protective of both man and beast, and is far more cost effective based upon the following logic:

The exposed sediments contain 9 curies Cesium, which is by far the worst hazard to huma or creature. The exposure to workers during the period the pond was drawn down was so small, the radiation monitoring was not required. A linear correlation of exposure vs. exposed sediments is conservative, based upon the stated fact that the worst areas of contamination are in the deeper sections of the pond. This is somewhat offset, however, by the fact that exposure of sediments is the greatest with the first few feet of level decrease due to the slope of the shoreline. On balance, it appears that the risk in Alternative 3 would be an order of magnitude less that with alternative 1 (pond at 181'), and very close in magnitude that of Alternative 2.

No evidence of harm to wildlife from uptake of Cesium or mercury was observed with th pond at 181'. The vegetation uptake is proportional to the quantity of foliage growing in the contaminated sediments; with Alternative 3, the amount of foliage growing in the contaminated sediments will be essentially equal to that of Alternative 2; the foliage will not be able to establish itself in an area of varying water level.

The uptake of contaminants is also proportional to the area of habitat established o exposed sediments on which the nonvegetative food chain exists. The area of habitat established on exposed sediments under Alternative 3 is, if anything, less than that of Alternative 2.

Therefore Alternative 3 presents no substantial difference in risk than Alternative 2. It also satisfies all the expressed concerns of the regulators and the public (excepting the earthen dam concern), and is far more cost effective.

Should EPA disagree with the merits of our proposal, we would urge you to consider this proposal from a risk management perspective; we find that the exposed sediments at Par Pond present insufficient risk to warrant the expenditures proposed. The sediments were exposed for the last three years, without evidence of harm; surely what is prudent is to let the pond level vary with rainfall until more data is collected, if EPA indeed feels that this is indeed warranted.

In the event that the EPA feels that there is insufficient data to justify the exposure due to

varying
water level, perhaps the interim action should include a provision that once further assessment of
risk is complete, the pond will be allowed to vary. This would eliminate the need to develop another interim plan (the cost of which never appears in any discussion of alternatives).

We encourage you to give this proposal consideration as the preferred alternative.

We would like to request the comment transcript or summary from the December 14 public meeting, and copies of all written stakeholder comments as well. Thank you for inviting us to participate in this process, and please keep us on the distribution for future correspondence. We
look forward to your response."

Response to TRIM Letter:

Based on public input on the proposed action for PAR Pond, the preferred alternative will be modified to state that the pond will be refilled and following a required NEPA evaluation, the pond will be allowed to fluctuate assuming the NEPA evaluation supports this action. See the first general response. Note that a new alternative, alternative 3 as proposed, is not needed to implement the change. The existing preferred action can be modified without developing a new alternative within the current CERCLA documentation.

SRS believes TRIM's letter was well presented and thought out. However, there are some slight inaccuracies that need to be clarified. Although the statement that the risk to workers during the drawdown was negligible is correct, the risk evaluation based on existing data indicated, based on a modified standard worker scenario, that personnel working on the sediments could be at risk due to exposure. The standard default EPA values for risk assessments, which are conservative, were modified to reflect actual site working conditions. Currently worker access to the sediments is controlled and monitored and minimized. It is correct, as stated in the meeting, that workers are not required to wear radiation monitors. However, this is not because that the potential risk, as calculated, is low, but because the exposed sediments do not meet the definition of a radiological controlled/contaminated area. There are specific guidelines specified by DOE as to when monitoring inside a contaminated area is needed. These are different than risks calculated under CERCLA.

The existing estimate of worker risk is based on limited data. In order to gain an accurate estimate, more data would be required. A new evaluation may indicate there is a different risk that originally estimated. Based on the information available, the DOE, EPA and SCDHEC are being protective of human health and the environment by being conservative and recommending the refilling and maintaining of the pond, to reduce the potential risk, until more information becomes available.

Although there is no evidence of harm to wildlife from uptake of CS-137 or mercury there has been a noticeable increase in the uptake of cesium in some of the animals and vegetation on the sediments. The uptake levels have not yet reached a dose level where harm to wildlife will occur. The longer wildlife is exposed or can be exposed to the sediments the greater the uptake of contaminants will be and the greater the risk of physiological harm becomes. Wildlife monitoring will continue. Also, some of the nutrients supplied from the river water displace the uptake of CS-

137 and mercury in plant and animals. Potassium is one of these nutrients.

Therefore, by adding river water to the pond, SRS is reducing the possibility that the uptake levels may reach an unacceptable level.

1340 acres of aquatic habitat was lost (loss of the entire littoral zone) during the drawdown. The impacts from the drawdown are currently more visible than those associated with the contaminants in the sediments. Effects of the drawdown were outlined in the IAPP.

All comments received, as well as the meeting record will be placed in the Administrative Record File for the PAR Pond waste unit. If possible, copies will be sent to TRIM.

TRIM Comments on the Par Pond Interim Action Proposed Plan

"1. The agencies involved do not fulfill the need for public participation in this process, because
the are still in the Decide-Announce-Defend mode rather than seeking a Win-Win solution. Some regulators hide behind regulations, and when defending the proposal indicate that 'the regulations
require such and such'. No one argues the need to comply with our laws and regulations. In many cases the laws and regulations require issues to be addressed, but do not specify how they are addressed. Thus when the public comments, the responders should ask themselves, "how can I accommodate this stake holder within the constraints of the regulations?" rather than explaining
how the regulation constrains them.

The best example of this was the discussion of alternatives. The regulators limit discussion to the
alternatives being proposed, while other alternatives may be available that address the stake holder
issues and comply with the regulations. The agencies do not solicit solutions from stake holders
we never hear "how could we accommodate this concern within the constraints of the regulations?" The alternative that we present in this memo could have easily come to light with proper facilitation.

From the information presented, three concerns were identified by EPA, DOE, and the Public; 1) risk to human health; 2) risk to the environment; 3) cost effectiveness. The following comments address each of these concerns."

Response:

Additional alternatives proposed by the public are always considered. However, the IAPP only proposed 2 actions and that is what was presented to the public. Under the RCRA/CERCLA process, upon receipt of public comments, the alternatives are reviewed to determine if the option chosen is still the preferred alternative. DOE has discussed the Par Pond IAPP with some stakeholders on numerous occasions. The Natural Resource Trustees were given two or three briefings on the proposed

alternatives. Several briefings were given to EPA and SCDHEC at quarterly meetings. A public meeting was held in Aiken where Par Pond was discussed in great detail, prior to the development of the IAPP.

As a result of the Public meeting held on 12/14/94 and comments received at that meeting, DOE is proposing to refill and maintain the reservoir until the NEPA process has been complete. NEPA will consider the ecological and other possible impacts of allowing the PAR Pond water level to fluctuate naturally. Should this alternative have acceptable environmental impacts it will be pursued. Therefore in this case, public participation helped DOE and EPA concur with the selection of the alternative proposed in the TRIM letter.

"Human Health Risk

2. The documentation clearly states than the situation at PAR Pond does not present a risk to the general public. Therefore, the IAPP does not need to address this topic. The risk to a hypothetical resident is reportedly greater, so the regulation requires that this be addressed. Given the fact that this is an interim action, and that residence of PAR Pond is not a reality in the near future, the IAPP should simply conclude that prior to establishing anything greater than worker exposure to PAR Pond, that an appropriate analysis be conducted at that time. Anything further would be a great waste of taxpayer dollars."

Response:

SRS agrees with the comment. Since this is an interim action and not a final action, the IAPP did focus on the immediate problem and not the potential of a future resident. The first revision (version) of the IAPP did present alternatives that focused on more permanent solutions to the problem, but was modified based on EPA comments similar to TRIM's. The risk assessment, based on limited existing data, did evaluate the future resident scenario as required by CERCLA guidance, however, for the purposes of the IAPP an attempt was made to focus on the current potential risks. The final CERCLA action will focus on the hypothetical future resident, depending upon future land use decisions, as well as the other required scenarios.

"3. The risk to the worker was identified as 'moderate', with a numerical value assigned of 10-4 to 10-6 chances of an additional cancer per year. The calculation that arrived at this figure was undoubtedly very conservative, due to the lack of hard and fast data. The risk identified was due to the radiation in the sediments exposed in the drawdown. It was also pointed out, however, that radiation monitoring is only required for workers if the dose exceeds 100 millirem (per year?). If this is the worst risk to human health, one can only conclude that the risk to workers is

negligible,
since it is clearly less risk than that of many site workers who do have to wear radiation monitoring. We feel that sufficient data is available to support the position that with the pond at
any water level > 181' there is no appreciable risk to the workers."

Response:

The guidelines that determine when radiation monitoring is required are different than these that axe used to calculate and estimated risk under CERCLA. DOE and the NRC regulate when radiation monitoring is needed. Radiation monitoring, as well as designating an area "Radiologically Controlled or Contaminated", is determined by internal procedures that follow DOE guidelines. Although PAR Pond workers are not required to wear radiation monitors; this does not mean that there is no risk to the workers present. It means that it does not meet the definition of a radiologically controlled area. The risks determined by CERCLA are based on a different set of conditions. As stated previously, the default conservative EPA parameters were modified for the worker scenario to reflect actual site conditions. If the standard conservative EPA parameters were used, the risk would probably have been estimated in the area of 10-2 excess cancers per year.

The radiation limit for formally trained radiation workers at the Savannah River Site is currently 3000 mrem per year. The radiation limit for members of the general public is 100 mrem/year and it is that limit that is applicable to workers on the Par Pond CERCLA unit. Three independent estimations of the radiation dose received by full-time workers at Par Pond (8 hr/day for 250 days per year) showed that the potential dose rate is in the range of 16 to 22 mrem/yr. Consequently, personal monitoring devices are not required by workers on Par Pond, but are available if requested. No special protective clothing is required for entry to the Par Pond unit, but it is recommended that workers wear rubber boots and gloves to minimize direct contact with the sediments and facilitate cleaning.

The existing estimate of worker risk is based in limited data. In order to gain an accurate estimate more data would be required. A new estimate may modify the risk that was originally estimated. In order to minimize any risk, actual exposure to the sediment is controlled by limiting worker access. Based on the information available, the DOE, EPA and SCDHEC are being protective of human health and the environment by being conservative and recommending the refilling and maintaining of the pond, to reduce the potential risks, until more information becomes available.

"4. We find it ironic that the exposure of the workers to the sediments poses the greatest actual
risk, yet no monitoring of the workers is required. Of all the money spent on quantifying the risk,
DOE is unable to quantify the actual exposure of the workers, nor compare their exposure to other
workers. How can they call it a real risk; and yet not attempt to quantify it?"

Response:

The DOE has initiated several sampling and monitoring programs to better assess the radiation environment of PAR Pond. Most of these data are not yet available. Please see #3 and the response to the letter.

"5. The risk to the environment was not clearly stated, however it was stated that no ill effects due
to the exposure/uptake of either radiation or mercury has been observed in the three years the pond
was down. The EPA indicated that their primary driver was to protect the species in the area.
Given the fact that no adverse impacts have been observed in three years, we feel that their money
would be better spent studying other areas at SRS."

Response:

Although there is no evidence of harm to wildlife from uptake of CS-137 or mercury there has been a noticeable increase in the uptake of cesium in some of the animals and vegetation on the sediments. The uptake levels have not yet reached a dose level where harm to wildlife will occur. The longer wildlife is exposed or can be exposed to the sediments the greater the uptake of contaminants will be and the greater the risk of physiological harm becomes. Wildlife monitoring will continue. Also note that 1340 acres of aquatic habitat was lost (loss of the entire littoral zone) during the drawdown. The impacts from the drawdown are currently more visible than those associated with the contaminants in the sediments. Effects of the drawdown were outlined in the IAPP.

"Risk to the Environment

6. After further discussion of who (humans or habitat) were at risk due to the lower pond, level,
it was stated that the risk was not indeed a driver for the refill, but rather the only driver was the
restoration of the pond as an ecological resource. The SREL person itTdicated that Par Pond is a

source of study on threatened and endangered species; that the drawdown had devastated an
invaluable wildlife sanctuary; that the population of ducks was vastly reduced; and finally that the
environmental quality could only be restored by refilling the pond. We believe that the value of the
pond as an ecological resource is valid, however we feel that scientific research should be funded
based upon it merits, not by blackmailing the regulators and DOE (who hold the taxpayers
checkbook) with the suspicion of harm to the environment."

Response:

DOE and EPA agree that there is a potential long-term risk to both human health and the ecology from the exposed sediments. Ecological receptors can be more sensitive

than human receptors and the risks are often difficult to quantify. However, it the potential risk associated with the exposed sediments that is driving DOE to refill the reservoir. The value of the ecological resource is an added benefit, but not one of the criteria for selecting the proposed alternative.

"7. We also believe that it is faulty science to claim that the diversity of the wildlife habitat is a result of 30 years of isolation, and that this is a "natural" habitat; this neglects the fact that for 30 years the government has pumped nutrients to the pond that otherwise would not have been there. Surely anyone with a few billion dollars could create a similar habitat for study."

Response:

Comment noted.

"Cost Effectiveness

8. The cost estimates provided were bogus at best, and the assertion that the preferred alternative is cost effective is ridiculous. A response to this comment that 'the regulations required that this methodology be used' is another representation of comment number one. What we would like to see included is a cost estimate that has at least a shred of credibility (you can also include the regulatory required' version to satisfy the regulators)."

Response:

Please see the general response to the cost estimate. The cost estimate is as accurate as possible and is presented in an industry accepted format.

"9. The following non-conservatism's were observed in the cost estimate:
Using a 5% reduction in cost each year is absolutely ridiculous - use a minimal inflation rate instead - like 2% in the other direction.
The $360,000 estimate was called an incremental cost: did this represent all the costs involved or does it represent the added cost of pumping?
The cost estimate does not include the whole path forward - like one member of the public stated, we are jumping on a train, but no one knows where the train is headed.
DOE stated that they intended to pursue another interim action to allow pumping to stop - if that is the case, then this IAPP should include the cost of preparing a second IAPP in the estimate in order to fairly represent the cost of this alternative."

Response:

Please see the general response to the cost estimate.

The 5% discount rate is not a reduction in the estimated annual cost but a way of measuring the time value of money. It includes inflation.

The $360K/yr. represents PAR Pond's part of the operating cost for the river water system.

The cost estimate does not and should not include the cost for the "whole path forward" or the cost of preparing another set of CERCLA documents for a yet to be determined action. These costs would be impossible to estimate since the scope of any future action is unknown at this time. The "whole path forward" for PAR Pond is dependent upon many other factors besides the current CERCLA action or any future CERCLA action (see page 1 of the Responsiveness Summary)

Letter from Mr. G. J. Phillips to the EPA

Mr. John Hankinson
Administrator
U.S. EPA, Region IV
345 Courtland Street
Atlanta, GA 30365

Dear Mr. Hankinson:

The reason for this letter is the public meeting I attended in Aiken, S.C. concerning the Interim Plan for Par pond. I am not writing to Mr. Crane, who represented your agency, because he does not have the authority to stop this wasteful project and also because Mr. Crane made it quite clear at this meeting that he had made up his mind that he was going to approve refilling the pond. I submit to you that he is a public servant and is required to listen to the voice of the people. Four people asked questions, and three of those four people were of the opinion that this project was unnecessary. Another person responded that he worked for the ecology laboratory and that it was necessary to fill the pond for the ducks, I would go along with this logic if it weren't for the fact that Savannah River is a closed site and that it is not open to the public and therefore the citizens of the United States do not benefit from being able to see these beautiful birds. However, these birds have migrated to surrounding lakes where they are enjoyed by all.

I am writing to you to request that your agency implement alternative I, which is no action at all for the following reasons:

1. There is no danger to human health, the animal population, fish, and ecology as pointed out by Westinghouse personnel at this meeting. However, Mr. Crane stated that there was a threat to the ecology. I went on record to ask Mr. Crane how he knew more about the dangers at SRS than the people who monitor the site daily. I also entered into the record information contained in the Savannah River Environmental Report for 1993 Summary Pamphlet that there were no dangers based upon the hypothetical individual who receives the maximum exposure from all pathways.

(See Appendix A). This report further goes on to compare the maximum dose from SRS releases, both airborne and liquid, to the applicable standard and the releases never exceeded the applicable
standard. (See Appendix B) The Sportsmen's Doses (See Appendix B, page 16) shows that 1,553 deer and 147 hogs were taken from the site and none of them has appreciable doses of cesium that required them to be taken from the hunters. This entire report is full of information as to why filling the pond is unnecessary, even though the hypothetical models were worst case scenarios.

Response:

SRS CERCLA units are evaluated with respect to both onsite and offsite risks associated with individual operable units. In contrast, data presented in the SRS Annual Environmental Monitoring Report (WSRC 1994) predominantly represent the cumulative risks associated with all SRS operations to offsite individuals and populations. These doses are associated with atmospheric and liquid release (e.g. stream) pathways. Additionally, potential doses related to the consumption of deer and hogs taken during the SRS public hunts are calculated. The analyses presented in the Annual Environmental Monitoring Report indicated that the radiological doses associated with SRS operation are minimal, and confirm the Par Pond CERCLA unit specific predictions that were presented in the Baseline Risk Assessment Using Existing Data for Par Pond (BRAEDPP: WSRC 1992). Additional pathways, such as the resuspension and offsite transport of contaminated soil particles, were considered in the BRAEDPP; these additional evaluations also indicated that the risk

to offsite populations and individuals from the Par Pond Exposed Sediments was within acceptable ranges.

The risk assessment under CERCLA (BRAEDPP) also included evaluation of the risks to trespassers into the unit, SRS workers working on the unit, future residents and organisms inhabiting the area. The BRAEDPP identified risk at, or higher than, the 10-4 threshold for the future Par Pond worker, and the future Par Pond resident, as well as potential risk for several components of the ecosystem that were evaluated. Under current use scenarios, risks of 10-6 or higher were calculated for the Par Pond worker, but not the trespasser. The available data indicated that ecological components may also be at risk by occupying the exposed sediments. Additionally, data collected by the Savannah River Ecology Laboratory (SREL) after completion of the BRAEDPP indicated that Cs-137 uptake by from soil to plants is higher than assumed in the BRAEDPP, thereby potentially increasing the risk from the exposed sediments. Because there are no current residents at Par Pond, that scenario was not evaluated.

Thus, the two documents are not in conflict. Both documents conclude that there is no unacceptable risk to offsite individuals, while risks to individuals and organisms directly encountering the exposed sediment unit at Par Pond are above the threshold criteria.

"2. The cost data in the report is incorrect. Westinghouse never got to discuss the cost data although I raised several questions about the validity of the information. It was as if Mr. Crane
and Westinghouse did not want to discuss this information. However I find it suspicious that

after
the meeting adjourned and we were no longer on record, that Mr. Clark and his assistant came up to me and started a conversation. I asked him if he thought that the $5.5 million life cycle cost was
correct, because when multiply 30 years by $360,000 a year your result is $10.8 million. Mr. Crane stated, off the record, that there must be a mistake and that Westinghouse should have added
5 percent each year. Once again why did he have this discussion with me off the record. I suggest
to you that the public is not being told the true cost of the project and EPA and SCDHEC are condoning these inaccuracies by not ensuring that the information in the IAPP is correct. I also
find fault with the estimate because there is no escalation for inflation."

Response:

Please see the general response to the cost estimate. There was no mistake in the calculated present work cost.

"3. It is the responsibility of EPA to make sure that there is a significant risk to the public first
and the animals last before you require DOE to spend money that is needed elsewhere. We have such a significant risk at the Site, the deterioration of plutonium storage containers, and it will
endanger the lives of the workers as well as the ecology. (See Appendix C) Let's put the money where it is most needed especially since Secretary O'Leary is talking about cutting billions from the
budget for environmental remediation. Please act responsibly and say no to the pond so that this
money can be used to protect 20,000 human lives at the site."

Response:

Please see response to comments #3, 4, 5, 6 (TRIM comments) on pages 8-10 of the Responsiveness Summary.

"I believe the three reasons given above are sufficient to choose alternative one or have another
public meeting and present the true facts. Although I believe the second alternative is a waste of
the taxpayers dollars. Further, I believe that Alternative I meets all the criteria stated in the IAPP
page II-2.

Another matter that I wish to bring to your attention is that Mr. Crane assured me that there would
be a public meeting on SRS's Groundwater treatment plans, although the announcement (See Appendix D) says that a meeting will be held only if the public requires it, because I requested one.
I have not seen this plan yet but will request a copy of it for my review. Mr. Rash from SCDHEC

also gave me the assurance that a public meeting will be held. Please let me know by December 27th when you plan on scheduling this meeting. Look forward to hearing from you and Mr. Crane."

Response:

Comment noted. Alternative 1 does not meet the required criteria (9 criteria). This is stated in sections IV.C and IV.D of the IAPP.

Letter from Mr. F. Ward Whicker to the EPA

"RE: Interim Action Proposal Plan for the
Par Pond Unit (WSRC-RP-92-1170)

I wish to register public comments on the Interim Action Proposed Plan for the Par Pond Unit:

1. I strongly support preferred Alternative 2, refilling and maintaining Par Pond to the original
200 ft. level.

2. I support Alternative 2 because it is:

    a. The least costly alternative.
    b. The most environmentally-sound alternative.
    c. The most timely action to reduce human health risks.
    d. Very feasible since the dam has already been repaired

3. I support the pumping of Savannah River Water to fill and maintain the level of Par Pond.

4. I support pumping of Savannah River Water to fill and maintain Par Pond because:

    a. It will restore lost nutrients which will reduce the biological mobility of the main contaminant, 137Cs.

    b. The nutrients are crucial to the full biological recovery of the ecosystem.

    c. The pumping will be required to prevent fluctuating water levels that would periodically expose large areas of contaminated sediments.

    d. Fluctuating water levels have been shown elsewhere to enhance the methylation rate of mercury, leading to higher uptake in fish and waterflow.

    e. Periodic pumping will have similarly positive ecological benefits and reduce contaminant mobility in other portions of the water distribution system. Examples are Pond 2, Pond 5, Pond C, and the Canal itself. Furthermore, the maintenance of the water distribution system is crucial to the maintenance of L Lake, a large reservoir that is also of immense ecological value.

    f. While the costs of pumping and maintenance are significant, the ultimate costs of not pumping are likely to be far greater because of regulatory requirements for site characterization, human health and ecological risk

assessments, and likely remedial actions that would ultimately be necessary under current risk guidelines.

I respectfully request that these comments be duly registered and considered in your deliberations."

Response:

The comments presented in the letter have been noted and supports the preferred alternative. SRS concurs that at this time, alternative 2 is the most cost effective and protective alternative.

Letter from Mr. S. Booher to A. B. Gould, DOE

"Subject: Public Comment on the IAPP

Dear Mr. Gould,

Having read your IAPP. I have no personal objection to your Alternative 2.

However, no where in the IAPP did I see you address the subject of On Going Studies at the Savannah River Ecology Lab.

REQUEST: I request that you investigate the current studies being conducted of Par Pond to insure that there at NO studies on going that would be negatively impacted by Alternative 2. A statement to this effect needs to be added to your Proposed Plan.

If you find there are studies then this needs to be a part of the decision making process.

If you find there are studies then this needs to be a part of the decision making process.

You may wish to delay your Alternative 2 until these studies are completed."

Response:

Comments in the letter have been noted. Although the research that has been and is being performed on the sediments is valuable in it's own right; the research being performed on the exposed sediments is out of the scope of this interim action, unless it directly effects the CERCLA action. Any studies being performed on the sediments are temporary in duration; i.e. as long as the pond level is down the studies can continue. However, most of the studies can continue after the pond is refilled. Few require the lower water level. The temporary nature of the drawdown has been known since it was initiated. Many of the current research programs were initiated as a result of the drawdown, while others are continuations of work begun before the drawdown. Refilling the reservoir will create other research opportunities.

Letter from Mr. E. F. Girardeau to the EPA

"SRS Remedial Project Manager
U.S. EPA, Region IV
345 Courtland St.
Atlanta, GA 30365

Dear Sr.,

I attended the meeting last night, December 14, 1994, concerning the PAR Pond Interim Action Proposed Plan. Following are my comments.

I felt that the material concerning the situation was well presented and questions of importance answered satisfactorily. From a personal opinion standpoint, I feel that the water should be returned to the 200 ft. level. By doing so 1340 acres of sediment would be covered and eliminate the potential problems that could come from the huge amount of sediment - problems to humans as well as wildlife. Why leave something exposed that may or may not be safe? Let's go the safe way be covering it with water since other methods are too expensive.

My interest is because I am an owner of a hunting club approximately ten (10) miles from PAR Pond. We primarily hunt ducks which we have suspected roost at PAR Pond. This was confirmed last night by Dr. Brisbin (Savannah River Ecology Lab) who described PAR Pond as holding more diving ducks than (Lake Murray, Santee, etc.) any holding area in the state of South Carolina. He stated that the numbers have been cut considerable since the pond was brought down in 1991. During this period the ducks that we have had have been reduced more than half. This, of course, is our concern. It was refreshing to hear from Dr. Brisbin that the ducks are safe to eat since this is a concern of our hunters.

The only suggestion that I have to improve your meetings is to put a limit on how long one person can address the group. Last night one person read meaningless numbers from a previous report that was not available to the rest of us and it was evident to me that the purpose for his being there was to bash EPA.

Then the lonely little man from Augusta, a professional "letter to the editor" type, talked for 15 or 20 minutes with a goal to protect the people of Savannah when in reality he needed to be heard for his own ego. These types hold down participation of the general public.

I appreciate having the facts furnished at this meeting and hope that the action taken will be to bring the water level back to a full 200 foot level.

Edward f. Girardeau"

Response:

The comments in the letter have been noted and support the preferred alternative.

Letter from Mr. Todd V. Crawford to the EPA

"SRS Remedial Project Manager
U.S. EPA, Region IV
345 Courtland Street
Atlanta, GA 30365

Ref: Interim Action Proposed Plan for PAR Pond

Dear Sirs:

I believe that the action to be selected should be between the two suggested alternatives (SRS Environmental Bulletin, Vol. 5, No. 26, December 1, 1994). Refilling PAR Pond to its original level of 200 feet above sea level and maintaining it there at a annual cost of about $360,000 for river water pumping can not be justified by public risk reduction. Leaving it at 181 feet above sea level can not be justified either as that would require the continual operation of systems to move water from PAR Pond into Lower Three Runs Creek During heavy periods of rain that could also cause movement of Cs-137 contaminated sediments in Lower Three Runs Creek due to large discharges of PAR Pond water into the creek to maintain the 181 feet elevation.

Instead, l believe that allowing PAR Pond's elevation to fluctuate between 181 and 200 feet with the weather is the better choice. I understand that the equilibrium level has not been clearly defined yet but the best estimates place it in the 190 to 195 feet range. This would minimize costs (although some cost would still be incurred to maintain a minimum flow in Lower Three Runs Creek). In this respect, PAR Pond would then be managed like Pond B (which also contains contaminated sediments) has been since the 1960's. A nearly constant minimum flow in Lower Three Runs Creek below the PAR Pond dam would also minimize movement of contaminated sediments in the creek and adjacent shore areas which would then be covered by vegetation. The Lower Three Runs Creek corridor is more accessible to the public than is PAR Pond. I believe that PAR Pond and Lower Three Runs Creek need to be considered as a system when minimizing possible public impacts and costs.

I look forward to receiving your response to this suggestion.

Todd V. Crawford"

Response:

The comments in the letter have been noted. Please see the general response on page 1 of the Responsiveness Summary.

Letter from I.E. Coward II to the EPA

"Mr. I. E. Coward II
Aiken, SC 29801

Gentlemen,

Par Pond at the SRS is one of the best ecological areas in the southeast for Wildlife native to the region. I highly support the refilling to its original level in order to cover and shield any
exposed contaminants. Every effort should be made to decrease the short term risk to public health and the environment.

Yours Truly,

Ira E. Coward"

Response:

The comments in the letter have been noted and support the preferred alternative.

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 03/06/1995
Operable Unit: 27
ROD ID: EPA/ROD/R04-95/218

Media: soil

Contaminant: Metals, VOCs, SVOCs, dioxins

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The Savannah River site (SRS) occupies approximately 310 square miles adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina. The site is a secured facility with no permanent residents and is located approximately 25 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina. It is owned by the U.S. Department of Energy (DOE). Westinghouse Savannah River Company (WSRC) provides management and operating services for DOE. The site has historically produced tritium, plutonium, and other special nuclear material for national defense. It has also provided nuclear material for the space program, and for medical, industrial, and research efforts.

This ROD addresses the D-Area Oil Seepage Basin, located in the southwest portion of the site. Construction of the basin began in 1952. The basin is located on the Ellenton Plain, the highest of three terraces between the Savannah River to the west and the Aiken Plateau to the east. Employee interviews indicated the basin was used

in the disposal of waste oil originating from D-Area Powerhouse operations, to dispose of nonburnable waste (drums, paint cans, metal objects, and rubber products), and for the routine burning of office and cafeteria waste. Unknown amounts and types of waste were disposed of into the basin. No historical evidence of overflow of the basin exists. Records of the contents of the disposed drums do not exist. To date, there is no evidence to indicate the presence of radionuclides in the drums. Employee interviews have indicated that no radionuclides were disposed of within the trenches. In 1975, the basin was removed from service and backfilled with soil. Approximately one foot of standing liquid, plus an unknown number of 55-gallon drums possibly containing waste oil, remained in the basin when it was backfilled. The basin remains inactive and is covered with natural vegetation, including bushes and grasses, and is surrounded by trees.

On December 21, 1989, the site was placed on the NPL. DOE has negotiated a Federal Facility Agreement with the EPA and the South Carolina Department of Health and Environmental Control (SCDHEC) to coordinate cleanup activities at the site. In November 1988, as part of a Remedial Investigation/Feasibility Study (RI/FS), three boreholes were drilled through the basin fill to the water table. The primary contaminants detected in the soils were metals, volatile organic compounds, semi-volatile organic compounds, and low levels of dioxins. In September 1993, another sampling event was conducted at the basin to confirm the presence or absence of harmful levels of dioxins and furans underneath the basin bottoms. Fifteen soil borings were conducted during this sampling event.

For the purposes of this interim action, the D-Area Oil Seepage Basin operable unit will result in the removal of suspected drum contents and large debris within the waste unit. It also will allow for further characterization of the entire waste unit.

Remedy: The selected remedy for the D-Area Oil Seepage Basin includes the removal and management of buried drum contents, pumpable free product, and discernible layers of sludge present within the basin, and replacement of excavated soils. Large removable debris would be excavated, characterized, and dispositioned through the Treatment, Storage, and Disposal Facility (TSDF) at the site.

Text: Full-text ROD document follows on next page.

Text:

United States Department of Energy

Savannah River Site

Interim Action Record of Decision
Remedial Alternative Selection (U)

D-Area Oil Seepage Basin

WSRC-RP-93-1550
Revision 1
January 16, 1995

Westinghouse Savannah River Company
Savannah River Site
Aiken, South Carolina 29808

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY UNDER CONTRACT DE-AC09-89-SR18035

INTERIM ACTION RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

D-Area Oil Seepage Basin

Savannah River Site
Aiken County, South Carolina

Prepared by:

U.S. Department of Energy
Savannah River Operations Office
Aiken, South Carolina

DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

D-Area Oil Seepage Basin RCRA/CERCLA Unit
Savannah River Site
Aiken County, South Carolina

Appendix C of the Federal Facility Agreement (FFA) lists this Resource Conservation and Recovery Act (RCRA)/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit as the D-Area Oil Seepage Basin (Building Number 631-G).

Statement of Basis and Purpose

This document presents the selected interim remedial action for the D-Area Oil Seepage Basin at the Savannah River Site (SRS), which was developed in accordance with CERCLA of 1980, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this specific RCRA/CERCLA unit.

Assessment of the Unit

The D-Area Oil Seepage Basin unit is located in the southwest portion of SRS. The basin was used for the disposal of waste oil originating from D-Area operations, to dispose of nonburnable waste (drums, paint cans, metal objects, and rubber products), and for the routine burning of office and cafeteria waste. Unknown amounts and types of waste were disposed into the basin.

A unit screening program was completed at the D-Area Oil Seepage Basin in November 1988. In addition, a limited scope sampling event was conducted at the waste unit in 1993. Data collected during both activities indicate the presence of hazardous substances in soils and groundwater at the unit. Accordingly, a RCRA Facility Investigation (RFI)/CERCLA Remedial Investigation (RI) Assessment Program is underway at the unit. In addition to the contaminated soils and groundwater, there are hazardous substances associated with buried drums within the unit. The

principal threat source material includes subsurface hazardous liquids including drum contents, pumpable free product, and discernible layers of sludges. If not removed, these substances pose a threat of continued hazardous material release to basin soils resulting in potential further impact to groundwater.

Description of the Selected Remedy

The preferred interim action alternative is Alternative 2, which consists of removal and management of buried drum contents, pumpable free product, and discernible layers of sludge present within the basin, and replacement of excavated soils. Large removable debris would be excavated and dispositioned through the Treatment, Storage, and Disposal Facility (TSDF) operated by the SRS Solid Waste and Environmental Restoration (SW&ER) Division. All hazardous wastes generated during the interim action will be dispositioned through an SRS facility that complies with the Off-Site Rule (58 FR 49200).

Declaration Statement

This interim action is protective of human health and the environment, complies with Federal and South Carolina applicable or relevant and appropriate requirements (ARARs) directly associated

with this limited scope action, and is cost-effective. The interim action involves no treatment of affected soils or groundwater. However, disposition of the buried waste material and debris excavated as part of the interim action, which may involve treatment, would be managed through the SRS TSDF operated by SW&ER following approved methods and procedures. All applicable Federal and state regulations will be followed. Since this action does not constitute the final remedy for the D-Area Oil Seepage Basin waste unit, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, although partially addressed in this remedy, will be addressed by the final response action. Subsequent

actions are planned to address fully the threats posed by the conditions at this unit. Since this is an Interim Action Record of Decision, review of this unit and of this remedy will be ongoing through implementation of the RFI/RI required in accordance with the terms of the FFA as the U.S. Department of Energy, the U.S. Environmental Protection Agency, and the South Carolina Department of Health and Environmental Control continue to develop final remedial alternatives for the D-Area Oil Seepage Basin.

Date	Thomas F. Heenan Assistant Manager for Environmental Restoration & Solid Waste U.S. Department of Energy Savannah River Operations Office
Date	John H. Hankinson, Jr. Regional Administrator U.S. Environmental Protection Agency Region IV
Date	R. Lewis Shaw Deputy Commissioner Environmental Quality Control South Carolina Department of Health and Environmental Control

WSRC-RP-93-1550, REV. 1

JANUARY 16, 1995

DECISION SUMMARY
INTERIM ACTION
REMEDIAL ALTERNATIVE SELECTION (U)

D-Area Oil Seepage Basin

Savannah River Site
Aiken Connty, South Carolina

Prepared by:

U.S. Department of Energy
Savannah River Operations Office
Aiken, South Carolina

WSRC-RP-93-1550, REV. 1

JANUARY 16, 1995

INTERIM ACTION RECORD OF DECISION
D-AREA OIL SEEPAGE BASIN

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INTERIM ACTION RECORD OF DECISION
D-AREA OIL SEEPAGE BASIN

I. Site and Operable Unit Name, Location, and Description

The Savannah River Site (SRS) occupies approximately 310 square miles adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina (Figure 1). SRS is a secured facility with no permanent residents. The Site is approximately 25 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina. According to 1990 census data, the average population densities (in people/square mile) for the surrounding South Carolina counties are 111 for Aiken County, 36 for Barnwell County, and 28 for Allendale County, and for the surrounding Georgia counties are 228 for Columbia County, 524 for Richmond County, 25 for Burke County, and 21 for Screven

that would result in the removal of suspected drum contents and large debris within the waste unit. This operable unit or discrete action will allow for further characterization of the entire waste unit.

The D-Area Oil Seepage Basin is located at an elevation of approximately 150 feet above mean sea level (Figure 2). Physiographically, the basin is lcrated on the Ellenton Plain, the highest of three terraces between the Savannah River to the west and the Aiken Plateau to the east (Huber, Johnson, and Bledsoe, 1987).

The closest surface water feature is a Carolina bay, a natural wetland, located approximately 175 feet west of the unit. The Carolina bay

County. The population within a 50-mile radius of SRS is 635,000 people.

SRS is owned by the U.S. Department of Energy(DOE). Westinghouse Savannah River Company (WSRC) provides management and operating services for DOE. SRS has historically produced tritium, plutonium, and other special nuclear maLerials for national defense. The Site has also provided nuclear materials for the space program, and for medical, industrial, and research efforts.

Chemical and radioactive wastes are byproducts of nuclear material production processes. Hazardous substances, as defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), are currently present in the environment at SRS. Appendix C of the Federal Facility Agreement (FFA, 1993) lists the D-Area Oil Seepage Basin waste unit (Building 631-G) as a Resource Conservation and Recovery Act (RCRA)/CERCLA unit.

The D-Area Oil Seepage Basin waste unit is located in the southwest portion of SRS between unimproved dirt Roads A-4.4 and A-4.5, approximately one mile north of the coal-fired D-Area Powerhouse (Figures 1 and 2) and approximately 1.9 miles from the nearest

appears to be dry during the summer months or periods of little or no precipitation, but may contain surface water during wet seasons. The major surface water drainage system is the Savannah River and associated swamps, located approximately 1.3 miles to the west of the basin (Figure 1). Upper Three Runs Creek is located 1.7 miles to the north-northwest; Fourmile Branch is 1.7 miles to the south-southeast.

II. Operable Unit History and Compliance History

Operable Unit History

Construction of the D-Area Oil Seepage Basin trenches began in 1952. Employee interviews indicated the basin was used in the disposal of waste oil originating from D-Area Powerhouse operations (Huber et al., 1987; Plunkett, 1993), to dispose of nonbumable waste (drums, paint cans, metal objects, and rubber products), and for the routine burning of office and cafeteria waste. Unknown amounts and types of waste were disposed into the basin. No historical evidence of overflow of the basin exists. Records of the contents of the disposed drums do not exist. To date, there is no evidence to indicate

the presence of
SRS boundary. For purposes of this interim radionuclides in the drums. Furthermore,
action, the D-Area Oil Seepage Basin operable employee interviews have indicated that no
unit is defined as the proposed remedial action
radionuclides were disposed within the
trenches (Plunkerr, 1993).

<IMG SRC 0495218>

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INTERIM ACTION RECORD OF DECISION
D-AREA OIL SEEPAGE BASIN

<IMG SRC 0495218A>

WSRC-RP-93-1550, REV. 1
JANUARY 16, 1995

INTERIM ACTION RECORD OF DECISION
D-AREA OIL SEEPAGE BASIN

In 1975; the D-Area Oil Seepage Basin was A unit screening program was completed at the
removed from service and backfilled with soil D-Area Oil Seepage Basin in November 1988
(WSRC, 1990). Approximately one foot of (WSRC, 1990). In addition, a limited scope
standing liquid, plus an unknown number of sampling event was conducted at the waste unit
55-gallon drums possibly containing waste oil, in 1993. Data collected indicate the presence of

remained in the basin when it was backfilled. The basin remains inactive and is covered with natural vegetation, including bushes and grasses, and is surrounded by trees.

Compliance History

Waste materials are managed at SRS that are regulated under RCRA. Certain SRS activities have required Federal operating or post-closure permits under RCRA. SRS received a hazardous waste permit from the South Carolina Deparment of Health and Environmental Control (SCDHEC) on September 30, 1987. On December 21, 1989, SRS was placed on the National Priorities List (NPL). A site placed on the NPL comes under the jurisdiction of CERCLA. In accordance with Section 120 of CERCLA, DOE has negotiated a Federal Facility Agreement (FFA, 1993) with the U.S. Environmental Protection Agency (EPA) and SCDHEC to coordinate cleanup activities at SRS into one comprehensive strategy that fulfills RCRA Section 3004(u) and CERCLA assessment, investigation, and response action requirements. The FFA lists the D-Area Oil Seepage Basin as a RCRA/CERCLA unit requiring further evaluation using an investigation/assessment process that integrates and

hazardous substances in soils and groundwater at the unit. Accordingly, an RFI/RI Assessment Program is required at the waste unit. In addition to the contaminated soils and groundwater, there ave hazardous substances associated with buried drums within the unit. If not removed, these buried drums pose a threat of contained hazardous material release to basin soils resulting in potential further impact to groundwater. For remedial purposes, the D-Area Off Seepage Basin (corner boundary coordinates: E23995, N68604; E23886, N68136; E23400, N68732; E23127, N68306; see Figure 2), as bounded by the markers, should be considered the waste unit area. The area to be excavated, shown on Figure 2, represents the location of suspected and specific waste disposal activities.

III. Highlights of Community Participation

Public participation requirements are listed in Sections 113 and 117 of CERCLA. These requirements include the establishment of an Administrative Record File that documents the selection of cleanup alternatives and provides for review and comment by the public of those alternatives. The

SRS public involvement plan
combines the RFI with the CERCLA Remedial (DOE, 1994) is designed to facilitate public
Investigation (RI) to determine the actual or involvement in the decision making processes
potential impact to human health and/or the for permitting, closure, and the selection of
environment. This action is being carried out remedial alternatives. The PIP addresses the
in accordance with the requirements of the FFA requirements of RCRA, CERCLA, and the
and the state and Federal RCRA permits. National Environmental Policy Act (NEPA).
Section 117(a) of CERCLA, 1980, as
The D-Area Oil Seepage Basin is listed as a amended, requires the preparation of a
Solid Waste Management Unit (SWMU) under proposed plan as part of the site remedial
both state and Federal RCRA permits. The process. The Interim Action Proposed Plan
provisions of these permits require (IAPP) (WSRC, 1994) for the D-Area Oil
investigation and implementation of corrective Seepage Basin, which is part of the
measures, as necessary, for releases of Administrative Record File, highlights key
hazardous constituents from SWMUs. The aspects of the assessment and investigation
permits also provide for implementation of phases of the remediation process and identifies
interim measures to stabilize SWMU releases. the preferred interim action alternative for

remediation of the D-Area Oil Seepage Basin. on October 11, 1994. Written and oral
comments were aecepted during this meeting.
The Administrative Record File, which Responses to comments are discussed in the
contains the information upon which the Responsiveness Summary (Appendix B).
selection of the response action was made, was

made available at the EPA-Region IV office and at the following locations:

U.S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

Similar information was made available through the following repositories:

Reese Library
Augusta College
2500 Walton Way
Augusta, Georgia 30910
(404) 737-1744

Asa H. Gordon Library
Savannah State College

IV. Scope and Role of Operable Unit within the Site Strategy

This interim action addresses only the remediation of the source material within the D-Area Oil Seepage Basin waste unit. The discrete action constitutes the first part of the proposed strategy which would address the principal threats posed by the waste unit. The overall strategy of remediating the D-Area Oil Seepage Basin waste unit is to: (1) perform the proposed interim remedial action described herein; (2) further characterize the waste unit delineating the nature and extent of contamination and identifying the media of concern; (3) perform a baseline risk assessment to evaluate media of concern, chemicals of concern, exposure pathways and characterize potential risks; and (4) evaluate and perform a final action to remediate the identified medium(s) of concern. The objectives in developing interim remedial alternatives were to evaluate interim actions that would address the principal threat source material, subsurface hazardous liquids including drum contents, pumpable free product, debris, and discernible layers of sludges. The alternatives would result in buffed drum

content removal, to
Tompkins Road
further releases, and provide a
Savannah, Georgia 31404
environment for future
(912) 356-2183
studies. Providing a drum-free
environment and
removing the large debris will
The public was notified of the comment period
characterization studies to
for the D-Area Oil Seepage Basin through
and safely and allow
mailings of the SRS Environmental Bulletin, a
development of final remedial
newsletter sent to more than 1400 citizens in
Following the performance of this
South Carolina and Georgia, and through
further characterization, and a
notices in the Aiken Standard, the Allendale
final action(s) will be
Citizen Leader, the Barnwell County Banner,
addresses residual risk or
the Barnwell People-Sentinel, the North
Additionally, a modification to
Augusta Post, The State, and the Augusta
Solid Waste Act/RCRA
Chronicle newspapers.
accomplished during the final
action for the D-Area
Oil Seepage Basin.
The 30-day public comment period began on
August 15, 1994 for the IAPP for the D-Area
Oil Seepage Basin operable unit. The public
comment period was extended for 30 days until
October 13, 1994. A public meeting was held

prevent potential
drum- and debris-free
unit assessment
allow the RFI/RI
proceed more easily
subsequent
alternatives.
interim action,
risk assessment, a
evaluated which
contamination.
the Hazardous and
permit will be

V. Summary of Operable Unit
Characteristics
geologic information is
1987). No detailed
available for the
area surrounding the basin.

Based on employee interviews, the D-Area Oil Seepage Basin was constructed as at least three separate unlined trenches, each divided by berms. Approximate basin boundaries (Figure 2) were determined by ground-penetrating radar (GPR) in 1988 and 1992 and magnetometer surveys in 1993. The three suspected disposal trenches have total approximate dimensions of 383 feet long, 108 feet wide, and 8 feet deep. Two additional areas of disturbed soil were identified by GPR and magnetometer measurements. The westernmost disturbed soils area has approximate dimensions of 100 feet long by 50 feet wide. The easternmost disturbed soils area is approximately 75 feet long by 65 feet wide (Figure 2).

Numerous buried drums and other material were detected in the basin through GPR and magnetometer studies. The drums have been buried at least 17 years; therefore, their condition is questionable. Visual inspection of the drums has not been attempted. It is assumed that intact drums (if any) may contain free liquids and/or residual sludges. However, until the drums are excavated this cannot be verified.

As a preliminary effort to characterize the geologic and hydrologic conditions and to monitor the water table elevation and groundwater in the vicinity of the basin, three monitoring wells (DOB-1,-2, and-3) were installed in 1983 (WSRC, 1990). A fourth well, DOB-4, was installed in 1984 (Figure 2).

Data collected from the four DOB wells at the D-Area Oft Seepage Basin waste unit show that the water table depth at this location varies from approximately 4 to 20 feet bls, indicating occasional saturated conditions within the basin. Horizontal water table gradients between wells and across the unit vary from 0 to 0.017 ft/ft based upon 1987 and 1988 data (WSRC, 1990). The average horizontal gradient is 0.0033 ft/ft. Potentiometric maps of the water table at the basin indicate that groundwater flow is often to the west-southwest toward the Carolina bay. However, groundwater elevation data from 1984 through 1989 indicate that the water table flow direction changes, and at times, the flow is toward the east-northeast. This does not appear to be a seasonal variation in groundwater flow.

SRS Health Protection Department surveys

The field geologic log associated with soil sampling conducted in 1989 described the occurrence of oil and the following additional materials in soils collected within the basin: ash, fired glass, burned soil, metal strips and tubing, metal wire, electrical cable, asphalt, concrete fragments, and lumber.

The soil types in and adjacent to the D-Area Oil Seepage Basin waste unit have been identified as fluvaquents (frequently flooded), Udorthents, friable substratum, and Blanton sand (WSRC, 1990). According to work conducted by the U.S. Army Corps of Engineers (COE) in 1952, the D-Area Oil Seepage Basin is located on alluvial deposits of Pleistocene age underlain by Tertiary age deposits (McBean and Congaree Formations). The alluvial sands, silts, and clays are approximately 20 to 39 feet thick (Huber et al.,

were performed in 1991 and 1993 at the D-Area Oil Seepage Basin waste unit, and detected no radioactivity above background (WSRC, 1990). Average annual temperature at the SRS is approximately 70øF (WSRC, 1990). Average annual rainfall is approximately 43 inches.

In 1988, as part of an RFI/RI unit screening program conducted at the D-Area Oil Seepage Basin waste unit, three boreholes were drilled through the basin fill to the water table (WSRC, 1990). Debris was encountered during this drilling activity and a drum was punctured. Drilling was halted upon encountering the drum. Liquid from the drum was removed and analyzed. The detected compounds included 1,1-dichloroethylene, trichloroethylene, tetrachloroethylene, 2-methylnaphthalene, fluorene, naphthalene,

phenanthrene, n-nitrosodiphenylamine, 4-

remedial

methyl-2-pentanone, acetone, ethylbenzene, toluene, styrene, xylenes, and methylene chloride (Table 1).

The primary contaminants detected in soils collected from beneath the D-Area Oil Seepage Basin waste unit in 1988 were metals, volatile organic compounds, semi-volatile organic compounds, and low levels of dioxins (WSRC, 1990). Only one soil sample was analyzed for metals. Metals found in concentrations greater than analytical method detection limits were silver, arsenic, barium, chromium, copper, mercury, nickel, lead, antimony, vanadium, and zinc (Table 1).

Several volatile and semi-volatile organic constituents were detected in at least one soil sample during the 1988 screening program (Table 1; WSRC, 1990). Many of these substances are fractional distillation products of crude or coal tar oils and are components in waste oil (e.g., methyl-naphthalene, chrysene, fluoranthene, fluorene, toluene, naphthalene, phenanthrene, pyrene, and xylenes). Bis(2-ethylhexyl)- phthalate was frequently detected in the soil samples at elevated concentrations.

investigations, evaluating potential remedies, and selecting and implementing remedies at RCRA facilities. The corrective action process under RCRA Subpart S would parallel the process established for remedial actions under CERCLA. Under the proposed rules, EPA establishes action levels for certain constituents that may trigger performance of a Corrective Measures Study (CMS). Action levels are media-specific, health- and environmental-based levels determined by EPA as indicators for protection of human health and the environment. Where appropriate, action levels are based on promulgated standards such as maximum contaminant levels (MCLs) for drinking water. Table 2 compares the analytical results of soil samples collected during 1988 from the three soil borings at the unit and the proposed Subpart S action levels, if available. The comparison of constituent concentrations to promulgated and proposed regulatory levels and background concert-trations is provided to give a relative indication of potential chemicals of concern. No constituent detected in unit soils exceeds the proposed action levels. Table 2 also provides a comparison of unit soil metals concentrations with SRS-wide

background levels of metals in

Phthalate species are used as plasticizers for cellulose, glass, plastic, and rubber products. Other substances detected, such as 4-methyl-2-pentanone, acetone, methylene chloride, ethylbenzene, and n-nitrosodiphenylamine, are commonly used as solvents. Styrene, which was detected in the buried drum sample, is generally used in resins or protective coatings. Acetone and methylene chloride were also detected frequently at low to moderate concentrations in the soil samples, but, because these constituents were also detected in quality assurance/quality control samples and are common laboratory contaminants, these detections may be artifacts of the laboratory process.

EPA has proposed corrective action requirements for SWMUs at facilities implementing corrective action under Section 3004(u) of RCRA (55 FR 30798; July 27, 1990). The proposed rules create a new Subpart S in the RCRA Part 264 regulations that would define requirements for conducting

soils. The comparison indicates that antimony, chromium, copper, lead, and nickel exceed the site-wide ranges for those constituents.

Radionuclide indicators (gross alpha, gross beta, total radium, and tritium) were analyzed in two sod samples (WSRC, 1990) and, at a later date, the liquid from the buried drum sample. No radionuclide indicators were detected in the soil or the drum sample.

A limited scope sampling event at the D-Area Oil Seepage Basin waste unit was conducted on September 28-30, 1993. The primary objective of the sampling was to confirm the presence or absence of harmful levels of dioxins and furans underneath the basin bottoms. The data generated was also used to further delineate the horizontal and vertical extent of contamination from the 1988 unit screening. Additionally, the data generated will be used to develop a site-specific health and safety plan which will help protect workers during excavation activities.

Table 1. Analytical results from sampling of three boreholes and a buried drum at the D-Area Oil Seepage Basin waste unit from the 1988 field screening.

Core	DOSB-01			DOSB-02			DOSB-03			
Interval No.	01	02	02S	02	03	04	00	01D	02	03
Depth, ft	11-12'	16-18'	16-18'	6-7'	7-9'	18-20'	Drum(æg/l)	8-10'	16-18'	8-10'
Organics, æg/kg										
2-Methylnaphthalene	ND	ND	ND	ND	2200	ND	73,000	16,000	1200	5900
Chrysene	ND	ND	ND	ND	400	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	70	ND	ND
Fluorene	ND	ND	ND	ND	ND	ND	2300	140	ND	60
Naphthalene	ND	ND	ND	ND	ND	ND	28,000	290	40	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	70	ND	50
Phenanthrene	ND	ND	ND	ND	ND	ND	4800	390	40	150
Bis(2-ethylhexyl)phthalate	59	2	ND	ND	1400	430	ND	13,000	90	2200
n-Nitrosodiphenylamine	ND	ND	ND	ND	ND	ND	3500	420	ND	ND
4-Methyl-2-pentanone	ND	15	ND	ND	ND	ND	4,400,000	ND	ND	ND
Acetone	150	45	ND	43	160	460	1,200,000	480	170	450
Ethylbenzene	ND	ND	ND	ND	ND	ND	570,000	94	ND	120
Toluene	130	32	ND	35	170	110	1,400,000	150	110	140
Styrene	ND	ND	ND	ND	ND	ND	62,000	ND	ND	ND
Xylenes	ND	ND	ND	ND	ND	ND	3,400,000	ND	ND	940
Methylene chloride	160	16	11	45	210	150	1,400,000	150	56	120
Metals, mg/kg										
Silver				0.94			26			

Arsenic	0.72	ND
Barium	54.00	13
Chromium	194.00	49
Copper	122.00	32
Mercury	0.23	0.21
Nickel	17.00	ND
Lead	183.00	6
Antimony	23.00	ND
Vanadium	2.80	ND
Zinc	116.00	33

S An "S" extension to the internal number indicates a split sample
D A "D" extension to the internal number indicates a duplicate sample
ND Not detected (below analytical detection limits)

Table 2. Range of soil concentrations of organic and metal constituents determined from 1988 sampling at the D-Area Oil Seepage Basin waste unit, compared with proposed RCRA soil action levels and SRS soil background levels.

CONSTITUENT	Soil Sample Concentration		EPA	SRS
	Minimum	Maximum	Action Level1	Soil Background Levels2
ORGANICS, mg/kg				
2-Methylnaphthalene	ND	16.00	NA	NA
Chrysene	ND	0.40	NA	NA
Fluoranthene	ND	0.07	NA	NA
Fluorene	ND	0.14	NA	

	Naphthalene	ND	0.29	NA
	Pyrene	ND	0.07	NA
	Phenanthrene	ND	0.39	NA
	Bis(2-ethylhexyl)phthalate	ND	13.00	50
	n-Nitrosodiphenylamine	ND	0.42	100
	4-Methyl-2-pentanone	ND	0.02	NA
	Acetone	ND	0.48	8000
	Ethylbenzene	ND	0.12	8000
	Toluene	ND	0.17	20,000
	Styrene	ND	ND	20,000
	Xylenes	ND	0.94	200,000
	Methylene Chloride	0.01	0.21	90
	METALS, mg/kg			
	Silver	0.94	0.94	200
	Arsenic	0.72	0.72	80
	Barium	54.00	54.00	NA
	Chromium (total)	194.00	194.00	4003
	Copper	122.00	122.00	NA
	Mercury	0.23	0.23	20
	Nickel	17.00	17.00	2000
	Lead	183.00	183.00	5004
	Antimony	23.00	23.00	30
	Vanadium	2.80	2.80	NA
	Zinc	116.00	116.00	NA

NA
NA
NA
NA
NA
NA
NA
NA
NA
NA
NA
0.01 - 1.80
<0.50- 15.20
0.94 - 77.40
1.31 - 105.10
0.36 - 14.12
<0.01 - 0.89
0.11 - 17.90
<1.00 - 16.67
5.53- 15.20
3.61 - 72.11
1.80 - 267.00

1 EPA Proposed Corrective Action Rule for Solid Waste Management Units, 40 CFR 264.521, Appendix A; 55 FR 30798, July 27, 1990.
2 Looney et al., 1990

3 Published action level for chromium (Cr) is for the Cr+6 oxidation state (hexavalent form).
4 EPA, 1989b
NA Not available
ND Not detected (below analytical detection limits)

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Fifteen soil borings were conducted during this sampling event (Figure 3). The borings were strategically located at known disturbed areas and at the interface of basin bottoms and sidewalls. Twelve of these borings collected soil samples from 2-4, 6-8 and 12-14 feet bls. Three borings were hand augered (for safety purposes) directly into the basin bottom and soil samples were collected from 2-4 and 6-8 feet bls. This resulted in a total of 57 discrete samples collected including quality control samples.

The analytical suites selected for this sampling event included radionuclide indicators, dioxin and furan homologues, and the target compound list, target analyte list and library scan for tentatively identified compounds.

The geological field logs indicated that oil stained soils were evident in almost every

including benzene, toluene, ethylbenzene, xylene and naphthalene. The sampling also detected low concentrations of the solvent trichloroethylene and tetrachloroethylene. Analytes with concentrations greater than method detection limits are summarized in Table 3.

Based upon observations in the field and analytical results from the unit screening and additional limited sampling, hazardous substance contamination at the D-Area Oil Seepage Basin waste unit extends from the bottom of the basin at least 18 feet bls. In one borehole, a bailed groundwater sample produced a film of free product floating on the surface.

Monitoring well (DOB-1, -2, -3, and -4) analytical results from 1984 to 1989 indicate trichloroethylene and

vinyl chloride
boring and in some samples to at least 14 feet
bls (the last interval sampled). Ash, burned
soil, wire, cable, rusted metal objects,
concrete, insulation, aluminum foil, plastic
sheeting and cloth were found in the drill
cuttings at a number of locations. Several
shallow borings had to be abandoned and re-
located because buried debris prevented the
hand auger from penetrating basin soils. One
boring, in particular, emitted a strong odor of
anaerobic decomposition indicating the
possibility of natural biodegradation.

The 1993 limited scope sampling detected a
wide variety of organic and inorganic
contaminants in basin soils, primarily in the
sampling intervals of 6-8 feet and 12-14 feet
bls. The predominant organic contaminants
detected in the sampling, pesticides, PCBs and
the congeners dibenzo-p-dioxin and dibenzo-p-
furan, are all characterized by being immobile
and persistent in the environment.

The most toxic compound detected was 2, 3, 7,
8-tetrachlorodibenzo-p-furan which was
present in two of the 57 samples. The most
commonly detected organic contaminant was

groundwater concentrations exceeding Safe Drinking Water Act maximum contaminant levels (MCLs; WSRC, 1990). Iron and manganese groundwater concentrations exceeded the Secondary Drinking Water Standards. Additional groundwater data from 1989 to 1992 indicate the above constituents continue to be detected.

The trenches at D-Area Oil Seepage Basin waste unit, in total are approximately 383 feet long, 108 feet wide, and 8 feet deep. The volume of material within these trenches, based solely on these dimensions, would be approximately 12,300 cubic yards. Based on interviews with site personnel, over 100 drums primarily containing waste oil have been disposed in the basin (WSRC, 1990). The volume of buried debris is assumed to equal 20 percent of the basin volume or 2500 cubic yards, leaving approximately 9800 cubic yards of soil. The westernmost disturbed soil are identified by GPR and magnetometer surveys is approximately 100 feet long by 50 feet wide, and the easternmost area is 75 feet long by 65 feet wide. It is not known whether waste materials are present in these areas, and,

octochloro-dibenzo-p-dioxin which was present in 37 of 57 samples. Also identified were organic substances identified as fractions of oil and oil compounds accordingly, no specific waste volumes are estimated. However, assuming a depth of disturbance similar to the depth of the trenches, the total volume of material within the disturbed

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Table 3. Analytical results from soil sampling at the D-Area Oil Seepage Basin waste unit during 1993.

Analyte, mg/kg	Hits	Mean	Minimum	Maximum	ACTION LEVELS: RCRA Subpart S mg/kg (chronic)	ACTION LEVELS: PRG for Soil mg/kg (systemic)	ACTION LEVELS: PRG for Soil
ORGANICS							
2-Methylnapthalene	6/57	1.10	0.163	1.65			
Benzene	2/57	0.02	0.0119	0.0288	24	22.12	
Benzo(g,h,i)perylene	1/57	0.27	0.273	0.273			
alpha-Chlordane	1/57	0.00263	0.00263	0.00263	0.5		
gamma-Chlordane	1/57	0.00338	0.00338	0.00338	0.5		

Total chlordane	2/114	0.00601	0.003	0.016	0.5	0.49	16.47	
Chloroethene	1/57	0.00373	0.00373	0.00373	0.3684	0.338		
4,4'-DDE	5/57	0.015456	0.00908	0.0256	2	1.89		
4,4'-DDT	4/57	0.008613	0.0014	0.0208	2	1.89	137.22	
Dieldrin	12/57	0.02	0.00531	0.0832	0.04	0.04	13.72	
Heptochlorodibenzo-p-dioxin	13/57	0.002623	0.0001	0.016				
Hexachlorodibenzo-p-dioxin	6/57	0.0059	0.0001	0.019	0.0001	0.000103485		
Octochlorodibenzo-p-dioxin	37/57	0.004197	0.0001	0.03	0.0047 +			
Pentachlorodibenzo-p-dioxin	2/57	0.0039	0.0031	0.0047				
Tetrachlorodibenzo-p-dioxin	2/57	0.001	0.0005	0.0015				
Ethylbenzene	9/57	0.013691	0.00252	0.0415	8000	27,443.61		
2,3,7,8-Tetrachlorodibenzo-p-furan	2/57	0.0002	0.0001	0.0003	0.00005 +			
Heptachlorodibenzo-p-furan	3/57	0.000833	0.0004	0.0013				
Hexachlorodibenzo-p-furan	5/57	0.00036	0.0001	0.0009				
Octochlorodibenzo-p-furan	1/57	0.0004	0.0004	0.0004				
Pentachlorodibenzo-p-furan	3/57	0.000833	0.0004	0.0014				
Tetrachlorodibenzo-p-furan	2/57	0.0005	0.0002	0.0008				
alpha-Hexachlorocyclohexane (lindane)	2/57	0.0095	0.003	0.016	0.1	0.10		
beta-Hexachlorocyclohexane (lindane)	1/57	0.00263	0.00263	0.00263	4	0.36		
Naphthalene	5/57	0.58	0.247	1.79		10,977.44		
Bis(2-ethylhexyl)phthalate	2/57	0.11	0.111	0.113	50	45.83	5,488.72	
n-Butylbenzyl-phthalate	1/57	0.10	0.0998	0.0998		54,887.22		
PCB 1254	2/57	1.13	1.01	1.25				
PCB 1260	4/57	0.86	0.148	1.22				
Total polychlorinated biphenyls	6/114	0.95	0.148	1.25	0.09	0.08		
Tetrachioroethylene	10/57	0.14	0.00416	0.462	10			
Toluene	9/57	0.04	0.00293	0.104	20,000	54,887.22		

Trichloroethylene	6/57	0.08	0.00361	0.356	60			
Xylene, mixture	9/57	0.0493	0.0126	0.12	200,000	548,872.18		

Table 3 (cont'd). Analytical results from soil sampling at the D-Area Oil Seepage Basin waste unit during 1993.

Analyte, mg/kg	Hits	Mean	Minimum	Maximum	ACTION LEVELS: RCRA Subpart S mg/kg (chronic)	PRG for Soil mg/kg (systemic)	PRC for Soil
TOTAL METALS							
Aluminum	57/57	6005.667	489	14,400			
Antimony	1/57	8.4	8.4	8.4	3000	109.77	
Arsenic	15/57	2.137	1.1	5.3	0.4	0.37	82.33
Barium	31/57	166.423	21.3	2380	5600	19,210.53	
Cadmium	2/57	2.6	2.5	2.7	40		
Calcium	5/57	4862	1220	9320			
Chromium	57/57	7.946	1.2	45.4	400 *	1,372.18	
Cobalt	3/57	16.933	10.2	26			
Copper	35/57	45.943	2.7	617	2960	10,154.14	
Iron	57/57	6870.68	142	140000			
Lead	57/57	11.628	0.35	210	500		
Magnesium	4/57	3842.5	1150	7650			
Manganese	55/57	64.92	2.7	1710			
Mercury	46/57	0.066	0.023	0.318			

24 82.33

Nickel 6/57 34.15 5.2 62.2
1600 5,488.72

Silver 1/57 2.2 2.2 2.2
400 1,372.18

Vanadium 27/57 16.385 5.4 55.4
560 1,921.05

Zinc 56/57 70.507 2.5 1530
24,000 82,330.83

* Chromium (VI)

Looney ì
Unit-Specific Background
SOIL BACKGROUND
Analyte, mg/kg Mean Minimum Maximum
Mean Minimum Maximum
TOTAL METALS

Aluminum 11,697.41 715.00 53,530.00
10,110.00 4,440.00 13,700.00

Antimony <10.6 5.53 15.20

Arsenic <2.0 <0.50 15.20

Barium 16.43 0.94 77.40
24.00 24.00 24.00

Cadmium <.60 0.12 1.19

Calcium

Chromium 16.41 1.31 105.10
13.35 4.10 17.90

Cobalt <1.50 0.46 5.27

Copper 3.94 0.36 14.12
5.87 5.30 6.30

Iron 13,341.32 885.90 79,600.00
14,587.50 2,950.00 22,500.00

Lead 5.14 <1.0 16.67
2.40 1.40 3.20

Magnesium 133.76 12.87 759.40

Manganese 27.71 <1.6 498.20
16.60 7.40 26.40

Mercury <.1 <0.01 0.89
0.05 0.04 0.06

Nickel 4.12 0.11 17.90

Silver <1.00 0.01 1.80

Vanadium 27.80 3.61 72.11
33.40 6.20 48.30

Zinc 12.39 1.80 267.00
6.13 4.50 7.70

Table 3 (cont'd). Analytical results from soil sampling at the D-Area Oil Seepage Basin waste unit during 1993.

D-Area Oil Seepage Basin Samples				Looney ì			
RADIOACTIVE SCREENING							
Analyte, PCG	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean
Radiation Indicators							
Gross alpha	5.25	<4.0	20.00	8.33	1.40	35.90	
Non-volatile beta	7.78	<5.0	23.00	10.71	3.10	40.70	
Tritium	NA	NA	NA	21.68	2.83	42.70	

All action levels were calculated based upon the recommended exposure assumptions and formulas (listed below) in Subpart S, Federal Register, Vol. 55, No. 145, Appendix D, July 27, 1990.

\+ Calculated values utilizing EPA, 1989a

ì Looney et al., 1990

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areas would amount to approximately 3000 cubic yards. Therefore, the total volume to be excavated in the interim remedial action would amount to 15,300 cubic yards.

obtained during characterization activities to background levels, health-based action levels, and promulgated standards. COCs are also developed in

conjunction with the remediation unit. Since soil and characterization is not part of this interim action, and PRGs have not been developed, there are no COCs for this operable unit. PRGs and COCs will be developed and defined during the RI/FS.

The threat source materials being acted upon during this interim action includes the waste oils in the drums, free product and sludges found in the trenches, and the removable debris. See Section VII for a detailed discussion regarding the quantity and types of waste expected to be removed. Types of contamination that may be encountered in the source material include PCBs, dioxins, volatile and semi-volatile organic compounds, and polynuclear aromatic hydrocarbons (PAHs).

No radionuclide contamination is expected. This information is based on previous sampling activities. However, potential COCs for the soils, which are not addressed by this interim action, can be preliminarily identified based on comparison of detected contaminants to promulgated or proposed regulatory levels for constituents in the environment or to SRS-wide background levels (TabIes 2 and 3). However,

VI. Summary of Operable Unit Risks

As required by CERCLA, a risk assessment will be conducted based on characterization data obtained during the RFI/RI unit assessment following the interim action. This risk assessment will provide the risk analysis necessary to determine if additional remediation is warranted to protect human health and the environment. Development of future remedial actions will be contingent upon further characterization of the D-Area Oil Seepage Basin waste unit, delineation of the nature and extent of soil and groundwater contamination, analysis of associated risks, and the RCRA corrective action requirements.

Source Material of Concern. The D-Area Oil Seepage Basin operable unit, as defined herein, addresses as the source material of concern drum contents and large debris, pumpable free product or discernible layer of sludge, solid waste, and other principal threat source material. Groundwater and contaminated soil layers encountered during the interim action are beyond the scope of this interim action and will

be addressed during the RI/FS process. The RI will further define the nature and extent of contamination and the media of concern in the waste unit. The future risk assessment will address risk associated with exposure pathways for each contaminated medium. It is not anticipated that airborne contamination or radioactive contamination will be a concern during the interim action.

Potential Chemicals of Concern. For the purposes of this operable unit, there are no potential chemicals of concern (COCs). Since the soils and groundwater are not addressed under this operable unit, there are no potential COCs for this action. Although there is contamination in the soil and groundwater at the D-Area Oil Seepage Basin, COCs will not be defined for these media during this action. COCs are defined for each environmental media by comparison of contaminant levels RFI/RI assessment process, the risk no conclusions concerning potential COCs can be made prior to performance of the risk assessment, which would take into account multiple contaminants and multiple exposure pathways and will be performed during the RI/FS.

Baseline Exposure Scenarios. The proposed interim remedial action would result in removal of principal threat source material. As a discrete action, the removal of drum contents would lessen the risk to both human health and the environment as leaching of drum contents to soils and/or groundwater would be reduced. Workers conducting the proposed interim action would be required to adhere to an approved Health and Safety Plan. Human exposure to waste materials in a disposal facility can occur only as a result of direct contact and transport via surface, subsurface, or atmospheric pathways. As part of the activities. Drums,

debris, and contaminated
assessment will develop and evaluate exposure soils would be left
in place at the unit.
scenarios. Potential continued
impact of soils and/or
groundwater could
occur under this alternative
Ecological Risks. The proposed interim action and the continued
presence of drums in the
will alleviate some risk from further basin will interfere
with planned assessment
environmental impact through removal of drum activities.
contents. Drum contents may pose the most
significant risk to the environment Removal Treatment Components.
No treatment would
of drum contents would reduce potential be implemented under
Alternative 1.
leaching of contaminants to surrounding
environs. Identified baseline pathways which Engineering Controls.
No engineering controls
could potentially impact the environment will would be executed
under this alternative.
be evaluated during the RCRA/CERCLA
process, following implementation of the Institutional
Controls. Access to SRS is
proposed interim action. controlled at primary
roads by continuously
manned barricades.
Other roads entering the
VII. Description of Alternatives site are closed to
traffic by gates or barriers.
The entire SRS
facility is surrounded by an
Interim action alternatives were developed for exclusion security
fence, except along the
the D-Area Oil Seepage Basin that would result Savannah River. The
SRS is posted against
in controlling impact to soils and/or trespassing under
Federal and state statutes.
groundwater at the unit. The alternatives Road A-4.4 provides
access to the D-Area Oil
presented in this IROD include: Seepage Basin and is
currently not access
controlled to onsite
workers. Access to D Area
Alternative 1 is, however,
restricted from the general public.
No Interim Action No additional/new
controls will be instituted.

Alternative 2 Quantity of Waste.
The D-Area Oil Seepage
Buried Drum Content Removal with Soil Basin is
approximately 383 feet long, 108 feet

Replacement and Limited Debris Removal
and Disposition

The interim action altematives are described
separately below. As required under
CERCLA, the no action alternative, Altemative
1, is included in the evaluation as a baseline for
comparison.

As mandated under the FFA, a full scale
RFI/RI and CMS/CERCLA Feasibility Study
(FS) will be conducted at the unit in the future.
Final remedial alternatives will be developed as
part of those activities.

The RFI/RI will begin in the fall of 1995 and a
final remedial action selection will be made in
approximately late 1998.

Alternative 1 - No Interim Action

Alternative 1 would include no interim removal
remain in place until a final

deep. The volume of material
trenches, based solely on these
approximately 12,300
on interviews with site
drums primarily
have been disposed in the
The volume of buried
equal 20 percent of the
cubic yards. The
be excavated of disturbed
GPR and magnetometer
approximately 100 feet long by 50
long by 65 feet wide. It
waste materials are
areas and, accordingly, no
volumes are estimated.
depth of disturbance
of the trenches, the total
within the disturbed area
approximately 3000 cubic
yards. Under
and drums would

wide, and 8 feet
within these
dimensions, would be
cubic yards. Based
personnel, over 100
containing waste oil
basin (WSRC, 1990).
debris is assumed to
basin volume or 2500
additional areas to
soil identified by
surveys is
feet wide and 75 feet
is not known whether
present in these
specific waste
However, assuming a
similar to the depth
volume of material
would amount to

remedy is mevaluated.

Implementation Requirements. This alternative is readily implementable.

Estimated Construction and Operation and Maintenance Costs. No costs are associated with implementation of this alternative.

ARARs Associated with the Considered Alternative. Applicable or Relevant and Appropriate Requirements (ARARs) ate Federal and state environmental regulations that establish standards that remedial actions must meet. There are three types of ARARs: (1) chemical-specific, (2) location-specific, and (3) action-specific. The three types of ARARs are described in detail in Section III.E. This section sets forth major ARARs associated with the remedial alternative.

No location-, action-, or chemical-specific ARARs are associated with Alternative 1.

The only potential chemical-specific ARAR for non-radioactive constituents in soils under Federal and South Carolina regulations was for PCBs. ARARs for PCBs are governed by the

process. The objective of

be to provide a drum-free

would allow subsequent

complete physical and

characterization of the D-Area Oil

overall process under

include uncovering of

waste unit and

contents to new drums

on-SRS TSDF operated

Additionally, pumpable free

discernible layers of sludge, solid

principal threat source material,

groundwater or contaminated soil

during the interim remedial

pumped or placed into new

and managed by the TSDF

The interim action will

appropriate regulations.

the purpose of this interim

drums, cans and other

will be termed as

containers are defined as

Full Containers

- Excavated containers

content removal

Alternative 2 would

waste unit which

investigations and

chemical

Seepage Basin. The

Alternative 2 would

buried drums from the

transferring the drum

for management by the

by SW&ER.

product or

waste, or other

not including

layers, encountered

action would be

drums at the surface

operated by SW&ER.

adhere to all

Specifically, and for

removal action,

excavated containers

containers. These

follows:

1. Partially Full or

a. Intact Containers

Toxic Substances Control Act (15USC 2601-2671). For non-restricted access areas (e.g., residential), the PCB cleanup standard is 10 mg/kg by weight, provided that the soil is excavated to a minimum depth of 10 inches and that the excavated soil is replaced with clean sod (i.e., soil containing less than 1 mg/kg PCBs). However, since no PCB congeners or total PCBs in excess of 10 mg/kg were detected in soils and soil remediation is not part of this operable unit, this ARAR does not apply to the interim action for this unit.

Also, since no soil or groundwater treatment is being proposed, MCLs as an ARAR, and RCRA Subpart S as a "to-be-considered" factor, do not apply.

Alternative 2 - Buried Drum Content Removal with Soil Replacement and Limited Debris Removal and Disposition

Alternative 2 would involve an integrated sampling, analytical characterization, and drum

that are unbroken and still retain at least 75% of their original holding capacity shall be considered intact containers. Contents shall be transferred into new drums by practices commonly utilized for waste removal. Not more than 2.5 centimeters of waste (non-acutely hazardous) shall remain in the bottom of any intact container to be considered an empty container.

b. Crushed/Degraded Containers - Excavated containers that are crumpled or crushed more than 25% and not easily emptied by practices commonly utilized to remove waste would be considered debris. Contents would be transferred into new drums by practices commonly utilized for waste removal.

2. Empty Containers (per 40 CFR 261.7 and South Carolina Hazardous Waste Management Regulations R.61-79.261.7.b)

a. Intact Containers - Excavated containers that are unbroken and that could still retain at least 75% of their original holding

capacity, and having not more than 2.5 centimeters of waste (non-acutely hazardous) remaining in the bottom shall be considered empty containers. Empty containers are not subject to regulation and can be land disposed.

b. Damaged/Degraded Containers - Excavated containers that would not satisfy intact container criteria, or are crumpled or crushed more than 25% would be considered debris.

3. Container Fragments would be considered as debris.

Management of debris is described further below. Appendix A provides a decision tree for the drum content management and debris management under the Alternative 2 process.

Excavation activities will begin at the western end of the "disturbed areas" and proceed sequentially in discrete sections. The top two to three feet of soil across the "disturbed areas" or trenches is assumed to be relatively clean. This top soil will be removed and placed

b. shall include visually located removal activity such as damaged/degraded containers, metal piping, concrete, railroad ties, rubber materials and cable.

2. Non-Removable Debris:

a. shall be defined as debris mixed with soil that would be replaced with the excavated soil into the basin prior to completion of Alternative 2.

b. shall include basin aggregate (cobble); small man-made materials such as nails, broken glass, metal fragments, and other man-made materials visually located during the interim action removal activities.

Removable Debris Alternative 2 would be determined to be either hazardous or non-hazardous debris. This determination would be based upon all proper waste identification techniques utilized to determine hazardous constituents such as visual inspection, location, photo-ionization detection, organic vapor analyzation, total petroleum hydrocarbon field testing, Toxicity Characteristic Leaching Procedure (TCLP)

adjacent to the excavation for later use as soils, and radiological surface backfill. Excavation will continue with the remaining soil temporarily placed within the area of contamination, primarily on the previously identified disturbed axeas. As the excavation proceeds through the disturbed areas, the contaminated soils will remain in the pit while continuously being displaced laterally as backfill. Excavation activities would not commence until the water table recedes to below 3 m bls (10 ft). Should groundwater infiltration occur during excavation, removal activities would be suspended until the groundwater recedes, and the regulatory agencies would be notified.

For the purpose of this interim removal action, removal of drums, free debris shall be defined as Removable Debris or debris, and/or the sludge layer Non-Removable Debris.

1. Removable Debris:

a. shall be defined as debris that would be removed from the basin and dispositioned according to hazardous or non-hazardous debris determination using proper waste identification techniques.

testing of associated scanning.

1. Hazardous Debris determined identification shall be operated by the A provides the management of debris.

2. Non-Hazardous determined identification hazardous can be land disposed.

Immediately following product, limited at the bottom of the basins from the excavated section, the excavated soil will be placed into the excavation. The excavated soils will be backfilled into the previous excavation(s) until the soil is approximately one and one half feet below average grade. As drums, free product and/or limited debris are removed from the disturbed area, a corresponding void space will

result. At the end of removal activities, the void will be apparent at the eastern end of the trench in the form of a small pit. This pit will be lined, backfilled with clean soil, and covered with a polyethylene liner. The original top two or three feet of clean soil will then be returned to the top of the trenches. The area will be graded across the disturbed area and seeded to minimize rainwater infiltration and erosion.

Treatment Components. The interim action itself involves no treatment of soils or groundwater. Disposition of the drummed waste material and removable debris, which may involve treatment, would be managed through the TSDF operated by SW&ER following approved procedures (Appendix A). Excavated drum contents, debris, and other principal threat source material characterized to be hazardous will be transported to the SRS-operated storage facility for hazardous and mixed waste. The SRS-operated storage facility is a RCRA-permitted facility that provides interim storage for hazardous waste until it is transported off-site for final disposition through one of several permitted

the unit would be constructed to divert gradient runon. Erosion control fences would be established at the western extent of the unit to prevent erosion runoff toward the Carolina bay.

Institutonal Controls. Public access to SRS is controlled by existing security personnel and security equipment as discussed under Alternative 1.

Quantity of Waste. Because neither the quantity of drums nor the volume of buried debris is known, assumptions must be made regarding the total number of drums and the number of drums containing waste product in the D-Area Oil Seepage Basin. For estimating purposes, it is assumed that at least 100 drums are buried at the D-Area Oil Seepage Basin (WSRC, 1990) and that 50 of these drums contain waste product. One hundred intact 55-gallon drums would occupy approximately 27 cubic yards. It is also assumed that the volume of buried debris is equal to 20 percent of the basin volume, or 2500 cubic yards, leaving approximately 9800 cubic yards of soil. The additional areas of

disturbed soil detected by hazardous waste TSDFs. Specific TSDFs will be determined at the time of disposal and be dependent upon characteristics of the hazardous waste.

Engineering Controls. Under Alternative 2, approximately 12,300 cubic yards of material (see Quantity of Waste) would be excavated from the basin. However, the two areas of disturbed soil would also be excavated and would increase the total volume of soil to be excavated to approximately 15,300 cubic yards. Upon uncovering drums during excavation activities, the drum contents would be transferred to new drums which would be stored in a temporary placement area. Drums, soils, and debris would be covered and secured at the end of a work day to prevent water from entering the placement area. Each area would be bermed and would be lined with a polyethylene liner. Runoff control would be accomplished by grading the ground surface prior to excavation such that stormwater would drain away from the excavation. A containment dike around the outer perimeter of GPR may contain waste materials. Any materials uncovered during excavation of those areas would be managed as described for basin materials.

Implementation Requirements. Standard excavation equipment should be readily available for implementation of this alternative. New 55-gallon drums and materials needed for the staging areas are also readily available. Construction and removal activities are projected to require between three and six months, depending on the number of drums encountered, weather conditions, and other unpredictable factors. Plans are for the interim action to be initiated in early 1995. This proposed schedule meets the 15-month regulatory requirement for remedial action startup.

Estimated Construction and Operation and Maintenance Costs. The costs for Alternative 2 are estimated to be $1,400,000 (Appendix Table B.1). Costs include excavation and drum content sampling/analysis activities.

ARARs. Associated with the Considered
Alternative. No location- or chemical-specific
ARARs are associated with Alternative 2. As
with Alternative 1, because no soil or
groundwater treatment is being proposed,
MCLs and PCB ARARs along with RCRA
Subpart S as a "to-be-considered" factor, do
not apply. Action-specific requirements for
Alternative 2 include:

Occupational Safety and Health Administration (OSHA) Regulations 29 CFR 1926 - Excavations

OSHA Regulations 1910.120 - Hazardous Waste Operations and Emergency Response

OSHA Regulations 1910.146 - Permit Required Confined Space Entry

Land Disposal Restrictions regulations do not apply to any interim action activities conducted within the area of contamination. Since the hazardous wastes generated during the interim action will be dispositioned off-site, as defined by 40 CFR 300.5 of the NCP, SRS will comply with the Off-Site Rule (52 FR 49200). All applicable requirements will be

reduction of toxicity, mobility, and volume through treatment
short-term effectiveness
implementability
cost
state acceptance
community acceptance

Table 4 provides a summary of the considered alternatives in relation to the nine NCP criteria.

Overall Protection of Human Health and the Environment.

Alternative 1 would not achieve any reduction in potentially unacceptable health risks posed by the D-Area Oil Seepage Basin.

Alternative 2 would offer reduction in human health risk.

Alternative 2 would involve an interim remedial action whereby buried drum contents and pumpable free product present within the basin would be withdrawn and properly managed.

The alternative would include excavation of removable debris followed by proper management and disposition.

Backfill would be graded and seeded to promote vegetative growth. The effect would be to control infiltration and inhibit migration of contaminants.

Environmental risks

associated with D-Area Oil
met. Specifically, the off-site TSDF must Seepage Basin would
continue to exist under
comply with the Land Disposal Restrictions Alternative 1.
Chemicals would continue to
regulations. Prior to the transference of waste leach into the
groundwater and the resulting
materials, EPA and SCDHEC will be notified contaminant plume
will continue to migrate
of the specific receiving units and a full from the D-Area Oil
Seepage Basin.
demonstration of compliance will be Alternative 2 offers
a reduction in risk to the
performed. environment.
Alternative 2 would provide
grading and seeding
of backfill material to (1)
VIII. Summary of Comparative control infiltration
of precipitation, thereby
Analysis of Alternatives minimizing
contaminant migration; (2) prevent
wind dispersion of
contaminants; and (3)
The National Contingency Plan (40 CFR control erosion of
soils.
300.430(e)(9)) sets forth nine evaluation
criteria that provide the basis for evaluating Compliance with
Applicable or Relevant and
alternatives and subsequent selection of a Appropriate
Requirements (ARARs). The
remedy. The criteria are: purpose of this
interim action is to remove the
source of
contamination to soils and
overall protection of human health and the groundwater (i.e.,
buried drums). Removal of
environment the drums from the
basin will allow for
compliance with applicable or relevant and performance of an
RFI/RI unit assessment,
appropriate requirements (ARARs) which is essential
for developing final remedial
long-term effectiveness and permanence alternatives.

Table 4
Summary of the Comparative Analysis of Considered
Interim Action Alternatives

NCP Criterion	Alternative 1	Alternative 2
Overall Protection of Human Health	No reduction in potential risk to human health	Reduces risk of exposure to drum contents
Overall Protection of the Environment	No reduction in potential risk to the environment	Reduces risk of further leaching of drum contents to soils and groundwater
Compliance with ARARs	No location- or action-specific ARARs associated with the alternative; meets identified chemical-specific ARARs	No location- or chemical-specific ARARs; action-specific ARARS include OSHA 29 CFR 1910.120, and 1926, 1910.146
Long-Term Effectiveness and Permanence	Magnitude of risk would eventually reduce through natural attenuation mechanisms; however, initial risk would increase due to continued leaching of contaminants from buried drums	Offers permanent solutions to buried drum contents and large debris; risk to human health and the environment would be reduced
Reduction of Toxicity, Mobility, or Volume	Alternative 1 would offer no significant reduction of toxicity, mobility, or volume of contamination	Volume of drummed wastes, free product, and sludges significantly reduced; no reduction of contaminated soil.
Short-Term Effectiveness	Offers no mitigation of potential risks associated with direct exposure to contamination; poses no risk	Reduces potential risks to human health and the environment associated with direct exposure to

drum removal;	to remedial workers or the community upon implementation	contents through risk to remedial workers controlled through adherence to an approved health and safety plan; no risk to community
Implementability	No implementation required	Requires no special or non-readily available equipment or materials
Cost	$0	$1,400,000
State Acceptance	State review of IAPP completed	State accepted alternative
Community Acceptance	Public comment period completed	Public accepted alternative

ARARs - Applicable or Relevant and Appropriate Requirements
OSHA - Occupational Safety and Health Administration
1926 - Excavations
1910.120 - Hazardous Waste Operations and Emergency Response
1910.146 - Confined Space Entry
IAPP - Interim Action Proposed Plan (WSRC, 1994)

Alternative 2 allows for the replacement of contaminated soils within the designated area of contamination. This interim action would be accomplished to allow the RFI/RI unit assessment to safely proceed.

Reduction of Toxicity, Mobility, or Volume. The volume of drummed wastes, free product, and sludges at the D-Area Oil Seepage Basin would be significantly reduced under Alternative 2. The mobility of remaining contaminants would be

minimized through
No location-specific ARARs are associated grading and seeding
to limit soil erosion and
with the alternatives; however, erosion control infiltration.
Alternative 1 would offer no
measures would be implemented during immediate reduction
of contaminant toxicity,
Alternative 2 to mitigate impact to the adjacent mobility, or volume.
However, over time
Carolina bay. natural attenuation
would be expected to occur.

Action-specific requirements of Alternative 2 Short-Term
Effectiveness. Implementation of
would be met through adherence to approved Alternative 2 would
mitigate potential risks to
site-specific procedures and a health and safety human health
associated with direct exposure to
plan. drum contents and
free products at the D-Area
Oil Seepage Basin.
Soil used to backfill the
Long-Term Effectiveness and Permanence. basin would act as a
protective barrier
The magnitude of risk associated with preventing access to
underlying soil
Alternative 1 would diminish over time due to contamination.
Alternative 2 would expedite
natural attenuation of D-Area Oil Seepage Basin the permanent removal
of drums containing
constituents. Natural attenuation mechanisms pure waste product
from the basin.
include effects of adsorption, dilution, Additionally, removed
debris under Alternative
biodegradation, oxidation/reduction, and 2 would be excavated,
characterized, and
hydrolysis. However, conditions would properly managed and
disposed.
deteriorate and potential risks to human health
and the environment would increase anytime a One drawback with
regard to the short-term
drum containing pure waste product effectiveness of
Alternative 2 is the potential
deteriorates and releases the waste into the increased human
health risk associated with
environment. Many years would pass before exposure to
contaminants during excavation,
natural attenuation of D-Area Oil Seepage Basin treatment, and
disposal of the buried drums and
contaminants would reduce chemical debris and the
contaminated soil; however,
concentrations to acceptable levels. Alternative adherence to an
approved Health and Safety
2 offers permanent solutions for the Plan and engineering

controls would mitigate
management of recovered drum contents and these effects.
pumpable free product encountered during the
excavation. The alternative offers the Implementability.
Alternative 1 does not
management and disposition of removable require
implementation. Alternative 2 is readily
debris. Alternative 2 would offer the long-term implementable
requiring no special or non-
benefit of significantly reducing potentially readily available
equipment or materials.
unacceptable risks associated with the D-Area
Oil Seepage Basin. Alternative 2 would not Cost. The cost
associated with Alternative 1 is
result in removal of the entire source of estimated to be $0.
Costs for Alternative 2 are
contamination. estimated to be
approximately $1,400,000.

Following performance of a complete RFI/RI State Acceptance.
The state has reviewed the
unit assessment, remedies could be developed IAPP and approved the
selection of the
which offer potentially greater effectiveness at a preferred interim
action remedial alternative.
reduced cost. The objective of obtaining a
drum-free environment in the basin to allow Community Acceptance.
Community involve-
further assessment studies would be achieved ment in evaluation of
the proposed interim
under Alternative 2. action has included a
60-day public comment

period and a public meeting held on October and allow for future
unit assessment studies
11, 1994. Public comments were considered essential for the
development of final
and incorporated into this IROD. Discussion alternatives.
of specific public comments and their
resolution are included in the Responsiveness Within 15 days of the
signing (approval) of the
Summary (Appendix C). Interim Record of
Decision (IROD), SRS will

IX. Selected Remedy

The preferred interim action remedial alternative is Alternative 2 - Buried Drum Content Removal with Soil Replacement and Limited Debris Removal and Disposition. The interim remedial alternative consists of uncovering buried drums through excavation, transference of drum contents to new drums, and management of drum contents by the TSDF operated by SW&ER (Appendix A). Pumpable free product, or discernible layers of sludge, solid waste, or other principal threat source material, not including groundwater or contaminated soil layers, encountered during the interim remedial action would be pumped or placed into new drums at the surface and managed by the TSDF operated by SRS SW&ER. Removable debris at the surface would be characterized as either non-hazardous or hazardous and dispositioned through the TSDF operated by SW&ER (Appendix A). Immediately following drum, free product and/or limited debris removal from the excavated section, the excavated soil will be placed into the excavation. The soils will be placed in the excavation such that the most contaminated material will be left contaminated soils are at the bottom and the

submit an outline for the post-IROD documents; the Remedial Design/Corrective Measures Design and Remedial Action/ Corrective Measures implementation Plans. The post-IROD documents will be submitted within 30 days after the outline is approved by EPA and SCDHEC. The interim remedial action will begin after the post-IROD documents areapproved.

X. Statutory Determination

The preferred interim action remedial alternative for the D-Area Oil Seepage Basin operable unit, Alternative 2, addresses those principal threat source materials, which are liquid or concentrated hazardous substances that may readily migrate to subsurface soils and groundwater. Buried Drum Content Removal with Soil Replacement and Removable Debris Disposition. This interim action will be protective of human health and the environment, will comply with Federal and state ARARs, and will be cost effective. While partially fulfilling the statutory preference for remedies that reduce toxicity, mobility, and volume, some in place with this interim action alternative.

clean soils are at the surface. The excavated soils will be backfilled into the previous excavation(s) until the soil is approximately one and one half feet below average grade. As drums, free product and/or limited debris are removed from the disturbed area, a corresponding void space will result. At the end of removal activities, the void will be apparent at the eastern end of the trench in the form of a small pit. This pat will be lined, backfilled with clean soil, and covered with a polyethylene liner. The original top two or three feet of clean soil will then be returned to the top of the trenches. The area will be graded level for commencement across the disturbed area and seeded to minimize rainwater infiltration and erosion. The combined results of Alternative 2 would be to remove a primary source of contamination

Subsequent investigatory actions are planned to fully evaluate the risk to human health and the environment posed by the remaining contamination at the D-Area Oil Seepage Basin waste unit to determine the necessary final remedial actions for the unit.

XI. Explanation of Significant Changes

Based upon the recent installation of a network of piezometers and the ability to better monitor and track local groundwater conditions, the groundwater action level for commencement and continuation of excavation activities as defined under Alternative 2 has changed from greater than 10 feet bls to greater than or equal to 0.5 feet below the bottom of the basin

trench. Local groundwater conditions will be monitored with respect to the bottom of the basin trench during excavation activities. This change, and contingencies for various groundwater elevations, are outlined in Section 6.0, Contingency Plan Implementation Strategy of the Remedial Design/Remedial Action Work Plan for the D-Area Oil Seepage Basin, (WSRC, December, 1994).

XII. References

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APPENDIX A

IMPLEMENTATION AND WASTE
MANAGEMENT STRATEGIES

ALTERNATIVE 2
IMPLEMENTATION STRATEGY

Interim Remedial
Action:

Treatability Study

Soil Left In Place

Drum Content
and
Removable Debris Management

WSRC-RP-93-1550, REV. 1
JANUARY 16, 1995

INTERIM ACTION RECORD OF DECISION
D-AREA OIL SEEPAGE BASIN

<IMG SRC 0495218C>

WSRC-RP-93-1550, REV. 1
JANUARY 16, 1995

INTERIM ACTION RECORD OF DECISION
D-AREA OIL SEEPAGE BASIN

<IMG SRC 0495218D>

APPENDIX B

COSTS

WSRC-RP-93-1550, REV. 1
JANUARY 16, 1995

INTERIM ACTION RECORD OF DECISION
D-AREA OIL SEEPAGE BASIN

Table B.1 D - Area Oil Seepage Basin
Westinghouse Savannah River Corporation
Alternative 2 - Drum Content Removal
Cost Estimate

Assumptions:
1) Suitable borrow material can be obtained onsite.
2) Necessary borrow material volume is 1,500 cubic yards (382' x 53' x 23').
3) Volume of drum contents, free product, and sludge removed...2750 gallons; (100 55 - gallon drums; 50% capacity)
4) Cover and liner material need only be overlapped...not welded.
5) 2 - Backhoes/1 - Frontend Loader/4 - Bobcats Used for Excavation

Item	Quantity	Units	Unit Costs($)	Total Costs($)
Capital Costs				
Site Preparation				
Chain Link Fence - 6 feet high; 6 ga. wire	1,400	Feet	12.39	17,346
Drive - thru Gate - 16 feet	1	Each	218	218
Construct Soil Staging Pad - 100'x 200'				

Barrier Liner Material - 40 mil Coaxil Liner 33,600
SF 0.19 6,384
Soil Bern - 2' High 45
CY 10 450
Cover Uner Material - 40 mil Coaxil Liner 40,000
SF 0.19 7,600
Construct Drum Staging Area - 60' x 60'
Barrier Liner Material - 40 mil Coaxil Liner 3600
SF 0.19 684
Soil Bern - 2' High 18
CY 10 180
Cover Liner Material - 40 mil Coaxil Liner 10000
SF 0.19 1,900
Subtotal 1
34,762

Excavate Seepage Basin
Unearthing Drums - Level C
Mobilization 1
LS 2100 2,100
Equipment Rental 300
HR 850 255,000
Manpower 300
HR 420 126,000
Segregate Debris 1,000
CY 12 12,000
Subtotal 2
395,100

Waste Transfer & Removal
Personnel - 6 People; 5 Drumss/Day; Level C 20
Day 5,000 100,000
Transportation - S Trucks 20
Day 135 2,700
Per Diem 20
Day 150 3,000
Misc. Expenses - Pumps, Hoses, Supplies, etc. 1
LS 20,000 20,000
New 55-Gallon Drums - 22 Gauge Composite 50
Each 45 2,250
Subtotal 3
127,950

Backfilling - Level D
Barrier Liner Material - 40 mil Coaxil Liner 98,000
SF 0.19 18,620
Cover Liner Material - 40 mil Coaxii Liner 98,000
SF 0.19 18,620
Installation
Personnel - 6 People; Level C 8
Day 5,000 40,000
Transportation - 3 Trucks 8
Day 135 1,080
Per Diem 8

Day 150 1,200
Misc. Expenses - Pumps, Hoses, Supplies, etc. 1
LS 2,000 2,000
Excavate and transport borrow soil
Backhoe - 0.75 CY, wheel mont. 1,500
CY 3.50 5,250
Dump truck - 12 CY, 0.25 mi RT. 1,500
CY 2.00 3,000
Spread borrow material 1,500
CY 1.45 2,175
Subtotal 4
91,945

INTERIM ACTION RECORD OF DECISION
D-AREA OIL SEEPAGE BASIN

Table B.1 D - Area Oil Seepage Basin (Continued)
Westinghouse Savannah River Corporation
Alternative 2 - Drum Content Removal
Cost Estimate

Item	Quantity	Units	Unit Costs($)	Total Costs($)
Capital Costs (Continued)				
Sampling & Analyses				
TCLP (Full Scan)	60	Each	1,500	90,000
Flash Point	60	Each	33	1,980
PCBs	60	Each	250	15,000
Dioxin/Furan	6	Each	1,100	6,600
TOX	60	Each	50	3,000
RCRA Metals	60	Each	275	16,500
Gross Alpha	60	Each	45	2,700
Gross Beta	60	Each	45	2,700
Tritium	60	Each	45	2,700
Subtotal 5				

141,180

Sampling & Analyses Labor
Sampling - 3 Sampler: 3 Samples/Day: Level C 20
Day 2,500 50,000
Transportation - Truck 20
Day 45 900
Per Diem 20
Day 75 1,500
Misc. Expenses - Supplies 20
Day 450 9,000
Shipping - 3 Coolers/Day...$70/Cooler 20
Day 210 4,200
Subtotal 6
65,600

Total Capital Costs (Subtotals 1 - 6)
856,537

Operation & Maintenance (1 Year)
Daily Inspection of Soil Piles - WSRC Employee 50
Day 90 4,500
Fence Repair 4
Qtr 300 1,200
Weed Control 4
Qtr 500 2,000
Total Annual O&M Costs
7,700

PRESENT WORTH O&M COST (30 YRS, i = 5%)
118,364
(Present Worth Factor = 15.372)

Factored Costs
Health and Safety 5 % of capital
costs 42,827
Bonds, insurance 5 % of capitel
costs 42,827
Contingency 15 % of capital
costs 128,481
Engr./Const. Mgmt. 15 % of capital
costs 128,481
Prime Contractor Ovrhd & Prft 10 % of capital
costs 85,654
Total Factored costs
428,269

TOTAL PRESENT WORTH COSTS (Capital + O&M + Factored)
1,403,170

APPENDIX C

RESPONSIVENESS SUMMARY

INTERIM ACTION RECORD OF DECISION
D-AREA OIL SEEPAGE BASIN

Responsiveness Summary

General Response

During the 30-day comment period, a request for a public meeting was received (ref. letter to Mr. H. Horner from Ms. C. Lambert, 8/22/1994). The public comment period was extended an additional 30 days so the public meeting could be held. The public information meeting was held on October 11, 1994 in Aiken, South Carolina.

The public meeting was divided into three main segments: (1) a general introduction section, (2) a discussion about the proposed TNX groundwater interim action, and (3) a discussion about the proposed DAOSB interim action. The DAOSB discussion was broken into a general information and background segment, a discussion and question/answer session about the proposed interim action and finally an opportunity was provided for formal commenting. No formal comments were received at the public meeting.

During the general discussion, many question were asked about the interim action. Questions raised included general information questions regarding the physical state of the unit, how SRS was planning to remove the drums, a general discussion of what options were reviewed and evaluated and how SRS selected the preferred alternative. This discussion included a review of some of the

options that were not presented in the IAPP. A main topic of the discussion centered around why SRS was replacing the soils and was not proposing to treat the excavated soils at this time. This question was also received as a formal written comment during the public comment period. The question and response can be found below.

SRS stated that many treatment and storage options were reviewed. The main drawbacks of treating the soil on site as an interim action were time and cost. SRS believes that the cost of constructing and permitting an on site treatment facility (or bringing in a portable treatment unit) would, at this time, not be cost effective. The nature and extent of contamination is not known. Based on the data available, the possibility exists that the soils may not warrant extensive treatment. On the other hand, if remedial investigation may determine otherwise, we may have to treat more soil during the final action, it would be more cost effective to wait and treat all the soils needing remediation at once. From the standpoint of time, it may take up to 2 years to bring in a treatment system, get it permitted and operational. By the time the system would be operational, SRS would be near completion of the RI/FS process. The treatment of the excavated soils is also out of the scope of the proposed interim action. Soil treatment is more of a final action. A final action will be completed following the expedited RI/FS. See the specific comments and responses for more detailed information.

Based on some of the discussions during the meeting and the comments received, it has become apparent that including the incineration alternative in the IAPP has clouded the primary purpose for proposing and performing the interim action. SRS agrees that the all or nothing approach to dealing with the basin soils was not consistent with the interim remedial action objectives. Therefore, alternative 3, excavation and incineration of basin soils, will be removed from the Interim Action Record Of Decision.

During the public information meeting, suggestions were received on potential improvements to the meeting format. These comments will be evaluated and to the extent possible, the recommendations will be followed. Opportunities to provide for earlier public involvement through coordination with the SRS Citizens Advisory Board (CAB) and/or holding public availability sessions are currently under consideration. It is the goal of the three parties to the FFA to address these

opportunities in the next
update to the SRS public involvement plan.

INTERIM ACTION RECORD OF DECISION
D-AREA OIL SEEPAGE BASIN

Written comments were received from the following sources and the responses are below.

Ms. Carrie Lambert (requested the public meeting)
Ridgeland, SC

RPM, Inc.
Mr. George Robinson, President
Aiken, SC

Energy Research Foundation
Mr. Tim Connor, Associate Director
Columbia, SC

Plasma Chem, Inc.
Mr. W. Paul Stephens, President
Atlanta, GA

SPECIFIC COMMENTS

Comment

Plasma Chem, Inc.
Mr. W. P. Stephens
8/16/94 letter to SRS Remedial Project Manager, EPA - Region IV

Plasma Chem recommends the use of their smelting process (Ausmelt Furnace) for the destruction of the waste material within the DAOSB trenches.

Response

SRS appreciates Plasma Chem's interest and suggestion, but since no treatment is being recommended at this time, the potential use of the suggested equipment is not appropriate for the interim action. SRS will evaluate the technology during the final RI/FS. Please note, the CERCLA process details the technologies to be used for remediation. Most of

the time, especially with thermal technologies since there are many similar types of equipment in the market, the CERCLA does not specify specific brands of equipment. This is done through procurement.

Comment

RPM, Inc., 9/8/94
Ref. letter from G.C. Robinson, RPM, Inc.

"In the Savannah River Site Environmental Bulletin dated August 8, 1994 there is a release plan for the D-Area Oil Seepage Basin. After reading and evaluating the problem RPM believes we have possible innovative technologies that could be applied to the project allowing significant cost and time savings. Our approach would be to solidify the oil and sludge material into non-metallic containers and totally remediate the area...Realizing that the EPA and DOE are seeking innovative technologies to apply in solving environmental problems, RPM's method of cleaning up D-Area Oil Seepage Basin is a viable alternative to the three methods presented in the Environmental Bulletin.... "(ref. RPM letter)

INTERIM ACTION RECORD OF DECISION
D-AREA OIL SEEPAGE BASIN

Response

RPM's proposed innovative technology for remediating the D-Area Oil Seepage Basin (DAOSB) has been reviewed by SRS and at this time, it is believed to be inappropriate for the proposed interim action.

The proposed 'innovative technology' is in essence a basic stabilization technology that uses a unique container to receive the stabilized material.

From the point of view of stabilization, it may advantageous to stabilize the DAOSB material in place. Using the RPM method, the material would have to be removed, stabilized and then stored or disposed in a permitted facility. The proposed stabilization method would require more handling (potentially posing more of a threat to human health) and potentially cost more than another stabilization process due to the cost of the containers and the storage or disposal cost (versus in situ stabilization).

Stabilization has been proven to be somewhat ineffective on volatile organic compounds. Because the characteristics of the waste material are not fully defined, stabilization may not be needed; it is possible that only containerization is needed to store the material.

From a CERCLA standpoint, it is better to destroy and/or reduce the toxicity and/or the volume of material than it is to reduce its mobility. While most stabilization technologies increase the volume of material an average of about 30%, it appears that the RPM technology doubles the amount of waste material that must be stored or disposed. Other potential technologies exist for DAOSB that will treat/destroy the waste materials.

As part of the final CERCLA Remedial Investigation/Feasibility Study (RI/FS) process, in which a final remedial action will be chosen for the DAOSB, a full range of technologies, including destructive technologies and stabilization technologies, will be evaluated based on the CERCLA criteria. SRS is proposing only an interim action at this time, not a final action. Since the type and extent of waste in the basin have not been fully characterized, it may not be prudent, or cost effective, at this time to treat all of the basin soils.

When the final remedial actions are being developed and evaluated for the DAOSB, SRS will be pleased to fully evaluate RPM's technology.

Comment

Energy Research Foundation (ERF), 9/8/94
Mr. Tim Connor, Associate Director

1) While the excavation of the contaminated soils is necessary to remove the drums, it does not follow that they should be replaced in the manner described in Alternative #2.

It is plausible, based on the yet to be completed RFI/RI assessments (which presumably would incorporate future land use considerations combined with a more thorough risk assessment) that the ultimate closure plan will require either re-excavation of these soils or additional treatment of the soils in situ. Therefore the necessary excavation of the soils as part of the interim action presents an opportunity to either treat the soils and/or replace them in a way that greatly reduces their continuing threat to groundwater and their long-term potential threat to public health. If future treatment is necessary, then replacing the soils now would have the effect of making final remediation more expensive because of

the potential need to re-excavate the soil for treatment or for the installation of a barrier beneath the soils to protect groundwater.

The preferred option would return contaminated soils to the ground in an unlined trench. The option also proposes that the most contaminated soils would be buried at the bottom of the trench where they are closer to the water table and more likely to come in contact with groundwater (which testing shows is already contaminated). Both facets of the re-burial are highly questionable. Because the interim action is justified, and the excavation of contaminated soils is an unavoidable action, we think this places an inescapable burden on SRS to show that the subsequent disposition of the contaminated soils does not re-introduce a potential groundwater contamination source to the site. Indeed, because the more contaminated soils would be placed closer to groundwater, the re-burial of the soils may make matters worse than they were prior to excavation.

Response

The treatment and/or storage of the basin soils will be addressed under ERF's comment #2.

From the standpoint of ex-situ remediation, the excavation of the soils, in most cases, is a relatively small cost compared to the cost of the associated treatment technology. Since the nature and extent of the contamination within the trenches and the DAOSB waste unit is not fully characterized, treatment and/or storage of excavated soils may not be needed and doing so may be very costly.

While placing soils back into the ground may appear questionable, SRS believes the preferred alternative will minimize the potential for continued groundwater contamination. SRS concedes that the IAPP may not be clear as to what specifically will be removed and how the material will be dispositioned. The IAPP proposed removing

the drum contents, pumpable free product, discernible layers of sludge and other principal threat source material. SRS considers other principal threat source material to be the interval at the bottom of the trenches that is saturated with and contains free product. SRS will excavate the two main trenches to their respective bottoms, to a maximum depth of approximately 8 ft, and remove the bottom layer of basin soils seen to be contaminated with free product. SRS will not remove all the stained soils. The removed soils will be placed in B-25 boxes (special storage boxes), characterized for waste acceptance criteria and dispositioned according to applicable state and federal regulations through the SRS TSDF. The soils will be replaced into the excavation in a last-out-first-in fashion such that the cleaner soils will be toward the surface. A comprehensive remedial investigation will be conducted during the summer of 1995 which will include characterization of the vadose zone, the saturated zone soils and groundwater. From this, a risk assessment will then be conducted to determine the potential risk and help select a final course of action.

SRS believes that by removing the principal threat material at this time, the impact to groundwater will be minimized. Replacing the remaining potentially contaminated soils back into the excavation would at most minimally impact the groundwater. After being subjected to 20 years of groundwater fluctuations, it is unlikely that any contamination remaining in the replaced soils would migrate or leach to the groundwater. Based on limited soil sampling data, the majority of the mobile species of contaminants are not present at elevated levels in the basin soils. It is believed that the majority of the mobile species would be found in the free product and sludge layers and in the drums. It is unlikely that by performing this interim action and placing the soil back into the basin in a last-out-first-in fashion, SRS would be making matters worse than they were prior to

excavation. Currently, the most contaminated soils, along with the free product and sludges, are closest to the groundwater. By performing the proposed interim action and placing the soils back in a last-out-first-in fashion, SRS would not be making matters worse but greatly decreasing the potential for further groundwater contamination.

Comment

2.) Because the projected cost of treating the excavated soils and debris is the problem with Alternative #3, ERF would like to see a more thorough assessment of the treatment/disposition options. Specifically, there should be more consideration given to options that would involve on-site treatment of the contaminated soils as opposed to transporting them to another site for incineration.

With respect to treatment options DOE's Office of Technology Development has, for example, initiated the Supercritical Water Oxidation (SCWO) Program for the treatment of mixed and hazardous wastes. in a February 1994 profile of the SCWO program OTD reported: "In contrast to incineration, SCWO can easily be designed as a full containment process with no release to the atmosphere (and) can achieve the high destruction efficiencies for hazardous waste such as polychlorinated biphenyls (PCBs) or dioxins" both of which are present in D-Area soils at levels in excess of RCRA Subpart S action guides. Other treatment options may also be available or under development that could substantially lower the costs of treatment.

Even if lower cost and adequate treatment technologies are not immediately available, consideration should be given to storing the soils in a readily retrievable form at least until a more thorough risk assessment is completed as part of the RFI/RI process. This could be done at a fraction of the cost of transporting and incinerating the soils. While it may preclude burial of the soils in the manner proposed in Alternative #2, it would not necessarily preclude burial of the soils at another location at SRS if this is compatible with RCRA and CERCLA regulations. It would also allow more time for the development of treatment options.

If storing the soils is inappropriate for some reason, then another alternative which might be considered is lining the basin before the soils are re-introduced. This would at least provide some additional protection while a final remedial action is selected.

Finally, storage and treatment alternatives could be considered for the most contaminated soils as a less expensive alternative than storing or treating all removed soils. While not fully protective of public health and the environment, it might be preferable to the all or nothing approach outlined in the proposed plan.

Response

Per the NCP and CERCLA guidance for an interim action, only a limited number of alternatives need to be considered and in some cases perhaps only one. The alternatives considered must be within the scope of the interim action and not conflict with any potential final remedial action. The purpose of proceeding with this interim action is to achieve the interim remedial action goals and objectives of removing the principal threat source material (i.e. drum contents, free product and sludges) to minimize potential releases from the trenches.

Many treatment options, including both on site and off site treatments, other than the those included in the IAPP were reviewed. They included such treatments as in-situ bioremediation, soil washing, lining and capping the trenches, debris washing and super critical extraction/liquid phase oxidation to name a few. Most of the options were

rejected, on an interim basis, due to inconsistency with the interim remedial action goals, implementability problems, cost and insufficient data regarding the nature and extent of

contamination at the DAOSB. Also, one major factor for eliminating on site treatment was time. It would take well over a year to construct and permit an on site treatment facility and by the time it was operational, SRS would be close to completing the RI/FS process for the unit. The simplest method for on site "treatment" is to send the waste material to the on site TSDF for disposition. The disposition may include storage and or disposal through one of the TSDF disposal contracts. As described in the IROD all appropriate State and Federal regulations will be followed during the disposition of the hazardous materials removed.

Since it is currently not known whether the soils are characteristically hazardous or contain substances which require special treatment and handling practices, incineration was selected as the primary treatment option. Incineration represents the best available technology for many types of constituents, including PCBs, dioxins and furans.

It has become apparent that including the incineration alternative in the IAPP has clouded the primary purpose for proposing and performing the interim action. Incinerating the basin soils is more appropriate for a final action, and not the interim action. SRS agrees that the all or nothing approach to dealing with the basin soils was not consistent with the interim remedial action objectives. Therefore, alternative 3, excavation and incineration of basin soils, will be removed from the IROD.

The issue of replacing the excavated soils was discussed internally and externally at length. Options that included not replacing the contaminated soils and variations on replacing the soils were reviewed. By not replacing the soils an open pit would remain. Under this option, infiltration of rainwater could facilitate further groundwater contamination or cause it to spread faster. If the excavation was to be refilled with clean soils, there is the possibility that they would become contaminated due to the movement of the groundwater. While lining the excavation would prevent the spread of contamination into or out of the trench, it would allow the excavation to act as a pool for the infiltrating water. Adding a cover or a cap would prevent the pooling effect. But since the waste unit is not fully characterized, drilling through the liner and the cap would be necessary thus compromising the integrity of the cap and liner. Furthermore, a liner and cap may need to be removed for final remediation. Replacing the soils without a liner or cap and excavating them a second time for final remediation, if needed, would be

cheaper.

SCWO is a promising innovative technology which has the ability to achieve organic destruction efficiencies of over 99.99% (DOE, 1994). SCWO is being developed to treat mixed waste streams at DOE facilities. At present, candidate mixed waste streams at DOE facilities include: spent solvent, oils, and other organic or aqueous liquids, sewage and organic laden sludges, spent carbon, solvent contaminated rags, and explosives and energetics (DOE, 1994). The current design of the SCWO unit is as a continuous process. The operating temperature and pressure of the unit (the critical point of water) would be 374 degrees Celsius and approximately 3000 psi.

No cost information is available for the SCWO technology. But based on similar technologies and the type of equipment required (high temperatures and pressures), SCWO may prove to be an expensive technology.

Two other potential options for treating D-Area Oil Basin soils by SCWO is to: (1) manage the soils in a batch process or (2) extract the contaminants in an aqueous stream

and subsequently treat the aqueous stream by SCWO. Batch processing of wastes is in the early stages of research and development. Extraction techniques have been established for organic contaminants and some full-scale extraction technologies are available. However, activities in the SCWO are in the pilot plant construction and testing phase. The testing milestone is expected to be completed by the end of 1995 (DOE, 1994). Full-scale operations for hazardous waste treatment has not been predicted. Treatment of soils from the basin by SCWO could require years to initiate. SRS will evaluate the SCWO technology and any other technologies suggested.

The ongoing RI/FS will fully evaluate an appropriate range of storage and treatment options. SRS would appreciate any further input for consideration during the final remedy selection.

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 04/13/1995
Operable Unit: 08
ROD ID: EPA/ROD/R04-95/224

Media: groundwater

Contaminant: Tritium, alpha and beta emitting radionuclides, metals

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The Savannah River site occupies approximately 300 square miles adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina. The site is a secured facility with no permanent residents and is located approximately 25 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina. It is owned by the U.S. Department of Energy (DOE). Westinghouse Savannah River Company (WSRC) provides management and operating services for DOE. The site has historically produced tritium, plutonium, and other special nuclear material for national defense. Recycling and reloading of tritium to keep the nation's supply of nuclear weapons ready is a continuing site mission. Currently, the Separations Facilities, of which F-Area is a part, are processing existing inventories of materials for a variety of purposes, including supplying Plutonium-238 for deep space probes and processing inventoried liquid radioactive materials into solid form for storage and testing.

This ROD addresses the F-Area Groundwater Operable Unit which is

the groundwater associated with the F-Area Hazardous Waste Management Facility (HWMF). The F-Area HWMF is located in the center of the Savannah River site, southwest of Road E and north of Road 4 approximately 16 miles from the nearest plant boundary. The F-Area HWMF was operated from 1955 until November 1988. The F-Area HWMF consisted of three unlined earthen basins that had a combined maximum operating capacity of 20.5 million gallons of wastewater during operation. The groundwater contamination plume associated with these basins makes up the F-Area Groundwater Operable Unit. It is in a zone extending from the water table surface to approximately 150 feet below land surface and covers an area of approximately 200 acres. The primary contaminants are tritium, alpha- and beta-emitting radionuclides, and hazardous metals. Closure of the HWMF began in 1989 and was completed in January, 1991.

Remedy: The F-Area Groundwater Operable Unit requires no further action under CERCLA. Cleanup of the F-Area Groundwater Operable Unit is being addressed under a Resource Conservation and Recovery Act (RCRA) permit.

The remedy outlined by the RCRA permit provides for the recovery of contaminated groundwater via extraction wells and treatment of hazardous constituents and radionuclides (except tritium and nitrates). The extraction wells will capture the groundwater and the treated groundwater will be injected into the shallow aquifer. Institutional and engineering controls, plus long-term monitoring of groundwater, surface water, and ecological conditions will take place. These actions have been determined to be protective of human health and the environment under CERCLA, and therefore, no additional cleanup will be necessary.

Text: Full-text ROD document follows on next page.

Text:

United States Department of Energy

Savannah River Site

Interim Action Record of Decision

Remedial Alternative Selection

for

F-Area Groundwater Operable Unit (U)

Revision.1 April 1995

Prepared by:

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29802

Prepared for the U.S. Department of Energy Under
Contract DE-AC09-89SR18035

Interim Action Record of Decision
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Revision 1

April 1995

Declaration for the Interim Action Record of Decision

Site Name and Location

F-Area Groundwater Operable Unit
Savannah River Site
Aiken County, South Carolina

The F-Area Groundwater Operable Unit is the groundwater associated with the F-Area Hazardous Waste Management Facility (HWMF). Both the F-Area Groundwater Operable Unit and the F-Area HWMF are part of the F-Area Fundamental Study Area. The F-Area HWMF (Building Numbers 904-41G, 904-42G, and 904-43G) is listed as a Resource Conservation and Recovery Act (RCRA) regulated unit in Appendix H of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS). These terms have been defined in the Interim Action Proposed Plan for the F-Area Groundwater Operable Unit. That document is part of the administrative record for this unit and is the document on which this declaration and the accompanying Record of Decision are based.

Statement of Basis and Purpose

The purpose of this Interim Action Record of Decision (ROD) is to address the potential concerns at the F-Area Groundwater Operable Unit under a program that comprehensively and responsively meets the needs of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and supports the SRS RCRA Permit as the primary decision-making authority. If the remedy appearing in the permit is significantly revised, a review of this interim action will be performed to determine whether requirements for continued protection of human health and the environment are being met

This document presents the selected interim corrective action for the F-Area Groundwater Operable Unit at the SRS, which was developed in accorrdance with the FFA. This decision is based on the Administrative Record File for this specific unit. The selected interim action under CERCLA is no further action beyond that required by the corrective action as identified in the SRS RCRA Permit.

Assessment of the Site

The F-Area HWMF is a source specific operable unit within the F-Area Fundamental Study

Area. The F-
Area HWMF is located in the center of SRS, Southwest of Road E and North of Road 4 approximately 16
miles from the nearest plant boundary. The F-Area HWMF consisted of three unlined earthen basins that
had a combined maximum operating capacity of 20.5 million gallons of waste water during operation.
The groundwater contamination plume associated with these basins is called the F-Area Groundwater
Operable Unit and is observed in a zone which extends from the water table surface to approximately 150
feet below land surface and covers an area of approximately 200 acres. The primary contaminants are
tritium, alpha, and beta emitting radionuclides, and hazardous metals. The potential pathway for
contamination from the F-Area Groundwater Operable Unit is through discharge of contamination into an
onsite stream.

Remedial alternatives were developed for corrective action of the F-Area Groundwater Operable Unit as
part of the SRS RCRA Permit process. Monitoring and investigation of the groundwater operable unit is
being conducted. DOE is scoping a phased approach to identify the optimal sequence of activities for
corrective action.

Description of the Selected Remedy

Closure of the F-Area HWMF was conducted under a RCRA closure plan approved by the South Carolina
Department of Health and Environmental Control (SCDHEC). The corrective action of the groundwater
operable unit associated with these basins is being addressed under the SRS RCRA Permit.

The CERCLA selected alternative for the F-Area Groundwater Operable Unit is no further action beyond
that required by the SRS RCRA Permit. The remedy described in the 1992 SRS RCRA Permit provides
for recovery of contaminated groundwater via extraction wells and treatment of hazardous constituents
and radionuclides (except tritium and nitrates). The treated water under the conditions of current permit
will be injected into the shallow aquifer at the upgradient extent of the plume. DOE has been proceeding

to implement this action. On March 1, 1995, the renewal of the SRS RCRA Permit was issued as a draft for public/permittee review and comment.

Declaration Statement

Corrective action for the F-Area Groundwater Operable Unit is specified by the SRS RCRA Permit issued by the State of South Carolina. Pursuant to the FFA, the permit addresses all identified constituents capable of harming human health and the environment. This action has been determined to be protective of human health and the environment under CERCLA. Therefore, no further remedial action beyond or in addition to that established under the SRS RCRA Permit is necessary under CERCLA.

Date

Thomas F. Heenan
Assistant Manager for
Environmental Restoration and Solid Waste
U.S. Department of Energy

Date

John H. Hankinson, Jr.
Regional Administrator
U.S. Environmental Protection Agency
Region IV

I. Site and Operable Unit Names, Locations, and Descriptions

The Savannah River Site (SRS) occupies approximntely 300 square miles (800 square km) adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina (Figure 1). SRS is a secured facility with no permanent residents. The site is approximately 25 miles (40 km) southeast of Augusta, Georgia, and 20 miles (32 km) south of Aiken, South Carolina. SRS is owned by the United States Department of Energy (DOE). Westinghouse Savannah River Company (WSRC) is the managing and operating contractor for DOE.

The original mission of the site was to produce nuclear materials for national defense. Recycling and reloading of tritium to keep the nation's supply of nuclear weapons ready is a continuing site mission. Today the Separations Facilities, of which F Area is a part, are processing existing

inventories of materials for a variety of purposes, including supplying Plutonium-238 for deep space probes and processing inventoried liquid radioactive materials into solid form for storage and testing. This activity is expected to continue for several years.

The F-Area HWMF is a RCRA-regulated unit (Figure 2). As an operable unit, the basins comprising the F-Area HWMF were stabilize and closed in 1991. The F-Area Groundwater Operable Unit is the groundwater associated with the F-Area HWMF. Contaminant plumes are shown on Figure 3.

II. Operable Unit History and Compliance History

Operable Unit History

The F-Area HWMF (basins F-1, F-2, and F-3) was operated from 1955 until November 7, 1988. During that time, the facility received waste effluents from F-Area chemical separations facilities such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads. Significant amounts of nitrate and caustic were received. Tritium was the primary radionuclide released to the basins.

The basins were closed by dewatering, physically and chemically stabilizing the remaining sludge on the bottom of the basins and placing a multi-layer clay/soil cover over them. The cover system reduces rainwater contact with the stabilized sludge and further contamination of the groundwater.

Compliance History

The entire SRS was placed on the National Priorities List (NPL) in December 1989. Following that date, RCRA preventive activities at the F-Area HWMF have also been required to meet CERCLA regulations. The Federal Facilities Agreement, which became effective in 1993, formalized the integration of RCRA and CERCLA in remediations on the SRS. Remediation of environmental contamination on the SRS is directed by a Federal Facility Agreement (FFA), which was signed by EPA Region IV, DOE, and SCDHEC and became effective August 16, 1993. The FFA identifies all sites that may require remediation and establishes an administrative process to set priorities and guide response actions. The FFA requires CERCLA Records of Decision on for all RCRA decisions.

Preventive actions at the F-Area HWMF were conducted pursuant to the requirements of RCRA per Settlement Agreement 87-27-SW between SCDHEC and DOE. In 1988, a RCRA Closure Plan was

submitted to SCDHEC. The closure plan underwent revisions to address SCDHEC comments prior to approval in 1989. Closure of the F-Area HWMF was begun in 1989, completed in January 1991, and the unit was certified closed in February 1991. In April 1991, the closure certification was accepted by SCDHEC as being in compliance with RCRA requirements. Following a review of the SCDHEC RCRA action, EPA determined that it was protective of human health and the environment and that no additional

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actions were necessary. The three parties to the FFA then embodied this decision in a CERCLA Record of Decision on the closed basins which was signed on September 10, 1993. A RCRA Permit Application for Postclosure Care of the cover and to address groundwater contamination was submitted in December 1990 and revised in 1992. SCDHEC addressed the F-Area HWMF in the SRS RCRA Permit effective November 1992. This permit required submittal of a corrective action plan for the groundwater associated with the F-Area HWMF. The Corrective Action Plan was included in the RCRA Permit Renewal Application (submitted in October 1993). On March 1, 1995, as part of renewal of the permit, a draft SRS RCRA Permit was issued for public/permittee review and comment. Issuance of the renewed SRS RCRA Permit is anticipated in the near term.

III. Highlights of Community Participation

The public comment period for the F-Area Groundwater Operable Unit Interim Action Proposed Plan was from December 14, 1994 to February 15, 1994. The comments received on the Interim Action Proposed Plan are addressed in the Responsiveness Summary found in Appendix B.

IV. Scope and Role of Operable Unit Within the Site Strategy

The description of the remedy addressing groundwater contamination at the F-Area Groundwater Operable Unit, summarized below, is from the SRS RCRA Permit.

As described in the SRS RCRA Permit, the goal of remediation of the F-Area Groundwater Operable Unit is to lower contaminant concentrations in the groundwater associated with the F-Area HWMF to levels specified in the RCRA permit and to minimize the discharge of contaminants to the adjacent stream. In accordance with the current 1992 SRS RCRA Permit, the remediation program includes groundwater extraction, treatment, and injection at the upgradient extent of the contamination. The remediation follows the closure of the F-Area HWMF, and precedes the investigation of smaller source-specific units in the F-Area Fundamental Study Area. The smaller source-specific sites will require investigation and possibly remediation in accordance with the FFA. The groundwater remediation is an interim measure pending an evaluation of its effectiveness in actual practice. The 1992 RCRA Permit specifies that the overall corrective action will be implemented in phases and will be periodically reevaluated. The scope of the Phase I action coupled with possible future actions (i.e., Phase II, Phase III) will serve to provide protection to human health and the environment.

V. Summary of Operable Unit Characteristics and Contaminants

Waste effluents from F-Area chemical separations facilities including the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads were discharged to the F-Area HWMF. Significant amount of nitrate and caustic were discharged to the basins. Tritium was the primary radioactive constituents (99%) released to the basin. According to the RCRA Permit the following constituents has been detected at concentrations above the Groundwater Protection Standards (GWPS) established in the 1992 SRS RCRA Permit:

Hazardous Constituents (South Carolina Hazardous Waste Management Regulations 264.94 Table 1)

Arsenic	Barium
Cadmium	Chromium
Lead	Mercury
Selenium	Silver

Hazardous Constituents (SCHWMR 261 Appendix VIII/264 Appendix IX)

Antimony	Benzene
Bis(2-ethylhexyl) phthalate	Cobalt
Copper	Cyanide
Nickel	Phenols
Tetrachloroethylene	Thallium
Trichloroethylene	Trichlorofluoromethane
Vanadium	Zinc

Non-Hazardous Constituent
Nitrate

Specific Radionuclides + Indicators

Gross Alpha	Gross Beta (i.e., Nonvolatile Beta)
Total Radium (226 + 228)	Tritium
Americium-241	Cesium-137
Curium-242	Curium-243/244
Curium-246	Cobalt-60
Iodine-129	Plutonium-238
Plutonium-239/240	Radium-226
Radium-228	Strontium-90
Technetium-99	Thorium-228
Thorium-230	Uranium-233/234
Uranium-234	Uranium-235
Uranium-238	

Statistically Derived Constituent

Uranium

VI. Summary of Operable Unit Risks and Basis for Remedial Action

The maximum detected level of several contaminants (e.g, tritium, cadmium, and lead) in the F-Area groundwater currently exceed the National Primary Drinking Water Standards, and applicable state standards. However, potential exposures to the general public are minimized by the distance from the operable unit to the site boundary, by natural attenuation and radionuclide decay, by institutional controls,

and by dillution in receiving streams. In addition, all off-site contaminant concentration are well below drinking water and other applicable standards. This corrective action will address the potential ecological impacts at the seeplines along Fourmile Branch, and will also serve to address the ambient water quality standards in Fourmile Branch by remediating this operable unit. The remediation of the F-Area Groundwater Operable Unit will be designed to meet, as far as practicable, the Phase I groundwater protection standards outlined in the RCRA permit.

VII. Description of Alternatives

Three alternatives were evaluated for remediation of contamination at the F-Area Groundwater Operable Unit. Each alternative is described below.

1. No Remedial Action.

2. Groundwater Recovery and Hydraulic Control with treatment of mobile hazardous constituents and radionuclides (except tritium and nitrates) and discharge of treated water to a surface stream.

3. Remedy as provided in the SRS RCRA Permit, i.e., groundwater recovery and hydraulic control with treatment of mobile hazardous constituents and radionuclides (except tritium and nitrates) by treatment and injection of treated water into the shallow aquifer at the upgradient extent of the plume.

All three of the alternatives include groundwater monitoring, engineering and administrative controls to guard against inadvertent human and ecological exposure to contaminated water.

Alternative 1. No Remedial Action

Under Alternative 1, no groundwater extraction would be conducted. Concentrations and activity levels of the constituents of concerns would gradually be reduced with time through natural attenuation processes such as dispersion and radioactive decay. Groundwater would continue to discharge low levels of contaminants into surface waters. Institutional controls and long term monitoring of groundwater, surface

water, and ecological conditions would be components of the no remedial action alternative. These activities are already being implemented and associated costs are substantially lower that the other alternatives. The lower cost is due to the lack of capital expenditures, such as the procurement of a treatment system and the installtion of wells. Potential risks to off-site receptors would be identified through monitoring and minimized by institutional controls.

Alternative 2. Groundwater Recovery, Treatment, and Discharge to a Surface Stream.

This alternative would consist of recovery of contaminated groundwater via extraction wells and treatment to remove hazardous constituents and radionuclides (except tritium and nitrates). The treated water would be discharged through an NPDES permitted outfall into a surface stream at SRS. A practical technology to remove tritium from the groundwater does not exist. Therefore, tritium would be released to the surface water. Hazardous constituents and radionuclides removed from the groundwater would be immobilized and disposed in permanent disposal vaults at SRS.

Discharge of the treated water would shorten the flow path of tritium-contaminated groundwater to surface streams. This strategy would allow less time for tritium decay before water discharges to surface waters. In the short term this system could increase specific activities of tritium in the onsite receiving streams. However, the impact to the Savannah River would be negligible due to dispersion and dilution. (The specific activity of a radionuclide is equivalent to the concentration of a chemical).

Institutional and engineering controls, plus long-term monitoring of groundwater and surface water conditions would be part of Alternative 2, and anticipated to be lower in cost than Alternative 3.

Alternative 3. Groundwater Recovery, Treatment, and Injection

Alternative 3 is the remedy provided in the 1992 RCRA permit. It provides three phases for the recovery of contaminated groundwater via extraction wells and treatment of hazardous

constituents and radionuclides (except tritium and nitrates). The extraction wells would capture the plume as defined by the 10,000 picoCuries per milliliter (pCi/mL) tritium contour (Figure 3). Groundwater modeling was used to determine optimal well locations and pumping rates. Unlike Alternative 2, the treated water would be injected into the shallow aquifer at the upgradient extent of the plume. Meeting treatment standards provided in the RCRA permit in the injected water is the remedial goal of Phase 1.

Although tritium will not be removed from the groundwater, injection of the treated water will partially control the movement of tritium-contaminated water. Upgradient injection will lengthen the tritium flow path to the seep lines, allowing more time for tritium decay before the plume water discharges to the receiving stream. This will reduce tritium discharges to the onsite receiving surface stream.

Institutional and engineering controls, plus long-term monitoring of groundwater, surface water, and ecological conditions would be part of Alternative 3. This alternative could be operational in accordance with the schedules in the SRS RCRA Permit, and it would have the highest costs of the three alternatives.

<IMG SRC 0495224B>

Table 1. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance

Actions	Requirements	Prerequisites	Federal Citation	South Carolina Code of Laws
LOCATION - SPECIFIC				
Groundwater Remediation	Establish a Corrective action program	Measurement of hazardous constituents in the groundwater which	40 CFR 270.14 40 CFR 264.92-100	SC - R.61-79.270.14 SC -

R.61-79.264.92 - 100 (Implemented by SRS RCRA Permit)		exceed established concentration limits. Substantive requirements applicable	the
CHEMICAL - SPECIFIC			
Protection of the general public from all sources of radiation	The general public must not receive an effective dose equivalent dose equivalent greater than mrem/year	Dose received by the general public from all sources of radiation exposure at a DOE facility TBC guidance	DOE Order 5400.5
Worker Protection	Maintain worker exposures to "as low as reasonably achieavable" (ALARA)	Internal and external sources of continuous exposure to occupational workers at a DOE facility - TBC Guidance	DOE Order 5480.11
	Maximum exposure to occupational workers: 5 rem/year (stochastic); 50 rem/year (nonstochastic) effective dose equivalent	Internal and external sources of continuous exposure to occupational workers at a DOE facility - TBC guidance	DOE Order 5480.11

Table 1. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance (cont'd)

Citation South Carolina Code of Laws	Actions	Requirements	Prerequisites	Federal
	ACTION- SPECIFIC			
SC - R.61-9	Water Treatment	Discharge limits will be established in the permit	Discharge of regulated constituents in water - Substantive requirements applicable	
SC Pollution Control Act Title 48-1-10	Stormwater discharge	Prepare a Notice of Intent in accordance with NPDES SC 1000000	Land Disturbance activities over 5 acres - Applicable	
SC 72-300	Erosion Control	Develop a plan for erosion sediment control	Land disturbing activities - Applicable	
SC R.61-71	Well Construction	Construction by a certified driller is required	Drilling water wells - Applicable	
144-147 SC R.61-7I		Standards for construction, maintenance, and operation of all wells	Drilling Water wells - Applicable	40 CFR
SC R.61-87.4		Standards for construction of injection wells	Construction injection well - Applicable	
	Discharge of treated water to groundwater	Injection of any waters to groundwaters of the State by means of an injection well is prohibited except as authorized by a	Discharge to injection wells - Substantive requirements applicable	

		Department permit or rule	
S.C. Pollution Control Act Title 48-1-1 I0	Wastewater Treatment	State of S.C. requires a permit to build and a wastewater facility	Construction and operation of industrial wastewater treatment facility - Substantive requirements applicable

Table 1. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance (Cont'd)

Actions	Requirements	Prerequisites	Federal Citation
South Carolina Code of Laws			
Wastewater Treatment (cont'd)	A NESHAP evaluation to determine if source of radionuclide emission required EPA approval	Radionuclides other than radon from DOE facilities (Air discharge may or may not be a part of the selected treatment process) - TBC Substantive requirements may be applicable	40 CFR 61.96
Secondary Waste Disposal	Disposal in a low level waste disposal facility	Generation of Low Level radioactive secondary waste - TBC guidance	DOE Order 5820.2A

Acronyms used in Table

TBC = to be considered
CFR = Code of Federal Regulations
DOE = Department of Energy

EPA = Environmental Protection Agency
NPDES = National Pollutant Elimination System
NESHAP = National Emissions Standards for Hazardous Air Pollutants
UIC = Underground Injection Control

VIII. Summary of Comparative Analysis of Alternatives

Each of the remedial alternatives was evaluated using nine criteria established by the National Contingency Plan. The criteria were derived from the statutory requirements of CERCLA Section 121. The results of the evaluation are presented in Table 2.

Description of Nine Evaluation Criteria

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) - addresses whether remedy will meet all of the ARARs of other federal and state environment statutes.

Overall Protection of Human Health and the Environment - addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls or institutional controls.

Long-term Effectiveness and Permanence - refers to the magnitude of residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

Short-term Effectiveness - refers to the speed with which the remedy achieves protection, as well as the potential for a remedy to create adverse effects on human health and the environment that may result during the construction and implementation period.

Reduction of Toxicity, Mobility or Volume Through Treatment- assesses reduction of toxicity, mobility, or volme through treatment, including how treatment is used to address the principal threats posed by a media-specific operable unit.

Implementability - assesses the technical and administrative feasibility of a remedy, including the

availability of materials and services that may be used to implement the chosen solution.

Cost - includes capital and operation and maintenance costs.

State Acceptance - indicates whether the state concurs with, opposes, or has no comment on the preferred alternative based on its review of the proposed action.

Community Acceptance - will be assessed in the Record of Decision following a review of the public comments received on the proposed interim actions.

IX. Selected Remedy

The SRS RCRA permit is viewed as the primary decision-making authority. Alternative 3 (groundwater recovery, treatment and injection) is the corrective action described in the 1992 RCRA permit. This action has been determined to be protective of human health and the environment under CERCLA, and therefore, no additional corrective action under Phase I is necessary at this time.

Table 2. Evaluation of Alternative Actions Considered for Remediation of Groundwater Contamination.

Evaluation Criteria	Alternative I No Action	Alternative 2 Pump-treat-dischargeto stream	Alternative 3 Pump-treat-inject (RCRA permit)
Overall Protection of Human Health and the Environment	This alternative is the least protective of human health and the environment. If groundwater above the GWPS continues to seep	In the short term, this alternative will increase tritium flux to the Savannah River (levels will remain below DWS).	This alternative will minimize tritium discharge to the wetlands, streams, and ultimately to the Savannah River. This

protective health and	along Fourmile Branch uncontrolled, then some measure of human and ecological impact may occur.		alternative is of human environment.
Compliance with treatment ARARs constructed compliance with treatment Treated will meet Injection permit and off. treatment Clean Air regulations. Clean this will meet levels.	This alternative will not be in compliance with the Groundwater Protection Standards as contaminant concentrations in the groundwater and local onsite surface water exceed primary drinking water standards.	This water treatment unit will be constructed in full compliance with wastewater treatment regulations. Treated groundwater will meet NPDES requirements and off-gas from the treatment unit will meet Clean Air Act regulations. Clean up goals for this alternative will be based on drinking water standards (with the exception of tritium).	The water unit will be in full wastewater regulations. groundwater Underground Control (UIC) requirements gas from the unit will meet Act up goals for alternative RCRA permit
Long-term effectivenss (except and permanence and nitrates) will from the and low level waste vaults Tritium	Adequacy of this alternative will be assessed by monitoring.	Contaminants (except tritium and nitrates) be removed from the groundwater and disposed of in low level radioactive waste vaults at SRS. Residual risk is	Contaminants will tritium be removed groundwater disposed of in radioactive at SRS.

expected to be minimal. Adequacy of this remediation will be assessed by monitoring.

discharge to surface water will be minimized. Residual risk is expected to be minimal. Adequacy of this remediation will be assessed by monitoring.

Table 2. Evaluation of Alternative Actions Considered for Remediation of Groundwater Contamination.
(cont'd)

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Pump-treat-discharge to stream	Alternative 3 Pump-treat-inject (RCRA permit)
Reduction of toxicity, mobility, or volume through treatment	None	Water treatment process will remove contaminants (except tritium and nitrates) from the groundwater, reducing toxicity. Tritium release to surface water may be increased; however, tritium levels in the Savannah River will	Water treatment process will remove contaminants (except tritium and nitrates) from the groundwater, reducing toxicity. Tritium release to surface water will be reduced by allowing a longer time for

radioactive decay of tritium before it discharges to surface water.		remain well below drinking water standards.
Short-term effectiveness Groundwater recovery and treatment will immediately reduce the amount of contaminants from discharging to wetlands and streams. Tritium release to surface water will immediately be reduced by allowing a longer time for radioactive decay of tritium before it discharges to surface water.	This alternative does not provide a short-term remedy for preventing discharges of contaminated groundwater to wetlands, surface streams and ultimately the Savannah River.	Groundwater recovery and treatment will immediately reduce the amount of contaminants (except tritium and nitrates) from discharging to wetlands and streams. Tritium release to surface water will be increased; however, tritium levels in the Savannah River will remain well below drinking water standards.
ince risks to the offsite population are minimal, no measures to protect the community will be required during remediation and during the time period before remedial goals are met.		S Since risks to the offsite population are minimal, no measures to protect the community will be required during remediation and during the time period before

remedial goals are met.

Protection of workers will be required to eliminate risks associated with handling and treatment of radioactive materials.

Table 2. Evaluation of Alternative Actions Considered for Remediation of Groundwater Contamination.
(cont'd)

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Pump-treat-discharge to stream	Alternative 3 Pump-treat-inject (RCRA permit)
Implementability	This alternative is already in place.	Water treatment processes to remove contaminants of concern (except tritium and nitrates) are commercially available.	Water treat processes to remove contaminants of concern (except tritium and nitrates) are commercially available. Technology to inject treated water into an aquifer exists; however, there may be operational problems with such a

. Some pment may be ed before the ion system design finalized.			system develo requir inject can be
Cost Capital Cost = approximately $16 million. Maintenance & Operation = estimated between $2 and $3 million per year.	Capital Cost = None Maintenance & Operation = Groundwater Monitoring and Reporting Costs	Capital Cost = approximately $16 million. Maintenance & Operation are probably less than the preferred alternative because surface discharge is less expensive to operate than an injection field.	to be
State Acceptance alternative has accepted by, SCDHEC. A RCRA requiring a corrective action plan pump-treat-inject to remediate groundwater contamination has been issued.	During negotiations with regulators, it was indicated that this alternative would not be acceptable to SCDHEC.	During negotiations with regulators, it was indicated that this alternative would not be acceptable to SCDHEC because it would not minimize tritium discharge to surface waters.	This been permit for
Community Acceptance criterion will be completed following	This criterion will be completed following public review.	This criterion will be completed following public review.	This public

review.

X. Statutory Determination

The National Contingency Plan (40 CFR 300.430(e)(9)) sets forth nine evaluation criteria that provide the basis for evaluating alternatives and subsequent selection of a remedy. The selected alternative, Alternative 3, was evaluated with respect to the five statutory findings, as required for interim actions under CERCLA. The results of the evaluation are as follows:

Protection of Human Health and the Environment. Alternative 3 will mitigate risks of exposure to contaminated surface water by minimizing discharge of contaminated groundwater to the adjacent wetlands and stream. In addition, removal of hazardous constituents and radionuclides (except tritium and nitrates) will reduce the future risk of exposure to contaminated groundwater by ingestion.

Attainment of ARARs. All ARARs, as identified in Table 1, pertaining to the treatment and disposal of contaminated groundwater and injection of treated water will be met by the proposed alternative.

Cost Effectiveness. Alternative 3 has significantly higher operating and maintenance costs than the other alternatives, because the injection system is expected to be a long-term and high maintenance operation. However, operation of any treatment facility which will handle radioactive materials will be costly.

Use of Treatment Technologies and Permanent Solutions to the Maximum Extent Practicable. The chemical water treatment process represents utilization of treatment technologies to the maximum extent practicable. No practical treatment is available for tritium.

Reduction of Mobility, Toxicity, and Volume. The selected alternative utilizes extraction and treatment of contaminated groundwater in a way that minimizes migration of contaminants to surface waters and reduces the mass of contaminants in the plume. Hazardous constituents and radionuclides removed from

the groundwater will be immobilized and deposed in permanent disposal vaults at SRS. The system will be designed to ensure that the secondary waste sludge will not be a hazardous waste.

XI. Explanation of Significant Changes

There were no significant changes.

APPENDIX A

References for Development of ROD Format

EPA, 1991. "Guide to Developing Superfund No Action, Interim Action, and Contingency Remedy RODs, "OSWER Publication 9355.3-02FS-3, U.S. Environmental Protection Agency, Washington, D.C., April 1991.

Weeks, Victor, 1993. "Regarding Records of Decision, F-Area and H-Area, Savannah River Site, Aiken, South Carolina", Letter to Goidell (DOE), Savannah River Site, Aiken SC, April 14, 1993.

WSRC, 1992. "Draft RCRA Facility Investigation/Remedial Investigation Program Plan," WSRC-RP-89-994, Rev. 1, Chapter 15, Westinghouse Savannah River Company, Aiken, South Carolina, May 1992.

APPENDIX B

RESPONSIVENESS SUMMARY

During the 34 day public comment period, a request for a public meeting was received. The public meeting was held on January 9, 1995, in the North Augusta Community Center, North Augusta, South

Carolina. The public comment period was extended an additional 30 days so that comments could be submitted.

DOE has received comments regarding the F&H Areas Groundwater Operable Units and they have been addressed in this Responsiveness Summary. These comments are available for review in the Administrative Record.

During the public comment period, several letters were submitted from individuals and groups regarding the proposed interim action. This Responsiveness Summary addresses the general comments and concerns from the public meeting and specifically addresses the written comments received. The summary is divided into three sections: 1) general responses to specific comments and questions raised during the public meeting, 2) responses to written comments received on questionnaires at the public meeting and 3) specific responses to written comments received during the public comment period. Please note that some of the specific comments are addressed in the general response section due to common questions and concerns.

Many of the comments that DOE has received relating to this type of project question the soundness of the planned remediation. DOE is required to continue the groundwater remediation project under the terms of the Resource Conservation and Recovery Act (RCRA) Hazardous Waste Permit that is issued by the State of South Carolina in conjunction with the United States Environmental Protection Agency, (EPA). This permit sets forth all the requirements with which DOE is obligated to comply. Prior to issuance of the permit, the South Carolina Department of Health and Environmental Control (SCDHEC) issues a draft permit that is made available to the public and the DOE for a 45 day comment period. Any interested party can request a public hearing to discuss concerns regarding the conditions set forth in the draft permit. SCDHEC will evaluate these concerns prior to issuing a final hazardous waste permit. Many of the comments received are in regards to the appropriateness of this corrective action. These comments will be addressed through the SCDHEC RCRA renewal permitting process during the 45 day public comment period.

The following questions were extracted from the public meeting transcript and are numbered sequentially for ease of reference as they appeared in the transcript.

1. How does the cost effectiveness of this program relate to Grumbly's six goals?

Response: Grumbly's six goals are:

Eliminate and manage the urgent risks in our system
Emphasize health and safety for our workers and the public
Establish a system that is managerially and financially in control
Demonstrate tangible results
Focus technology development efforts on identifying and overcoming obstacles to progress
Establish a stronger partnership between the DOE and its stakeholders

These six Grumbly goals are Department of Energy programmatic goals. In terms of there goals the F- and H-Area projects do not rate highly in terms of managing urgent risks. However, SRS

must work within the framework of existing laws and regulations in making decisions regarding the cleanup of F- and H-Area Groundwater Operable Units.

2. Provide scientific justification?

Response: As part of the development of the Corrective Action Program contained in the RCRA Part B HWMF Permit, 12/3/90, SRS evaluated severaI potential ground water remediation technologies for implementation at the F&H Seepage Basins. Based on a thorough evaluation of various treatment alternatives, which included evaluations of Treatment Effectiveness, Constituents Treated, Treatment of Seep Area, Regulatory Requirements, Implementation Schedule, Capital Cost, etc., SRS selected the ground water removal with the surface treatment remediation alternative. Further studies were performed to evaluate the potential surface treatment technologies, and potential treated effluent discharge alternatives. A request for proposal has been sent out for bid 12/28/94. A commercially available water treatment unit will be selected based on technical evaluation of the vendor bids, cost, and the ability of the unit to meet or exceed the clean up levels.

Alternate remedial technologies have been evaluated as part of technology selection for the RCRA corrective action plan. Evaluation criteria included treatment effectiveness, feasibility, ability to

satisfy regulatory requirements, and capital cost. Pump and treat was chosen largely because it is a developed technology for groundwater remediation. A demonstrated technology can be implemented more quickly (and usually more inexpensively) than an innovative technology which would require extensive laboratory and field testing prior to implementation.

Potentially applicable technologies which have been considered include immobilization techniques such as deep soil mixing and in-situ vitrification. Other potentially applicable technologies are those which remove or immobilize contaminants in-situ (such as electrokinetic migration and magnetic separation.) Introduction of chemicals into the subsurface which would cause precipitation of contaminants or mobilize them for faster removal have also been considered. All of these were eliminated from consideration because of the expense involved in development and testing of these technologies, and because of the uncertainty of their effectiveness.

3. How long will the process take?

Response: The duration of the entire remedial process has not yet been determined. The RCRA Part B permit application calls for remediation to be accomplished in phases. Phase 1 is expected to operate for five years. The effectiveness of the corrective action will be evaluated at the conclusion of Phase I. At that time, a decision will be made whether to discontinue operation of the remedial system, to continue operation without modification, or to modify the system to enhance its performance in the next phase.

4. What kind of a standard are you cleaning up to? Residential or Industrial? Are you cleaning up to a residential standard? If this is being cleaned up to an industrial standard, would this even have to be done? So the reason to do this is to reduce the levels in the GW and at the seepline to get it to a residential standard? And if we were talking about an Industrial standard, it would strictly be for the tritium contamination, is that right? Discussion on land use including if industrial use, a different standard should be applied. Is that land use policy before you go in and spend money?

Response: The clean up levels, Groundwater Protection Standards (GWPS) are based on drinking water standards and background levels. These values are mandated by the RCRA permit and do not reflect either an industrial or residential standard as defined by EPA Risk Assessment Guidance for Superfund sites (RAG's). Residential standards are considerably more stringent than

the
GWPS for some constituents and less restrictive for others. Industrial standards as defined by EPA
guidance are more restrictive than the GWPS for some constituents and less restrictive for others.

RCRA does not recognize any difference between residential and industrial scenarios. RCRA is a
regulation that was developed to address mainly active, industrial sites--so there was not a need to
make distinctions between residential and industrial for the regulated units under the RCRA
permit.

5. Ability to Capture Contaminants? (referring to which COC's, ie. metals and radionuclides, will be
cleaned up)

Response: The medial system is being designed to extract contaminated water from the ground,
treat it to remove hazardous constituents and radionuclides (except tritium and nitrates), and inject
the treated water back into the shallow aquifers. In order to achieve clean up goals, the
contaminants must be captured by the extraction well network. Any contaminants which are in the
water and are mobile are expected to be capture and treatment by the pump and treat system.

Radionuclides and hazardous metals generally adsorb onto soil particles, which can inhibit their
capture by a pump and treat system. However, during operation, solutions with very low pH were
placed in the basins. The low pH facilitated the movement of hazardous metals and radionuclides
into the groundwater. Hazardous metals and radionuclides are present in the groundwater
downgradient of the basins, and in surface water at the seepline (wetlands), indicating that these
constituents are in the water and are mobile. Therefore, these constituents are expected to be
captured and treated by the proposed corrective action while the pH remains low in portions of the
plume. However, the pH is expected to rise as the system begins to operate which will reduce the

mobility of many of the metals and radionuclides.

Evaluation of the corrective action will take place at the conclusion of Phase 1. Modification of the system to enhance capture of any contaminants which remain in the groundwater will be considered at that time.

6. There is essentially no difference in the metals between the Four Mile Creek and the Savannah River?

Response: The levels of hazardous metals are below primary drinking water standards in the Savannah River. Cadmium has been measured above the primary drinking water standard in Four Mile Creek. Lead, cadmium and zinc exceed ambient water quality standards in Four Mile Creek.

7. When tritiated water is injected upgradient, how long will it take to reach the surface water and at what rate will it be decaying? To what degree will the tritiated water reinjected upgradient decay? Do we have a model as to what degree the tritium will decay by the time it gets to the surface water? Can you supply how much tritium will ultimately go into the creek?

Response: The pump-treat-inject system takes advantage of the short half life of tritium to minimize the migration of tritium from the F and H Area seepage basin plumes to surface water and ultimately the Savannah River. The half life of tritium is 12.3 years. This means that every 12.3 years half of the tritium has decayed. Groundwater extracted at the downgradient edge of the plume will be treated to remove hazardous constituents and radionuclides except tritium and nitrates. The treated water will be injected into the shallow aquifer upgradient of the plume. Based on groundwater modeling contained in the 1992 Part B Permit Application, It is estimated that it will take 3-5 years for injected water to travel back to the extraction network and be recaptured and reinjected for another 3-5 year cycle.
This system will provide a measure of hydraulic control which will minimize tritium discharge to adjacent wetlands, steams, and ultimately the Savannah River. The total estimated reduction in tritium discharged to surface water due to implementation of the proposed Phase I corrective action based on groundwater medeling is approximately 3000 curies. The total estimated tritium release

from F&H Areas to Fourmile Creek between the years of 1997 to 2027 is estimated to be 16,690 curies.

8. Describe the treatment system that takes place at the surface? Have you specified a particular treatment technology?

Response: The actual treatment process has not been determined. A commercially available water treatment unit will be used. A particular treatment technology has not been specified. Selection of the actual unit will be based on a technical evaluation of vendor bids and cost considerations. Technical evaluation will be based on the ability of the unit to meet or meet or exceed clean up levels. Performance specifications will require that any secondary waste generated will be non-hazardous. However, it will ultimately be up to the supplier to provide a commercial treatment technology that will meet the water clean up standards and the requirements of the specification. SRS has performed an evaluation of various treatment technologies, which included evaporation, reverse osmosis, ion exchange, chelation, and chemical precipitation.

9. Has the RFP gone out for bid?

Response: The RFP went out for bid on December 28, 1994.

10. "Found tritium 1500 feet down in wells in Georgia."

Response: The results of the tritium underflow study indicate that there is not any tritium migrating from the SRS to Georgia under the Savannah River. The tritium in the wells in Georgia was found to come from rainwater. The rainwater contained small amounts of tritium from atmospheric releases of tritium.

11. Will the drawdowm and reinjection increase the migration? If so, how much? What effect will drawdown and migration have on migration of radionuclides and other chemicals in the soil? Will drawdowm (and reinjection) increase the flow of nuclides more so than if you had left it the way it is? Will drawdown increase rate of migration? soil effects? radionuclides?

Response: The extraction / injection system is designed to change the flow path and increase the migration rate of contaminated plume water. Flow towards the extraction wells will be increased by pumping and drawdown. This will enhance delivery of the contaminants to the treatment unit. It is not xpected to increase migration of contamination towards surface water or any environmental receptors.

The effect of pumping and drawdown on migration of radionuclides and chemicals in the soils is expected to be minimal. In the saturated zone, the greatest fraction of contamination is thought to exist in the groundwater and is not expected to be adsorbed onto saturated sediments. Any contamination which is bound to sludge and soils in the unsaturated zone at the waste sites has been isolated from the groundwater by source control measures. Low permeability caps provide source control by deflecting rainwater from infiltrating into the closed waste site and thus protecting against transportation of contaminants into the groundwater. Pumping and drawdown will have no direct effect on the unsaturated zone.

12. "...this IAPP position is very negative and very technically oriented and very difficult for the common person who does not work on the site to understand." "Why was Rev 1 (IAPP) so negative and difficult to read when Rev 0 was much easier?"

Response: SRS will attempt to make these type of documents easier to read in the future. It can be a difficult balance to insert the appropriate amount of technical discussion for the regulators and reviewers, and at the same time summarize the proposed action in clear and concise manner. The Rev 1 document incorporated DOE-HQ, EPA and SCDHEC comments. Some of the comments requested incorporation of more technical discussion.

13. "...public can influence the decision-making process.."
Response: EPA, SCDHEC and DOE encourage and support public participation in the environmental restoration process. Both RCRA and CERCLA require public review of the

remediation decisions. These Proposed Plans document that the RCRA remedy chosen to remediate contaminated groundwater at F&H-Areas is protective of human health and the environment and meets the requirements of CERCLA. The RCRA decision had already been subject to the public review process and had been deemed acceptable. The public will be allowed another opportunity to provide comment in the RCRA process in the near future when the draft permit renewal is issued for public comment.

14. "Why does the Bulletin indicate that our minds are made up for the selected alternative when the IAPP says the public will be given the opportunity to participate in the selection of the remedial action."

Response: The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) are the regulations implementing CERCLA. The NCP gives specific requirements for selecting a remedy for a site. After identifying the alternative that best meets the requirements, the lead agency presents the alternative to the public. The proposed plan describes the remedial alternatives analyzed by the lead agency, presents a preferred remedial action alternative and summarizes the information relied upon to select the preferred alternative. The proposed plan is then made available to the public for review.

After review by the public the proposed plans are then re-evaluated to see if the preferred alternative provides the best balance of trade-offs, factoring in any new information or public perspective. The Bulletin identified the preferred remedy in the Proposed Plan and gave information about the public comment period.

15. "...the only action is the one done under RCRA 2 years ago or do we have a right to say which alternative we wish to have brought up before you folks.."
"...What makes me think that my opinion in the selection of the alternatives counts? Has anyone listened to what DOE is saying.?"

Response: The Proposed Plans for the F&H Groundwater Operable Unit state that no additional actions are necessary under CERCLA to address the contaminated groundwater. The RCRA actions are independent and required by other permits. There were no additional remedial actions proposed for the F&H-Area Groundwater Operable Unit at the public meeting.

16. How was SRS scored for placement on the National Priority List?

Response: The SRS was placed on the NPL December 21, 1989. SRS commented on the proposed listing to EPA during the allowable comment period. Specific comments regarding how the site was ranked are not specifically relevant to these Proposed Plans. However, this information can be obtained from Region IV EPA.

17. The H-3 Basin does not fall under RCRA and it is also the primary source for the release of mercury, and this has not been addressed?

Response: Basin H-3 was not considered a regulated unit under RCRA. However, the NCP gave EPA broad authority to determine how best to use its authorities under CERCLA, RCRA, or both to accomplish appropriate cleanup action at a site, even where the site is listed on the NPL. When the site is an active, RCRA-permitted facility, EPA may consider whether the use of RCRA or CERCLA authorities (or both) is most appropriate for the accomplishment of cleanup at the site. The cleanup plan would be discussed in the InterAgency Agreement, or the Federal Facility

Agreement (FFA) at the SRS. The DOE, EPA and SCDHEC agreed that cleanup would be best accomplished by integrating it into the existing RCRA action. This not only accomplished it faster and cheaper, but allowed the entire complex to be closed and monitored as one unit.

18. The National Academy of Sciences finds pump and treat an incomplete remedial activity? What would it recommend as an alternative?

Response: The National Academy of Sciences (NAS) performed an extensive review of alternatives for groundwater cleanup, which included a review of pump and treat systems. The NAS stated that based on a review of these systems, that the effectiveness of the pump and treat technology to restore contaminated aquifers seems quite limited and subsequently, this has led to a widely held view that pump and treat systems should not be used for groundwater

remediation.

The conclusions of this report are based on a review by the NAS of only 77 sites utilizing the pump and treat technology. The NAS has indicated that there are greater than 3000 pump and treat units currently in operation. Based on a review of the 77 listed sites and their associated hazardous wastes, only 3 sites were identified to contain metals, and the remainder all contained primarily organic hazardous wastes. Consequently, the results reported certainly do not represent the overall effectiveness of the pump and treat technology for all hazardous waste streams. Although the pump and treat technology appears to be limited, the NAS identifies several factors to be considered in utilizing pump and treat as a possible remediation method. The key technical reasons for the difficulty of cleanup include the following:

Physical heterogeneity: The subsurface environment is highly variable in its composition and contaminant migration pathways are often extremely difficult to predict.

Presence of nonaqeous-phase liquids (NAPL's): This includes many common contaminants like oils, gasolines, etc., that do not dissolve readily in water.

Migration of contamination to inaccessible regions: Contaminants migrate to inaccessible areas of the flowing groundwater.

Sorption of contaminants to subsurface materials: Contaminants adhere to solid materials in the subsurface.

Difficulties in characterizing the subsurface: The subsurface cannot be viewed in its entirety and is usually only viewed through a small number of drilled holes.

Based on a review of the above technical difficulties and the 77 sites reviewed by the NAS, which all contained primarily organic waste streams, it is apparent that the effectiveness of the pump and treat technology is very site specific. The difficulties noted above are not of major concern at the F&H Groundwater Operable Units, ie., the subsurface environment and contaminated pathways have been extensively characterized, groundwater monitoring indicates no presence of NAPLs, the plumes exist in shallow easily accessible aquifer units, and studies indicate that sorption of contaminants to subsurface materials in minimal. Finally, the NAS provides several alternative technologies or "enhanced pump and treat systems", i.e. soil vapor extraction, bioremediation, air sparging, etc., and states that these methods, show promise, but they are in the development stage, and their long term effectiveness has not yet been determined. These techniques are applicable to remediation of volatile organics (ie. TCE, PCE), but are not effective for cleaning up

metals and
radionuclides such as those that exist at F&H seepage basins.

19. How much will the proposed remediation cost? $270 million? Have any alternatives to reduce the operating cost by reducing the life cycle primarily been investigated as part of this? What technologies for reducing operating costs were looked at, if any, and at what point in the future operating scheme or phases is that expected to be done?

Response: Table 2 in each of the interim Action Proposed Plans for F&H Areas addresses the estimated costs for each of the alternatives. Alternative 3 (pump and treat system) capital costs are estimated at $16 million per area ($32 million combined) and the annual operating costs are estimated at $2 million to $3 million per area ($4 million to $6 million combined). Phase I will

operate for 5 years. Capital costs and operation of Phase I are estimated at approximately 45 million dollars. Future phases may incur additional costs. Total life cycle costs are dependent upon further evaluation of subsurface conditions and evaluations of the effects of pump and treat once the system is operational. Studies are underway across the DOE complex to identify and develop technologies which will enhance remedialion and reduce life cycle costs.

20. "Did you purposely plan the public comment period over Christmas? Why was this meeting so hurriedly called?"

Response: The public comment period is always scheduled as soon as possible after concurrence of the Proposed Plans by the three agencies. The comment period is usually only 30 days and it was extended because of the holidays.

21. "Now that we've had the request for 90 days, I'm sure the comment period will be extended."

Response: The public comment period was extended through February 15, 1995.

22. What amounts of heavy metals & nuclides are reaching the surface waters and how much, what sort of level?

Response: In the report titled "Semi-Annual Sampling of Fourmile Branch and Its Seeplines in the F and H Areas of SRS: February 1993, July 1993, and April 1994," results from these sampling events suggest that the seeplines in both F and H Areas and FMB continue to be influenced by contaminants migrating from the F and H Area Seepage Basins. The analytes exceeding groundwater protection standards or maximum concentration limits as indicated in this report are shown below;

Analyte	FMB	F-Seep	H-Seep	Standard	Units
Gross Alpha	3	20	16	15	pci/l
Non-Vol. Beta	28	614	426	50	pci/l
Tritium	1070	2030	4470	20	pci/ml
Sr-90	10	227	80	8	pci/l
Ra-226	5	14	32	20	pci/l
I-129	2	2	9	1	pci/l
Cadmium	6	15	16	5	æg/l
Lead	3	3	3	15	æg/l
Iron	668	28,300	7570	300	æg/l
Aluminum	109	5650	90,000	50	æg/l
Manganese	41	2760	891	50	æg/l
Nitrate	2000	50,000	31,000	10000	æg/l
Zinc	21	184	222	5000	æg/l

23. What contaminants exceed the ambient water quality standards that effect ecological issues?

Response: All analytes listed in the response to question #22 are also listed as ecological chemicals of concern. The metals that have exceeded the Ambient Water Quality Criteria (AWQC) for these locations are Cadmium, Lead, and Zinc. The radionuclides listed

do not have a
corresponding AWQC standard.

24. Does water in the wetlands (seepline) exceed drinking water standards?

Response: See response to question #34.
Levels of radionuclides and hazardous metals have been measured above primary drinking water
standards at the seepline in both F and H Areas.

25. Explain gross alpha and gross beta measurements? p.70.

Response: The gross alpha measurment is representative of alpha emitting raclionuclides (ie.
Uranium, Plutonium), and the nonvolatile beta measurement is representative of the beta emitting
radionuclides (ie. Strontium, Cesium). The EPA has set drinking water standards for these
measurements, which are 15 pci/l for gross alpha and 4 mrem (approximately 50 pCi/l) for
nonvolatile beta.

26. "Considering that treatment for this site has already progressed to the point where there's
procurement underway, under the RCRA decision, what in reality does this process under
CERCLA have to do with the ultimate treatment of the site?"

Response: To fulfill the requirements under the CERCLA process, the proposed plans state that no
further action under CERCLA is required to protect the human health and the environment.

27. How come the six treatment alternatives weren't presented to the regulators? How come they are
not in the public document?

Response: The six treatment alternatives were presented to EPA and SCDHEC in the Proposed
Plans for F&H Areas Groundwater Operable Units, Revision 0. During comment review and
negotiations with the Regulators, it was determined that the alternatives that had been previously
rejected should be removed.

28. "Are you familiar with the 11/8/94 Federal Register? Is it true that EPA is proposing to remove the
current requirement for postclosure permits?"

Response: The proposed provisions actually expands the authority of EPA to mandate post-closure care requirements. The proposal would allow EPA or an authorized State to use any other available legal authority as an alternative to the post-closure permit, as long as that authority provides the same level of protection and public participation as does the post-closure permit. The EPA and States had found that for closed or closing facilities they had very little incentive to submit the post-closure care permit applications. They did not want or need a permit to operate. The proposed rule would allow EPA and authorized states to bring an uncooperative facility into compliance through an enforcement action. Facilities that need an operating permit such as SRS, would still have to obtain post-closure care permits for their closed RCRA facilities. This proposal does not change the requirements for corrective action.

29. Haven't you heard lately that everybody's budgets are being cut? Haven't you heard that DOE's budget and that Secretary O'Leary as well as Mr. Grumbly are saying we want prioritization? What is the worst risk?

Response: We acknowledge budgets across the DOE complex will be reduced in the near term. SRS is no exception to the mandate from the Administration and Congress to use fiscal responsibility in planning its work. As such, SRS is evaluating its programs from a total risk standpoint, rather than risk posed to human health and the environment as a sole consideration. The parameters being used to determine total risk include: 1) public health and safety, 2) environmental protection, 3) worker health and safety, 4) compliance with stands, 5) clean-up mission and business efficientcy, 6) safeguards and security, 7) public and community relations, and 8) cost efficiency.

30. What about the GAO report (which criticized the progress of the DOE's cleanup programs and calls for consideration of alternatives such as creating a separate government cleanup commission)?

Response: The GAO Report, entitled Superfund, Status, Cost, and Timeliness of Hazardous Waste Cleanups and dated September 1994 was a general report evaluating the Superfund program across the nation (including federal and private cleanups). This report noted that expenditures for the

Superfund program are higher than expected and that the actual number of sites delete from the NPL remains small. Additionally, federal facility cleanup is slower than nonfederal facility cleanup. No reference could be found regarding creation/formation of a separate cleanup commission.

Another GAO upon (GAO/RCED-95-66, Coordinating Activities Under RCRA and CERCLA, December 12, 1994), examined how DOE coordinated cleanup activities under RCRA and CERCLA and outlines some problems encountered to date with those coordination efforts. The report notes that DOE intends to issue guidance in the spring of 1995 to facilitate this coordination and develop, with EPA and state involvement, model interagency agreement language. Again, no reference regarding the creation/formation of a separate government cleanup commission was found in this report.

31. SCDHEC and EPA, are you aware of any time that you granted SRS authority to pump tritium into the streams at levels that exceed 10,000 pCi? How about ETF?. Isn't that (32K Ci) significantly higher than the 10,000 we are supposedly treating? Tritium is the primary radionuclide in the effluent at the ETF and can not be separated and is currently being discharged to surface streams. What's the difference?

Response: In its implementing regulations (40 CFR 122 in particular), EPA refined the definition of "pollutant" to exclude radioactive materials regulated under the Atomic Energy Act of 1954 (AEA). Currently all discharges of tritium into sitewide SRS steams are regulated by the Department of Energy in accordance with the ALARA program. This information is provided to EPA and SCDHEC in an annual Environmental Report as well as in National Pollutant Discharge Elimination System (NPDES) permit applications. The levels of tritium discharged from the F/H Effluent Treatment Facility into Upper Three Runs Creek are 1-5% of the maximum allowable

levels (ie. 20 pci/ml), well within the safe levels for maintaining all applicable stream uses.

32. "Are we going to have another one of these meetings after you respond to the comments."

Response: Another meeting on the IAPP's is not currently planned.

Written comment received on questionnaire from the F&H Groundwater Public Meeting.

"There must be a better way to get public involvement than this kind of meeting."

Response: As part of the CERCLA process it is require to involve the public in selection, review, and comment of a proposed remedial action. This type of public meeting allows the public the opportunity to openly communicate their concerns, comments, and to go on record with any specific questions. Additionally, the public is given the opportunity to review and provide written comments on a proposed remedial action such as that contained in the F&H Groundwater Interim Action Proposed Plan documents. SRS would welcome any suggestions from the public on how to possibly improve the Public Involvement Program. Please submit any suggestions to:

Mrs. Mary A. Flora
WSRC
1995 Centennial Avenue
Aiken, SC 29803

Written comment received on questionnaire from the F&H Groundwater Public Meeting.

"What is the impact off sit action is taken? Quantify impacts if any against federal criteria and actual risk to public compared to other industries along river. Does the risk justify cost?"

Response: Environmental monitoring and risk assessment work indicate that there is minimal risk to the public if no corrective action is taken.

Revision 1

A

pril 1995

Letter #1 from Mr. Philip Brandt to the EPA

3325 Berkshire Circle
Johnson City, TN 37604
January 16, 1995

U.S. EPA Region IV
Attn: Jeff Crane
345 Courtland Street
Atlanta, Georgia 30365

Dear Mr. Crane:

A public meeting was held at North Augusta, South Carolina on January 9, 1995 on the Savannah River Site F&H Groundwater Proposed Plans. At that time I submitted written comments, however, due to time constraints those comments were incomplete. Attached please find a complete set of comments. Please disregard the original comments.

I am in the process of obtaining additional technical information relevant to the proposed alternative and request an extension of public comments for 90 days due to the time required to obtain information through the Freedom of Information process. In addition, I am requesting that a second public meeting be held after a formal response to all commentors have been completed.

If you need to speak with me directly you can call me at work (615) 734-9141 ext 1316 or home (615) 282-5239.

Sincerely,

Philip Brandt

COMMENTS
ON
F&H GROUNDWATER
PROPOSED PLANS

My name is Philip Brandt. I have a BS in Wildlife and Fisheries Science and three years of graduate study training in zoology and terrestrial ecology. I have over 15 years experience in the regulatory and environmental field including six years at the SRS. Three of those years was spent working for a consultant under contract to the DOE. During that time I provided expert

environmental regulatory support to the DOE. My last three years at SRS, I was employed by the DOE as Senior Waste Management Specialist and as Acting Branch Chief, Environmental Restoration. During my tenure there I was responsible for the RCRA Interim Status closure of the F and H Area Seepage basins and 58 acres of the mixed waste burial ground. Since leaving DOE and the SRS I have continued my environmental career in the commercial sector and have continued to work with both hazardous and radioactive contaminants. Most recently, I managed a removal action involving radioactive and hazardous waste which resulted in a release of the property with no restrictions by the regulating agency. My areas of expertise include both RCRA and CERCLA.

Over the Christmas holidays I became aware of this public meeting and have driven over five hours to be here to presently my comments. The direction the regulatory process has taken and how the public is kept informed and involved, or more importantly not informed, is of a great concern to me.

First I want to provide comments on the environmental facts concerning the Savannah River Site, the F and H area seepage basins and the proposed environmental remedy, facts which have not been properly identified or communicated to the public by the DOE or the regulatory agencies. At issue is whether the contaminated groundwater from the seepage basins pose a threat to human health and the environment. This threat is examined from the perspective of (1) impact on the Savannah River which is a recreation source in the area and a drinking water source for Beaufort, South Carolina and Savannah, Georgia, (2) impact to Four Mile Creek on the SRS reservation into which contaminated groundwater from the basins seep, (3) impact on wildlife and vegetation along the area between Four Mile Creek and where contaminated water seeps onto the land, and (4) impacts on the groundwater and its affects to both onsite and offsite users.

Facts on F and H Area Seepage Basin Operations

Wastewater flows from the F and H Area Separations to the F and H-Area Seepage Basins ceased on November 7, 1988. Liquid effluent that was discharged into the seepage basins is now processed at the H-Area Effluent Treatment Facility. Tritium is the primary

radionuclide in the ETF effluent. Because tritium is a hydrogen atom it cannot be separated from a water molecule which is made up of two hydrogen atoms and an oxygen atom. There is no known practical method for treating tritium contaminated water whether its ground water or surface water. Consequently, tritium is discharged along with the treated effluent into Upper Three Runs Creek under an NPDES permit. In 1989, the first year of full operation for the treatment facility, over 2,000 Curies of tritium were discharged to UpperThree Runs Creek (1). FACT: There is absolutely no difference in the health and environmantal impacts from the tritium that is discharged from the permitted treatment

facility and the tritium that seeps into the Four Mile Creek. Unlike other radionuclides, tritium does not bioaccumulate in animal or plant tissues or in the ecosystemm. There is absolutely no documentation or research that tritiated water onsite has harmed or ever will harm land and aquatic plants and animals. The concern over tritium is the potential dose to people when tritiated water is used as a drinking water source.

Facts on Regulatory, Authority Over Basin Closure and Ground Water Cleanup

Regulatory authority over the closure of the basins is fairly complex and is divided between the State of South Carolina and the EPA under two major laws, RCRA and CERCLA. The state enforces portions of RCRA and includes the regulation of contaminated groundwater from hazardous contaminent such as metals and organic chemicals. However, RCRA does not regulate redionuclides. Authority to regulate radionuclides comes under CERCLA which is administered by EPA. Basin H-3, which last received waste in 1962, is also regulated under CERCLA. RCRA was not enacted then and its rules cannot be applied retroactively. Consequently, any decisions made on groundwater cleanup actions for Basin H-3 fall under CERCLA regulations. Section 121(a) of CERCLA requires EPA to make certain remediation solutions are cost effective. The total life cycle costs for this project exceed $270 million and will be demonstrated not to be cost effective (5). The State regulates other groundwater contaminants not included under RCRA such as nitrates (same as fertilizer) and sodium (same as salt). The State also sets and regulates water quality standards for surface streams. Streams on the SRS have the Game water quality designation as does the Savannah River, Class B (7). This dual regulatory authority and who was going to be the lead agency was a source of problems in negotiating closure and post basin closure activities with the State and EPA when I was there five years ago. State's rights were a big issue and sometimes during negotiations I thought we had traveled back in time 134 years to Fort Sumter in Charlston, South Carolina.

After waste water discharges ceased in 1988, a formal permit under RCRA was agreed upon by all parties and physical closure activities begun. After inspection by an independent engineer, the State and EPA agreed and confirmed in 1991 that the basins had been closed based on the conditions of the RCRA permit. EPA reviewed the

closures and formally determined that the closures were protective of human health and the environment (10). How the ground water was to be treated was decided in a separate permit action from the closure action.

F and H Area Basin Ground Water Facts (7,8&9)

Simplified, there are three aquifers in the F and H seepage basin

area. The shallow water table is characterized by low flow and is not used onsite or offsite for drinking water or irrigation purposes. Some of the monitoring wells are located in perched aquifers which cannot provide a sustained yield of water. In other words, they would not support the water needs for a home. For example, the Federal home loan programs require that you have a well that provides a sustained yield of six gallons per minute. If you don't have a well that yields the minimum amount you will not get the loan. Water from the water table or shallow aquifer discharges into Four Nile Creek through a seep line near the creek. There is an aquitard that separates the shallow water table aquifer from the middle aquifer, however, it is not complete and contaminated groundwater also moves from the shallow aquifer into the middle aquifer. Groundwater from the middle aquifer discharges several miles away into Upper Three Runs Creek which is also on the SRS. A second, more complete aquitard, exists between the middle and lower a aquifer. This aquitard provides significant protection from the contaminated groundwater in the middle aquifer from entering the lowest aquifer. In addition, this lowest aquifer is under higher hydraulic pressure due to geologic conditions than the middle aquifer. This means that if the aquitard is breached the ground water will flow up towards the surface and not down. Ground water from the deepest aquifer discharges into the Savannah River. FACT: Geologically, water from the contaminated aquifars have not migrated into the groundwater beyond the site's boundary nor can it ever contaminate offsite groundwater aquifers because they all discharge into on site streams.

The primary ground water contaminants are radionuclides (principally tritium), nitrates, metals (principally cadmium in F-Area and mercury in H-Area), and sodium. Tritium, sodium, and nitrates are very mobile contaminants whereas metals will not move as fast through the ground water. For example, sodium concentrations exceeding 200,000 ug/L are found. Other contaminants such as plutonium move very little, if at all.

With the closure of the basins, two major positive impacts to the ground water occurred: (1) a waste source comprising many millions of gallons of waste water was eliminated and (2) further movement of contaminants from the basins into the groundwater were virtually eliminated due to the clay cap constructed over the basins (the clay cap isolates the water from coming into contact with rainwater that would have infiltrated the soil above the waste). FACT: Groundwater sampling from over 240 monitoring wells has confirmed that the water quality from the contaminated aquifers has improved dramatically and will continue to improve without any further

action regarding ground water treatment.

Surface Water Facts (7, 8, &9)

Contaminated ground water from the F and H area seepage basins

discharge into Four Mile Creek along a seep line. In 1993, the only radionuclides detected in Four Mile Creek were tritium and strontium. Estimated values have been reported for iodine 129 but I am personally aware that the source document used to develop the iodine inventory was of poor quality. The field work that resulted in quantifying the iodine inventory was superficial at best. In addition, there was a calculation error in the reported inventory which results in an over estimate of the iodine 129 inventory. Strontium concentrations have been declining every year since 1988 and decreased by 23% from 1992 to 1993 in the F area (194 mCi to 150 mCi) and 17% in the H area (78 mCi to 65 mCi). Based on measured inventory, tritium is the largest contributor to the creek. There is no known environmental impact to the environment that tritium at the existing concentrations can cause (for example, it has had no impact on plant or animal species diversity or abundance). Tritium migration or flux from the basins have also decreased dramatically since closure and capping. From 1992 to 1993 there has been, a 49% decrease in the Curies of tritium seeping from the F basins. For the same time period there has been a 31% decrease from the H basins. This trend of improving water quality will continue without any additional action such as pump and treat with reinjection. In 1993 an estimated 2,180 Curies of tritium seeped from the F basins and 1,020 Curies from the H basins (1,2, and 3 only). Due to plume mingling it is not possible to differentiate tritium from H-4 and the nearby radioactive burial ground, 643G (a CERCLA site). However, it is projected that from 1994 on that 4,500 Curies of tritium, which represents two thirds of the tritium flux that seeps into Four Mile Creek, will come from the old burial ground and not the seepage basins. By way of comparison, there were 11,300 Curies of tritium released in liquid form from all sources. Releases from the F and H seepage basins accounts for only 3,200 Curies or only 28% of the total. Liquid releases are completely dwarfed by air releases. In 1993, 191,000 Curies of tritium was released to the atmosphere which is sixty times greater than the release from the F and H basins and seventeen times greater than all liquid releases. Most of the tritium released to the atmosphere combines with water molecules in the air and returns to the surrounding areas both on and offsite in the form of rain or snow. This phenomenon has been confirmed through the drilling and testing of groundwater wells and shallow springs on the Georgia side of the Savannah River where well water concentrations of 2,000 pCi/L have been found and onsite where rainwater with tritium has been found in concentrations exceeding 42,000 pci/L (over two times current drinking watar standards). This tritiated rainwater either runs off to surface streams such as Four Mile Creek or becomes part of the groundwater on site, or under goes evapotranspiration. This is why you can find detectable, but acceptable, levels of tritium in drinking water supplies for cities such as Aiken, North Augusta, New Ellenton,

Jackson, and Augusta.

Water samples from Four Mile Creek, other surface streams on SRS,

and the Savannah River are routinely collected and analyzed. The Savannah River is an important recreational source and drinking water source for Beaufort, South Carolina and Savannah, Georgia. Radiological contaminant concentrations including such parameters as gross alpha and nonvolatile beta are the same above and below the SRS with two exceptions: (1) tritium and (2) cesium 137. Cesium is not released from the seepage basins. Tritium, some of which originates from the F and H area basins, is well below EPA established health standards. If the tritium that originates from the F and H Area basins could be eliminated completely (they) can't) there would be an insignificant change in the tritium concentration in the drinking water systems in Beaufort and Savannah. This is due to the ETF discharges (2,000 Curies in 1989), discharge from other seepage basins and the burial ground, and down washing of tritiated rainwater from the over 190,000 Curies per year of tritium released to the atmosphere. The prestigious Academy of Natural Sciences of Philadelphia has monitored water quality on the Savannah River since 1951 and in 1990 conducted a special study on plant and animal life including senstive indicator species. There was no difference in species richness or abundance due to SRS activities and no detectable difference in water quality factors due to SRS activities that could affect the species richness and abundance. This documentation of no impact to the Savannah River over the past forty years is in spite of the fact that the discharge of radionuclides and other contaminants were much higher in the past. In fact, the amount of tritium released to the river has been higher by a factor of ten (approximately 150,000 Curies) in 1963. If the river or human health was being negatively impacted a marked improvement would have been observed due to the continuous and intensive monitoring by the Academy of Natural Sciences. The fact is no environmental impact has been observed because there has been no impact. Over thirty parameters affecting stream water quality are routinely sampled on Four Creek including organics, gross alpha/beta, nitrates, sodium, and heavy metals. There is no difference in water quality for these parameters (samples taken from Road A and A7) when compared to the Savannah River except for tritium. The only measurable radionuclides discharging from the seep area are tritium and stronium. FACT: Tritium and other contaminants released from the F and H Area seepage basins have no impact on human health or the environment in the Savannah River or to sources down stream that use the Savannah River as a drinking water source.

Environmental and Health Risks from the F and H Area Seepage Basin Groundwater Facts (7, 8, &9)

The EPA sets the drinking water standards for communities. Limits prescribed are conservatively derived i.e. they err on the side of over protecting individuals. For radionactivity in drinking water, EPA has determined that concentrations that provide a dose of 4

mrem per year is protective of human health and the environment. The maximum dose received by the public from drinking tritium contaminated water is 0.04 mrem (1% of the allowable dose), and 0.05 mrem per year (1.25% of the allowable dose) at Beaufort, South Carolina and Port Wentworth, Georgia. This is in contrast to water wells in Georgia that have tritium concentrations that are 10% of the allowable limits (the source of which tritium released from air emission sources on the site which are in turn over sixty times greater than that released from the F and H area seepage basins. These doses measurements are based on a tritium limit of 20,000 pCi/L and will decrease by a factor of three when the proposed limits of 60,900 pCi/L are implemented by EPA. Cesium, which does not originate from the F and H basins, is found in the water system but it too is also well below allowable drinking water standards. In summary, there is no unacceptable human health or environmental risk to the Savannah River as a drinking water supply. If the F and H area seepage basin radionuclide contribution to the Savannah River was completely removed there would be an insignificant change in the radionuclide due to other regulated emissions and discharges from the SRS. There is no unacceptable human health or environmental risk to the onsite workers. Over 20,000 personnel work onsite on a regular basis. There are twenty seven onsite drinking water systems, some of which have been in operation since plant startup. Over 1,400 samples for chemical analysis were performed in 1993 and all systems met EPA's primary health based standards. In other words, the personnel onsite use drinking water taken from the same aquifers onsite that supposedly are in danger of being contaminated and have done so for over forty years while meeting all drinking water standards established by EPA and SCDHEC. Even under worst case conditions, where a theoretical "Bubba" spent most of his time living on the site boundary swimming, water skiing, hunting and fishing, drinking water from the Savannah River, eating contaminated fish and wildlife, could only receive an estimated 0.25 mrem per year dose. If someone would pay me to live this life style I'll do it. This way the site could collect real data and I could then justify why I wear white socks. This 0.25 mrem per year dose compares to an average dose of 300 mrem per year from natural causes. In other words, if the SRS could cease emitting all radioactivity (it can't) people would still be exposed to over 99.92% of the radiation that they are currently being exposed to. A measure of the risk 0.25 mrem/year presents is provided through the loss of life expectancy (LLE) calculation. LLE is the average amount by which one's life is shortened by the risk under consideration. For example, being overweight reduces your life expectancy one month for each pound you are over weight. Unless I lose weight I have shortened my life by over three years. Being poor and/or skilled reduces your life expectancy from semi-skilled, clerical/sales people by 2.4 years and an additional 1.5 years when compared to professional/manager personnel. The LLE for a person in Harrisburg, Pennsylvania from the Three Mile Island nuclear power reactor was 1.5 minutes. The LLE for 0.25 mrem/year is functionally equivalent to a regular smoker smoking one extra cigarette every fifteen years or an over weight person like myself increasing my weight by eight tenths of an ounce, about half a

candy bar.

Environmental damage is typically determined through a decline in the number plant/animal species and the abundance or total numbers of plants and animals. The only environmental damage noted has been some very minor vegetative stress along the seep line between where the basins seep into Four Mile Creek. The source of the vegetation stress is not known. However, it is highly likely that the stress is due to elevated soil/water concentrations of aluminum, sodium, and nitrates and not radionuclides or heavy metals. What is important is that since the basins were closed the vegetation has begun to recover and continues to recover. It is also important to note that the plant and animal populations along Four Mile Creek are not unique and do not support any threatened or endangered species. With the exception of very localized areas described above, the plant and animal species and populations along Four Mile Creek, are both diverse and abundant which is indicative of a healthy ecosystem.

FACT: There has been no siqnificant impact to the environment in the vicinity of the F and H seepage basins. Water damage that has been noted is recovering naturally. Water quality in Four Mile Creek continues to improve. There is no difference in species richness or abundance above and below the seep areas or in Four Mile Creek.

Proposed Mitigation (Pump/Treat/Reinject) Facts (5, 10)

The SCDHEC and the EPA are requiring the DOE install a series of imterceptor groundwater wells, pump down the aquifer, treat the water, and reinject the treated groundwater upgradient to the basins. SCDHEC requires that reinjected groundwater meeting drinking water standards before it is reinject. They both admit that tritium cannot be removed from the treated water, therefor it cannot meet drinking water standards, but will be reinjected anyway. Nitrates, which also exceed drinking water standards, will also be reinjected without treatment even though treatment technology exists for nitrates.

Normally under RCRA, regulated contaminants must be cleaned up to drinking water standards. Under specified conditions, a variance is allowed called an Alternate Concentration Limit. ACL's are allowed when the hazardous constituents (not radionuclides-they're regulated under CERCLA) are not capable of posing a substantial threat currently or a potential hazardous to human health and the environment in the future. DOE pursued this approach and was prepared to evaluate in the field some innovative technologies but was denied the ACL. Consequently, DOE was required to implement ground water cleanup. One of the treatment options rejected was to install the pumping wells, pump to a collection/treatment tank, adjust the pH, and discharge the water to the Savannah River under

a NPDES permit. This approach meets all regulatory requirements under RCRA for treatment and discharge. However, SCDHEC and the EPA required that a more expensive treatment system be implemented and the water reinjected. The purpose for the reinjection is to allow for the natural decay of tritium. However, as pointed out before there is no health or environmental risk for discharging the tritiated water or for allowing it to continue to seep out. In fact, a technical evaluation (5) conducted by DOE's Office of Environmental Restoration (EM-40) concluded that after 2005 (ten years) there would be no difference in the off site tritium flux to the Savannah River whether the corrective action was implemented or not (see previously discussed facts). DOE estimates (1993) that $12.6 million has already been spent on this project with an estimated $24 million budgeted for 1994/1995 and an estimated life cycle cost of $270 million.

The proposed ground water treatment may in fact cause additional problems. In response to questions at the public meeting on January 9, 1994, Ms. Kathy Lewis indicated they will not be able to intercept or control the contaminant plumes in their entirety nor can they guarantee that relatively immobile contaminants that don't presently show up in Four Mile Creek, such as plutonium, will be mobilized.

FACT: Reinjection to control tritium flux is a fallacious argument by SCDHEC and EPA. Tritium ground water contamination in the contaminated aquifers has improved dramatically over the past six years and will continue to improve. Tritium, because of its half life of 12.3 years, will continue to be removed permanently through decay. In 24.6 years 75% of the existing tritium inventory wi11 permanently "go away" through radioactive decay. Offsite and onsite drinking water quality are already protected with no further action, that is, without having to spend over a quarter of a billion dollars.

The proposed action has a high probability of failure and does not address one of dominant ground water contaminants, nitrates. Under the proposed remedy, the major contaminants (tritium, nitrates) will not be treated. Minor contaminants such as mercury and cadmium are in most cases just slightly above drinking water standards. The National Academy of Science has recently reviewed pump and treat technology (1). Their conclusion is that remediation by pump and treat is a slow process which can easily take tens, hundreds, or thousands of years and that the ability to restore contaminated groundwater to drinking water standards is uncertain at many sites. According to the NAS, geologic factors and the contaminants may make restoring contaminated ground water to drinking water standards technically infeasible. In addition, in public document EPA has acknowledged "some ground water contaminants cannot be completely eliminated, no matter how long we pump and treat". As of 1990, based upon research performed by the

Oak Ridge National Laboratory (3), there has been no documented case where a single aquifer in the United States has been confirmed to have been successfully restored through pumping and treating.

There is already onsite, documented evidence that pump/treat cannot restore an aquifer to drinking water standards. Ground water cleanup of organics using pump and Crest has been ongoing since 1985 in the M-Area. There is no technically competent person onsite (or off site) that will state or predict that the aquifer in the M-Area will be restored to drinking water standards for organics using pump and treat only.

DOE's Office of Environmental Restoration (EM-40) recognizes the futility of the F and H Area pump and treat system (5). DOE identified all proposed pump and treat projects within the complex and categorized them into three categories: (1) technically sound and reduces risk to the public, (2) limited risk reduction to the public, and (3) little or no risk reduction and may be technically unsound. The proposed pump and treat system for the F and H seepage basins falls into category three, "No measurable risk" with a recommended path forward to "negotiate with regulators for combined institutional control and innovative technology demonstration". This approach has been rejected by the regulators. It is most important to note that in 12.3 years of institutional control, half of the tritium decays away, in 24.6 years 75% - without taking into account any loss of tritium through seepage.

Comments and Questions

In order for the public to fully understand the impact, or lack of impacts, to the environment please provide the following information in your response to my questions. What has been the water quality trends over the last six years on Four Mile Creek at sampling stations 1B, 1C, 2B, 2, 3A, 3, 6, and A7 while describing the source terms that contribute to the contaminants? What data indicates that the contribution of hazardous substances to Four Mile Creek, including radionuclides, will increase over time with no further action. Over thirty water quality parameters are sampled routinely. Identify those parameters that do not meet SCDHEC water quality standards for Class B streams on a consistent basis (50% of the time or more). For noncompliant parameters provide documentation that the impact is due to releases from the seepage basins, that is there is a significant difference between upgradient and downgradient values from the F and H area basin seep lines along Four Mile Creek. Provide documentation that the flora and fauna on Four Mile Creek downgradient from the seepage basin are significantly different based on species diversity and abundance. Provide similar documentation for the area between the seep line and Four Mile Creek. Provide a map showing the ecotypes and acreage along the Four Mile Creek and calculate the acreage and percent of the total ecotype harmed by discharge from the basins. Provide documentation on the presence and/or bioaccumulation of all

those contaminants found in wells above drinking water standards in the water, flora and fauna from the seep line to Four Mile Creek and along Four Mile Creek (for example, gross alpha/beta, heavy metals, transuranics, etc.)? Finally, tritium production is currently at an all time low. However, at some future time tritium production may have to increase. Please document the maximum

allowable tritium emissions from air sources and the H Area Effluent Treatment Facility and compare them to current discharges to Four Mile Creek from the F and H area seepage basins (excluding the contribution from the old burial ground) and in 12.3 years (assuming no seepage from the basins). Numerous wells in the F and H area seepage basins are poor quality, low yield yields from perched water tables. How many of the water table wells provide less than six gallons per minute continuous yield, that is, are unsuitable for home use as a drinking water source? What is the water quality for these wells? How many of these wells do not yield enough water to provide a representative sample (minimum of three casing volumes)? How many of the wells evidence faulty well installation? Does SCDHEC and EPA require the same ground water protection for perched water tables which are unsuitable for a drinking water supply system as for legitimate aquifers? Provide documentation on the level of contamination that is discharged from the Congaree aquifer to Upper Three Runs Creek. Provide similar documentation for the deeper aquifer that discharges into the Savannah River. Finally, provide trend data over the past six years for those RCRA contaminants and radionuclides that are discharged to Four Mile Creek on select but key downgradient groundwater wells for the shallow water table and Congeree aquifers. As a comparison, include upgradient wells particularly those that show contamination from the old burial ground. Discuss and comment on whether the data trends support an improving or deteriorating groundwater quality. Provide the same information for nitrates and sodium. If the water quality is improving and there is no longer a source term recharging the basins does the risk of contamination of the deepest aquifer increase or decrease? Similarly, for the Congaree does the risk of contaminated discharge to the Upper Three Runs Creek increase or decrease? Numerous wells have been identified where gross alpha and nonvolatile beta are above drinking water standards and/or drinking water standards for other radionuclides are exceeded based on a maximum dose. Radiological dose is based on an average dose - not a single maximum datum point. What has been the average gross alpha and beta values? Is the data normally distributed or is a geometric mean more representative? If the geometric mean is more representative, is it above the established standard?

The EPA has determined that capping is proactive of human health and the environment capping. Is capping and institutional control an allowable remedial alternative under CERCLA? Since implementation of capping, groundwater has improved dramatically thus decreasing future risk to human health and the environment through institutional control. What period of institutional

control was considered by SCDHEC/EPA in evaluating the no action alternative under CERCLA. If it wasn't evaluated why not? As a means for comparing the effectiveness of pump and treat onsite as a viable technology, how long will it take the existing pump and treat system to clean up the ground water in the M-Area to drinking water standards and at what cost?

SCDHEC requires that ground water used in the reinjection wells

meet drinking water standards. How can SCDHEC allow tritiatad groundwater that is 1,000 times drinking water standards be reinjected. How can it allow nitrates that are 10-100 drinking water standards be reinjected when treatment technology exists to treat nitrates.

Pumped water can simply be adjusted for low pH and discharged to the Savannah River meeting all health and safety requirements of both EPA and SCDHEC at significant cost savings over the required remedy. What is SCDHEC's and EPA's justification, under RCRA, for not requiring the most cost effective remedy which meets all drinking and surface water quality standards?

The remedial action for H area includes Basin H-3. This site is a CERCLA site and not a RCRA site. Based on groundwater monitoring data it also the primary source of the metal contaminants down gradient from the basin complex. Under what authority was this site included under the RCRA regulations and where was the public input. Why isn't this site considered separately?

A different environmental remedy for the same site can be arrived at under CERCLA versus RCRA. In fact, the DOE submittal to SCDHEC and EPA for the proposed remedy under CERCLA is that no action be taken (10). What has been SCDHEC's and EPA's response to DOE's proposed remedy under CERCLA of no further action (Rev. 0, Proposed Plan for F and H Area Groundwater Operable Units). What was your basis for rejecting the proposal, particularly for basin H-3 which is not regulated under RCRA.

The risk assessment process used is flawed. Proposed tritium standards are three times higher than current standards. When performing your risk assessment you used proposed concentration limits when they were higher than existing limits. However, in the case of tritium you used the existing-limits when proposed limits are over three times higher. There is no rational basis for ignoring nitrates in the risk assessment process nor is there any health/environmental based reason for pumping/treating and recirculating the tritium plume to maintain a 20,000 pCi/mL contour. If you are not maintaining the drinking water standard isopleth then 200,000 pci/mL or current levels are as equally valid as the 20,000 pCi/ml isopleth for tritium. Why weren't the proposed tritium standards used (60,900 pCi/L)?

The State and the EPA have specific areas of regulatory authority. The State does not regulate ground water contaminatad by radionuclides. Does SCDHEC claim regulatory authority over radionuclides? Under what authority and has the Federal government given up its sovereign immunity?

Besides the DOE SRS, SCDHEC regulates municipalities, private businesses, and other State and Federal agencies. For example, there is tritium contaminated groundwater at the adjacent Chem Nuclear facility in Barnwell. Municipalities frequently fail to meet solid waste and groundwater requirements. Federal military

bases have a variety of environmental problems. Does the DOE SRS receive equal treatment under the law relative to enforcement or fines? What other facilities are being required to pump/treat and reinject as a remedial action? How many are allowed to reinject contaminated water above drinking water standards? What concentrations? How many ACL's have been granted by SCDHEC in the last five years? How many by EPA Region IV in past five years? Given the number of approvals, are ACL's in fact a viable alternative to restoring aquifers to drinking water standards? How many pump and treat actions of similar scope in South Carolina have resulted in the return of the contaminated aquifer to drinking water standards?

Regulatory oversite by SCDHEC at SRS is funded by a grant from DOE. How many municipalities, private industries, and other government agencies fund their own regulatory oversight? How does SCDHEC avoid a conflict of interest, that is, the more remedial actions required the higher the funding level for SCDHEC?

As expensive and futile as the proposed remedy is there was another solution which met the requirements under RCRA, complied with all other environmental laws, presented so significant risk, and was a lot cheaper. The remedy is to pump the shallow aquifer, adjust for Ph, and discharge to the Savannah River. Has the SCDHEC/EPA required municipalities, private businesses, or other State/government agencies in South Carolina to implement the most expensive ground water treatment option when a second, less costly alternative would meet all of the State and EPA requirement for protection of human health end the environment? Would the State be willing to pay the incremental cost between the two options? Under the law, can the EPA ever conclude under CERCLA that no further action was required where RCRA requires that a remedial action be implemented? Has the DOE been asked/requested/pressured to include the CERCLA site, 643G (Old Burial Ground), under RCRA? What has been DOE's response? If yes, what was the justification?

SUMMARY AND CONCLUSIONS

Due to the holidays I was unable to obtain additional data supposing the position that no further action is required.

Consequently, I have asked that comments be held open for an additional 90 days (given the lengthy time required to obtain documents under the Freedom of Information Act) and that a second public meeting be held so that all questions can be addressed.

I have polled friends and family in the Aiken, South Carolina area. When I describe what is being proposed and how much it will cost they are dumb founded. They have seen the public notices regarding these activities but they do not highlight the facts I have included nor do they address the questions I have posed nor do they make the public aware of the costs. I am appalled at the lack of effective public communication.

I will be forwarding my comments to my Congressional

representatives from Tennessee. Copies will also be sent to Senator Strom Thurmond and the Governor of South Carolina. Incumbents were removed from office because of governmental actions such as this and new people elected to make government accountable. This process reminds me of the EPA proposed action for the ski resort town in Colorado which has lead contaminated soil from a mining operation in the 1800's. EPA's remedy was to dig up four feet of the town and backfill with clean dirt. It wasn't until after several years of arguing with the residents that they finally looked at lead blood levels in children and found that they were below the national average. The selected remedial action is still being disputed. Signs have been posted in the town by the residents - the stake holders - those who are impacted by the site the most - for EPA to go home. This type of action at SRS does not enhance a person's belief or confidence that the regulators are here to help you. The proposed remedy at SRS appears to be along the same line as the Colorado incident. However, this is just the first of many ground water remedial actions that will be implemented by SCDHEC and EPA and SRS. In other words, the quarter of a billion action is just a down payment. Wasteful expenditures on this scale, without a real benefit or enhancement of the environment or human health, undermines and distorts the productivity of our economy. I'm hopeful that during a time of huge Federal deficits I will get an audience with the new Congress as they seek methods to cut the Federal budget and make government accountable. One method is to have Congress with hold funding for this activity. Under the Federal Facility Agreement, the DOE can only be held accountable for activities that are funded. I will also be encouraging my Congressional representatives not to support DOE funding in general for projects of this type. A quarter of a billion dollars could achieve measurable, quantifiable improvements to human health and the environment through a myriad of other programs such as education, job training, weight reduction programs, etc. It won't achieve measurable, quantifiable improvements to human health and the environment through the proposed remedial action of pump, treat, and reinject.

Finally, I would like to address the issue of effective public

participation, or lack of it, in the decision making process for selecting environmental remedies. It is not working and the response is narrowly orchestrated by such groups as the Energy Research Foundation and the NRDC who don't speak for the general public in the area. For example, how many comments were received from the public on the F and H Area post closure permit. How many of those originated from the EDF, other special interest groups and their members, other regulatory agencies, and how many originated from the public in general from the Aiken, Barnwell, and Allendale area? I had hopes that the Citizens Advisory Board would have addressed the issue of expensive remediation without environmental benefit but it appears that they too are unsuccessful in identifying and effectively communicating the concept of risk and the cost of cleanup to the public. I understand; however, there has been some lively discussion between some members over who gets reimbursed for meals. Is a possible reason for this immutable wall of silence that key Citizens Advisory Board chairs dealing with risk assessment are held by ERF personnel?

I have a great faith in the American public. Give them the facts and they will make the right decisions. Simplify the regulatory mumbo jumbo and put in a context that the public understands. I believe once the citizens of the area understand what is really happening to them, the right decision will be reached and it won't involve squandering a quarter of a billion dollars.

REFERENCES

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2. Before It's Too Late A Scientist's Case for Nuclear Energy, Dr. Bernard L. Cohen, 1983

3. Curtis C. Travis and Carolyn B. Dory, Can Contaminated Aquifers at Superfund Sites Be Remediated, 24 Environmental Science and Technology 1465, 1990

4. Environmental Bulletin, Savannah River Site, Volume 5, Number 28, December 14, 1994

5. Groundwater Pump-And-Treat Activities, Office of Environmental Restoration (EM-40), August, 1993

6. Proposed Plan for F and H Area Groundwater Operable Unit, Rev. 0, November, 1993

7. Savannah River Site Environmental Report for 1990

8. Savannah River Site Environmental Report for 1992

9. Savannah River Site Environmental Report for 1993

10. Savannah River Site Interim Actions Proposed Plans for the F- and H-Areas Groundwater Operable Units, November, 1994

<IMG SRC 0495224C>

United States Government Department of Energy

memorandum

DATE:

REPLY TO: EM-42 (J. Fiore, 903-8141)
ATTN OF:

SUBJECT: Ground-water Pump-and-Treat Notebook

TO: R. P. Whitfield, EM-40.
J. Baublitz, EM-40
R. Lighther, EM-45
W. Wisenbaker, EM-43
S. Mann, EM-44

I am pleased to forward the attached notebook on ground-water pump-and-treat activities managed by the Office of Environmental Restoration (EM-40). The notebook has been compiled as a result of data collected to support a July 25, 1993, senior managers' review panel which met to critique all of EM-40's pump-and-treat projects.

The effort vhtch went into collecting and presenting data for the senior manager's review provided an opportunity for an in-depth study of a type of remediation activity common to all areas managed by EM-40. Please identify what, if any, actions you would like relative to keeping this book up to date.

James J. Fiore
Director
Office of Eastern Area Programs
Office of Environmental Restoration

Attachment

CC:
N. Larson, EM-45
J. Lehr, EM-44
W. Murphie, EM-42
G. Turi, EM-43

Background

IRB briefing identified pump-and-treat systems not cost effective for protection of human health and safety.

EM-40 was tasked to review all pump-and-treat projects to determine their contribution to off-site risk reduction.

25 projects identified across EM-40.

Senior Manager's review panel met on July 25, 1993 to critique all 25 projects.

Identified:

- Three Category A projects - Technically sound; reduces risk to public health & safety;
- Sixteen Category B projects - Limited risk reduction to public health & safety; and,
- () Six Category C projects - Little or no risk reduction to public health & safety; may not be technically sound.

Category C projects are proposed for potential "Push Back."

Results From Review Board

Six Category C projects:

- Two in the Eastern Area:
  - General Separations Area (includes F&H) at Savannah River; and,
  - TNX Area at Savannah River.
- One in the Northwest Area:
  - Lawrence Livermore National Laboratory, Main Site,
- Three in the Southwest Area:
  - South Valley in Albuquerque, NM;
  - UMTRA site in Monument Valley, AZ; and,
  - UMTRA sites at Tuba City, AZ.

Two "low end" Category B projects:

- Site 300, Eastern General Services Area, Lawrence Livermore National Laboratory;
- Groundwater Treatment & Monitoring, Kansas City Plant

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  - þ UMTRA sites at Tuba City, AZ.

Two "low end" Category B projects:

- o Site 300, Eastern General Services Area, Lawrence Livermore National Laboratory;
- o Groundwater Treatment & Monitoring, Kansas City Plant

PUMP AND TREAT WORK SHEET

ADS: SR-515	Project: General Separations Area	Location: Savannah River	Office: EM-422

Purpose of Pump & Treat	Cleanup of contaminated GW
Groundwater Treatment	Currently proposed is neutralization, settling, filtration and reinjection of the effluent as well as air stripping with catalytic oxidation off-gas.
Principal Contaminant{s)	Tritium; Trichioroethylene (TCE); lead; mercury; radionuclide metals
Other Contaminant(s)	Nitrate
Baseline Risk	1 X 10-7
Post-Action Risk	No measurable risk reduction off-site
Amount of Water Contaminated (gal)	> 100 million
Pumping Rate (gal/day)	500,000 (347 gpm)

Estimated Initial Mass of Principal Contaminant(s) [lbs]	Further characterization required
Estimated Removed Mass (to date) of Principal Contaminants(s) [lbs]	None - Corrective action not yet underway
Cost of Construction ($M)	$37.2
Cost of Operation ($M)	$186.0
Other Cost ($M)	$228.0
Start Date (FY)	1992
Completion Date (FY)	2040
Legal Driver	SCHW Part B permit issued in 1992 requires F&H CAP (Oct 1993);MWMF CAP (Nov 1993) per Settlement Agreement
Other Pertinent Information	FY 95 Cost - $20 million Total Cost- $270 million Pump-and-Treat Operational in FY 97 Category C

<IMG SRC 0495224D>

TRITIUM MIGRATION IN GROUNDWATER

Refer to figure titled: Conceptual Behavior/Responae of Tritium during F & H Groundwater Remediation.)

Concentration of Tritium in 1990 was at 15,000 Ci/yr.

Concentration of Tritium in 1997 would be at 6,000 Ci/Yr with no action

Concentration of Tritium would decrease rapidly with pump and treat, but would surpass the no action level in 2005 due to reinsertion.

In the long run (2015) Tritium concentration levels would be the same with or without pump and treat

[SRS Data, 1994]. Like tritium migration, stronium migration is expected to continue to decline from these

capable of detecting iodine-129, will be analyzing for iodine-129 in the F-

Area seepage basin
closed seepage basins.

In 1993, no cesium-137 migration was detected from the F-Area or H-Area seepage basins. However, 160 mCi (5.9E+09 Bq) of cesium-137 were detected at the sampling location near the Four Mile Creek mouth over and above the 246 mCi (9.1E+09Bq) cesium-137 detected in direct process discharges. This additional cesium-137 is attributed to desporption of past cesium releases from the stream bed.

An estimated 22 mCi (8.2E+08 Bq) of iodine-129 were projected to have migrated from the F-Area and H-Area seepage basins during 1993. Because io-dine-129 emits very low energy beta/gamma radiation, it cannot be detected-using common radioanalytical methods-in dilute streams. However, as releases of other radionuclides from SRS continue to decrease, the percentage of the maximum individual off-site dose attributed to iodine-129, which has a long half-life of 1.57E+07 years, is likely to increase in future years. Therefore, beginning in 1994, the SRTC environmental laboratory, which has the sensitive instrumentation

<IMG SRC 0495224E>

3325 Berkshire Circle
Johnson City, TN 37604
February 15, 1995

EPA Region IV

migration samples.

Migration of
L-Area Seepage Basins
P-Area K-Area, and C-
been released
basins since 1978.
seepage basins to
to decay before the
and flows into the
of the basins reduces
downriver water
tritium releases. The
purging the
1970, but dissassembly
directly to SRS
earlier experience
the extent of
sufficient to
in P-Area, L-Area, and
these reactor areas
the basins occured

Attn: Jeff Crane
345 Courtland Street
Atlanta, GA 30365

Dear Mr. Crane:

Attached please find additional comments on the proposed F&H Groundwater Remediation.

Sincerely,

Phillip Brandt

Letter #2 from Mr. Philip Brandt to the EPA

ADDITIONAL COMMENTS TO THE PROPOSED F&H GROUNDWATER REMEDIATION

1. During the extended comment period, I was able to ascertain that the NPDES permitted F&H Area Effluent Treatment Facility (ETF) is allowed to discharge to onsite surface streams up to 30,000 Curies of tritium per year. Will the regulators explain to the public the difference in potential environmental impact from the permitted discharge of 30,000 Curies of tritium and the estimated (1993) 3,200 Curies of tritium seeping from the F&H Seepage Basins and the estimated (1993) 12,200 Curies of tritium released to the Savannah River from all sources (discharge and all seepage basins)? If there is documented environmental harm from 3,200 Curies of tritium discharging to a surface stream then how can 30,000 Curies be allowed to discharge to a surface stream? If the RCRA decision making process selected determined that pump/treat/reinjection was the lowest risk option how can you justify or allow a potential 30,000 Curies of tritium be released to a surface stream?

2. The costliest and technologically weakest option, pump/treat and reinject, was selected under RCRA in 1992. At the public meeting held in North Augusta, South Carolina on January 9, 1995, the question was asked why wasn't pump/treat and discharge to a surface stream or Savannah River selected since it was (a) much cheaper and (b) met all regulatory requirements. The response was that there was concern over increasing the tritium dose to down stream users. Under a no action alternative and a pump/treat and discharge alternative wouldn't the drinking water standards of downstream water users be met? Aren't the EPA regulations

entities, and the general public? For example, is there equal enforcement in the protection of waters of the state to rural, private residences that utilizes septic systems with leach fields or the farmer that utilizes compost and/or animal manure for fertilizer?

8. There have been recent, significant reductions in funding through out the DOE complex. Funding for environmental restoration has been cut. There is not enough funding to support all the currently identified environmental restoration activities. There are sites within the complex that do purposes a real or potential threat to human health and the environment. If DOE prioritizes how the funding is distributed and there is not sufficient funding to support continuing the F&H groundwater remediation, what will be the State of South Carolina and EPA's response? From a chemical and radiological prespective there are a number of sites at SRS that should be "ahead of" sites like the F&H Basins and other sites such as the TNX basins. How about the old R Reactor dissassembly basins whose water levels rise and fall with changes in the ground water table. What is the radiological water quality in those basins? Can you document that there aren't any source terms in the sediments and sludges in the bottom of the basin? What radionuclides and what are their concentrations along the canal system and intervening ponds that discharged contaminated water from the reactors to the Parr Pond? What steps are being taken to prevent the biological uptake and concentration in the flora and fauna in these areas?

9. The Energy Research Foundation in their January 31, 1995 response stated that the public has "had ample opportunity for input". Technically, I would have to agree with the statement that the requirements of the law regarding public comment have been complied with. However, has the intent of the law been complied with? How successful have you been in communicating the intent of your actions. At any time was the public informed in plain English as to how much the clean up would cost or that the contamination could never contaminate offsite groundwater? Exactly how many response were there from the stakeholders around SRS in Aiken, Jackson, Barnwell, etc. to the F&H groundwater permit? Considering the population base for that area does any one believe that there was a significant public response? I strongly disagree with the ERP statement "the evidence of the spread of contamination and its measurable impact on affected surface waters is a sound and compelling basis for the remedial action". What Class B water parameters were exceeded in Four Mile Creek and for the ones exceeded which showed a significant differnce upgradient and down gradient from the seepage basins? Valid, scientific data supports the position that no further action is justified. The ERP believes that CERCLA should simply validate a prescriptive solution under RCRA. Does the ERF also believe that the CAB should have no input under CERCLA when the Environmental Restoration Subcommittee also questions the proposed remedy? Does the ERF also believe that there should be no meaningful CERCLA evaluation for Basin H-3 which

is not a RCRA regulated unit? I would say to the ERF that the

intent of RCRA and CERCLA is to protect human health and the environment and that sometimes this can occur under a no further action scenario. I would counter argue that it is entirely appropriate to challenge under CERCLA a bad decision arrived under RCRA due to procedural requirements. By illuminating such differences, may be at some point in the future we can inject some common sense and reality into the remedial process instead of needlessly wasting resources on "improvements" in environmental quality that exist only on paper and benefit absolutely no one.

governing drinking water standards protective of the human health and the environment? On a relative risk basis, isn't there more risk from a 30,000 Curie tritium discharge than the 3,200 Curies from the F&H Area Seepage Basins? What is the legal basis for requiring the additional expenditures for remedial actions that are more protective to human health and the environment than required by statute particularly when the environmental threat is only 10% of that from the F&H ETF?

3. The 1992 RCRA permit required that groundwater be treated to the 10,000 pCi/L isopleth line. Based on the data I have received, which is two years old, the water quality has improved so dramatically that the proposed interceptor wells are already at or below the 10,000 pCi/L isopleth line in the F Basin area and rapidly approaching it at the H Basin area. In the H Area, Basin H-3 is the most significant contributor to groundwater contamination. What is the basis for now continuing with the pump/treat/reinject system when the groundwater quality has already improved and continues to improve beyond what was required in the RCRA permit? What is the basis for ignoring Basin H-3 under CERCLA in the remedial selection process when RCRA does not apply to it and it is the principal source term for groundwater degradation?

4. Given the dramatic and continuing improvement in the quality of the groundwater, it appears in retrospect that the State of South Carolina and the EPA used either (a) overly conservative risk assumptions in their analysis of remedial options or (b) made some sort of grievous error. The F&H Part B permit is up for renewal in March of 1995. Now that this "new" data is available which directly contradicts the conclusions and assumptions originally used and the RCRA permit is so close to renewal, shouldn't the remedial alternative selected be re-evaluated to reflect reality? Given the timing of the RCRA permit renewal, shouldn't this re-evaluation be coordinated and integrated with the CERCLA public participation process? The overly conservative assumptions used were justification for rejecting DOE's Alternate Concentration Limit submittal. Shouldn't the ACL application be revisited based on the "new" data? Doesn't this "new" data completely and

significantly change the risk conclusions reached in the earlier RCRA permit? Aren't we all seeking to find the least cost option that is protective of human health and the environment?

5. At the public meeting on January 9, 1995, the EPA Region IV representative stated that the SRS was placed on the National Priorities List (the EPA list of the worst sites that are or present a threat to human health and the environment) and that she personally knew that the offsite drinking water risk alone was sufficient justification for placing SRS on the NFL. Can the EPA explain how an offsite drinking water dose that is only 1% of EPAs allowable drinking water standards qualify it for inclusion on the NPL? The EPA establishes radionuclide limits for drinking water that are protective of human health and the environment, can the EPA explain how 30,000 Curies of tritium potentially discharged

from the F&H Area ETF can be legally allowable under an NPDES permit whereas a 12,200 Curie discharge (from all sources) is justification for placing the site on the list of the worst environmental sites in the country? I hope in the EPA response to this question that the EPA is astute enough to recognize there is sufficient real data to demonstrate that there is no credible mechanism for concluding that there is a measurable off site chemical or radiological risk other than tritium.

6. I have never been involved in a CERCLA public meeting in which the selected remedy has been presented in such a circuitous manner. Ostensibly, the public meeting was held to see if there were any comments as to whether additional treatment was required above and beyond pump/treat and reinject. Has the NEPA process been subverted? Weren't alternatives, including a no action alternative, considered? Where has the public been involved in the CERCLA review process in the selection of the remedial alternative? As part of the NEPA process, a Citizens Advisory Board (CAB) was created to obtain representative comments from the affected communities. The Co-Chair, Mr. W. F. Lawless, of the Environmental Restoration Subcommittee of the CAB indicated that they had serious concerns over the proposed remedy i.e. "no scientific justification" to support the choice. Mr. Lawless stated that the proposed remedy will be the supject of the CABs March meeting and requested an extension on public comments until after their meeting. Isn't it reasonable to extend the comment period so that the citizens group created under the CERCLA process can respond to and participate in the CERCLA decision making process? I request an even further extension since a draft RCRA permit is expected to be available from SCDHEC by March 1, 1995. The public will then have a 45 day comment period based on the latest facts. The environmental data clearly indicate improving water quality and that small, localized areas of stressed vegetation are coming back so there is no environmental harm in waiting. By postponing the CERCLA decision making process a more reasoned and logical conclusion can be arrived at, one that may be equally protective of human health and

the environment but costs less than a quarter of a billion dollars. What is the reason or basis for the State and EPA to reach a conclusion so quickly given the timing of the RCRA permit renewal and the concerns raised by the CAB? Do individuals at the state or Federal level receive any sort of merit award for the number of RODs completed? Is there a statutory requirement that requires the ROD to be completed within a certain time?

7. Would the State of South Carolina please explain to the public at what point in the geohydrological cycle that precipitation becomes water of the state? Is it when it infiltrates the soil but prior to evapotranspiration? Is it after evapotranspiration? Does it include all soil water? Does is include near surface groundwater that discharges to surface streams? Are all shallow groundwaters considered waters of the state regardless of sustained yield and water quality parameters? If the answer to the last question is yes, is the State consistently enforcing the regulations to agricultural users, municipalities, other industrial

Response: Several of the comments identified in Mr. Brandt's letters have been previously addressed as part of the comment responses prepared for comments summarized from the public meeting transcript, and therefore, are not repeated. The following response are provided for comments that have not been previously addressed and are numbered in order as they were extracted from the letters. The numbering sequence does not correspond to the question numbers that appear in letter #2.

1. What has been the water quality trends over the last six years on FMC at sampling stations 1B, 1C, 2B, 2, 3A, 3, 6, and A7 while describing the source terms that contribute to the contaminants? What data indicates that the contribution of hazardous substances to FMC, including radionuclides, will increase over time with no further action? Discuss and comment on whether the data trends support an improving or deteriorating groundwater quality? Does the risk of contamination of the deepest aquifer and discharge to Upper Three Runs Creek increase or decrease?

Response: In the most recent report "Semi-Annual Sampling of Fourmile Branch and Its Seeplines in the F and H Areas of SRS: February 1993, July 1993, and April 1994", a summary of the water quality is provided in the introduction section with a comparison of analytes

detected in 1989 samples. It is stated in this report and the 1993 Environmental Report that the sources contributing to these contaminants are the F&H Seepage Basins. There is no data that indicates that the radionuclides will increase over time with no further action.

Levels of tritium in the groundwater plumes have been generally decreasing since use of the basins for disposal of wastewater was discontinued in 1903. Construction of the low permeability caps over the basins has served to control any further migration of contaminants to the groundwater. These source control measures have resulted in decreasing the risk of contamination to the deeper aquifer and Upper Three Runs Creek. However, levels of contaminants in the groundwater continue to be measured at levels which exceed primary drinking water standards.

2. Numerous wells in the F&H area seepage basins are poor quality, low yields from perched water tables. How many of the water table wells provide less than six gallons per minute continuous yield, that is are unsuitable for home use as a drinking water source? What is the water quality for these wells? How many of these wells do not yield enough water to provide a representative sample (minimum of three casing volumes)? How many of the wells evidence faulty well installation? Does SCDHEC and EPA require the same groundwater protection for perched water tables which are unsuitable for a drinking water supply system as for legitimate aquifers?

Response: Wells at the F and H Area seepage basins have been installed to provide representative samples from the aquifer units that they monitor. No perched water zones are monitored. Low yield is not an indication of an inadequate monitoring well. Many of the wells monitor zones that have a high percentage of clays and fine grained materials. In some locations the water table surface is very close to the underlying confining unit; this results in a very thin water table aquifer. Wells in these zones (high clay content and thin water table) tend to produce a low yield. This is in contrast to wells which are installed to provide water for domestic use, which are specially designed to extract water from thick units of coarse grained materials in order to ensure a high yield.

The integrity of the monitoring network is evaluated regularly, and corrective actions are taken to repair and/or replace any wells which do not provide representative samples or show evidence of

faulty hardware or construction.

3. Provide documentation on the level of contamination that is discharged from the Congaree aquifer to Upper Three Runs Creek? Provide similar documentation for the deeper aquifer that discharges into the Savannah River?

Response: Environmental monitoring indicates that contamination which is discharged to Upper Three Runs Creek and to the Savannah River from deeper aquifers is negligible.

4. The EPA has determined that capping is protective of human health and the environment. Is capping with institutional control an allowable remedial alternative under CERCLA? Since implementation of capping, groundwater has improved dramatically thus decreasing future risk to human health and the environment through institutional control. What period of institutional control was considered by SCDHEC/EPA in evaluating the no action alternative under CERCLA?

Response: A future land use policy for the Savannah River Site is currently being prepared. Until future land use issues are resolved and a policy is implemented, institutional control cannot be considered as a remedial alternative under CERCLA.

5. SCDHEC requires that groundwater used in the reinjection wells meet drinking water standards. How can SCDHEC allow tritiated groundwater that is 1000 times drinking water standards to be reinjected? How can it allow nitrates that are 10-100 times drinking water standards to be reinjected when treatment technology exists to treat nitrates?

Response: Injection of water which contains tritium and nitrate in levels which exceed drinking water standards can be allowed in the context of this RCRA corrective action because overall groundwater quality in the aquifer will be improved.

6. Pumped water can simply be adjusted for low pH and discharged to the Savannah River meeting all

health and safety requirements of both EPA and SCDHEC at significant cost savings over the required remedy. What is SCDHEC's and EPA's justification under RCRA for not requiring the most cost effective remedy which meets all drinking and surface water quality standards?

Response: It would not be acceptable to extract contaminated groundwater that is currently not used as a drinking water source and to only adjust for low pH and then discharge it to the Savannah River. One of the remedial alternatives considered for the F and H Seepage basins was to extract groundwater and pump it directly to the Savannah River with minimal treatment. It was estimated that levels in the Savannah River would remain below drinking water standards if this alternative were implemented. However, this alternative was not selected. It seemed to be counter intuitive to pump contaminated water out of the ground where it is relatively isolated from environmental receptors and place it directly in the Savannah River which serves as a public drinking water source.

7. A different environmental remedy for the same site can be arrived at under CERCLA versus RCRA. In fact, the DOE submittal to SCDHEC and EPA for the proposed remedy under CERCLA is that no action be taken: What has been SCDHEC's and EPA's response to DOE's proposed remedy under CERCLA of no further action (Rev. 0, Proposed Plan for F and H Area Groundwater Operable Unit). What was your basis for rejecting the proposal, particularly for basin H-3 which is not regulated under RCRA.

Response: DOE is subject to the Federal Facility Agreement which mandates that all RCRA regulated units should be addressed under RCRA and then reviewed under CERCLA to determine if additional action is necessary to protect human health and the environment (Reference comment response number 17 in the general response section)

8. The risk assessment process used is flawed. Proposed tritium standards are three times higher current standards. When performing your risk assessment you used proposed concentration limits when they were higher than existing limits. However, in the case of tritium you used the existing limits when proposed limits are over three times higher. There is no rational basis for ignoring nitrates in the risk assessment process nor is there any health/environmental based reason for pumping/treating and recirculating the tritium plume to maintain a 20,000 pCi/mL contour. If you

are not maintaining the drinking water standard isopleth then 200,000 pCi/mL or current levels are as equally valid as the 20,000 pCi/ml isopleth for tritium. Why weren't the proposed tritium standards used (60,900 pCi/L)?

Response: Quantitative Risk Assessment based on the most current data has not been performed Risk assessment work performed to evaluate the potential risk associated with groundwater contamination at the F and H Area Seepage Basins is base on an extensive list of hazardous and radioactive constituents. The primary drinking water standard for tritium (whether proposed or current) is not a significant factor in the estimation of risk.

9. The state and EPA have specific areas of regulatory authority. The state does not regulate groundwater contaminated by radionuclides. Does SCDHEC claim regulatory authority over radionuclides? Under what authority and has the Federal government given us its sovereign immunity?

Response: SRS signed a Memorandum of Agreement on April 8, 1985, agreeing to comply with the substantive requirements of the South Carolina Pollution Control Act (PCA); the South Carolina Hazardous Waste Management Act (SCHWMA) and regulations promulgated thereunder. The definition of pollutants under the PCA can be interpreted to include radionuclides. In addition, to the above, SRS entered into a Settlement Agreement (87-27-SW), as amended on June 14, 1989, in which DOE agreed to address the hazardous constituent contaminants in the groundwater as defined by RCRA as well as groundwater contamination by other constituents such as nitrates and radionuclides as defined by the SC PCA. These actions were taken as a matter of comity rather than as a waiver of sovereign immunity.

10. Besides the DOE SRS, SCDHEC regulates municipalities, private businesses, and other State and Federal agencies. Does the DOE SRS receive equal treatmeat under the law relative to enforcement or fines? What other facilities are being required to pump/treat and reinject as a remedial action? How many are allowed to reinject contaminated water above drinking water standards? How many ACL's have been granted by SCDHEC in the last five years?

Response: SRS receives equal treatment under the law as compared to other industrial and

governmental facilities. The F and H Areas Seepage Basins groundwater plumes contain both hazardous and radioactive constituents that differ greatly from those found at most facilities requiring groundwater remediation. Therefore, the proposed corrective action is unique. No other facilities are currently required to pump/treat and reinject, or to reinject water which exceeds drinking water standards.

No ACL's have been approved by EPA Region IV or SCDHEC in the past five years. However, ACL's are a viable alternative to complete restoration of aquifers to drinking water standards. In fact the corrective action required by the RCRA pent specifically allows for evaluation of an ACL demonstration at the conclusion of Phase I.

11. Regulatory oversight by SCDHEC at SRS is funded by a grant from DOE. How many municipalities, privately industries, and other government agencies fund their own regulatory oversight? How does SCDHEC avoid a conflict of interest, that is, the more remedial actions required the higher the funding level for SCDHEC?

Response: Through permit fees and other funding mechanisms, all municipalities, private industries, and other government agencies fund their own regulatory oversight. There is no conflict of interest. The grant is based on a scope of work submitted by SCDHEC and approved by DOE on an annual basis so more remedial actions do not necessarily mean more funding as both parties must agree as to the level of work neeessary for the year.

Letter from Mr. George M. Minot to the EPA

Response:

1. Levels of tritium in the groundwater plumes have generally decreased since operation of the basins was discontinued in 1988. Additionally, the installation of the low permeability caps over the basins has further controlled the migration of contaminants into the groundwater. All of the tritium currently contained in the F&H Seepage Basins is due to pre-1988 operations. There is no

contaminated water currently being contributed to the F&H Area Seepage Basins. Contaminated effluent water and any contaminated water due to processing of existing inventories is transferred to the Effluent Treatment Facilities for processing.

As stated in the WSRC Report, "Assessment of Tritium in the Savannah River Site Environment," is a tritium balance for SRS operations from 1952 to 1991. The F&H Seepage Basins have received 669,790 Curies of tritium, released 268,533 to Fourmile Creek, released 202,567 Curies to the atmosphere through evaporation, and currently (as of 1991) the basins contain 37,618 Curies. Subtracting the last three numbers from the first gives a difference of 161,072 Curies, which is the amount of radioactivity eliminated through the radioactive decay process.

2. Currently, only funding for Phase I of the F&H Groundwater Remediation Project has been budgeted. Additional funding would be requested for the remaining phases, if required following a technical evaluation of the Phase I Operations.

Since the early fifties, a significant amount of research has been conducted on the transport, metabolism, and radiation dose due to tritium in the environment. One of the better references was published by the National Council on Radiation Protection and Measurements (NCRP) as NCRP Report No. 62, Tritium in the Environment. It may be ordered from:

NRCP Publications
7910 Woodmont Avenue
Suite 800
Bethesda, MD 20814-3095

The International Commission on Radiological Protection (ICRP) has developed a quite thorough, although somewhat complicated system for calculating radiation dose from ingestion, inhalation, and absorption of tritium through the skin. ICRP Publication 30, Part 1, contains tritium information in addition to a description of the radiation dose calculation system. It can be ordered through your local bookstore by referring to the identifier, ISBN 0 08 022638 8.

During the approximately 40 years of SRS operation, the tritium dose for customers of the Beaufort-Jasper Water Treatment Plant was about 3 millirem (WSRC-TR-93-214, Table 4-7). During the same time period, the very conservative EPA limit of 4 millirem per year would have allowed a dose of 160 millirem. Future liquid releases of tritium will decline since all reactors are shut down and the inventory of tritium in the seepage basins will be depleted by the natural decaying process.

George M. Minot
3 Bateau Road
Hilton Head Island, SC 29928-3012
803-365-5150

Memorandum

To: SRS Remedial Project Manager, U.S. EPA, Region IV

From: George M. Minot

Date: February 6, 1995

Subject: Resolutions Regarding SRS F- and H-Area Groundwater Operable Units

WHEREAS, the F-Area Hazardous Waste Management Area consists of a series of three hydraulically connected, unlined basins (F-1, F-2 and F-3) to which wastewater flow was terminated on November 7, 1988 and the H-Area Hazardous Waste Management Area consists of a series of three hydraulically connected, unlined basins (H-1, H-2 and H-4) to which wastewater flow was terminated on November 7, 1988, and

WHEREAS, the radioactivity released to the unlined basins constituting the F-Area Hazardous Wastes Management Facility and the H-Area Hazardous Waste Management Facility is due primarily to tritium, a radioacitve form or Hydrogen with a half-life of about 12.5 years, and

WHEREAS, currently, there is no known effective method to remove tritium from groundwater, and

WHEREAS, F- and H-Areas and vicinity are on a surface and groundwater divide; shallow groundwater flows toward either Upper Three Runs or Fourmile Branch, both of which discharge directly into the Savannah River, and

WHEREAS, the Maximum Containment Level (MCL) for tritium (i.e. the maximum permissible level of tritium in water that is delivered to a user of a public water system) is 20 picocuries per milliliter (pCi/L), and

WHEREAS, the Savannah River supplies domestic and industrial water for the Port Wentworth (Savannah, GA) water treatment plant and for Beaufort and Jasper Counties in SC and analytical results of calendar 1993 water studies indicated that the water in the Savannah River

downstream from SRS showed
a maximum reading during one sampling event of 1.92 pCi/mL of tritium (approximately 10% of MCL),
and

WHEREAS, analytical results of calendar 1993 water studies indicated that the water quality of the Upper
Three Runs and Fourmile Branch was "generally acceptable, with the exception of the tritium
concentrations" (i.e., Fourmile Branch maximum reading during one sampling event was 68.9 pCi/mL or
approximately 3.5 times the MCL Upper Three Runs maximum reading was 17.9 pCi/mL or
approximately 90% of MCl), and

WHERAS, in mid-1993, the contaminated groundwater plume, as defined by the 1,000 pCi/mL tritium
isoactivity contour (i.e., 50 times the MCL), in the F-Area was less than 400 feet from the Fourmile
Branch and the contaminated groundwater plume in the H-Area was approximately 135 feet from the
Fourmile Branch. At the same time, it was reported that the F-Area plume contained zones of tritium
concentrations as high as 30,000 pCi/mL or 1,500 times the MCL and the H-Area plume contained zones
of tritium concentrations as high as 16,000 pCi/mL or 800 times the MCL. In addition, it should be noted
that the aforementioned contaminated groundwater plumes are generally confined to the shallow aquifers

(i.e., Streed Pond, Upper Three Runs, and Gordon a.k.a. the Floridan Aquifer System) which are the
primary source of domestic water supplies in Aiken County, SC, and

FURTHER, in 1987, DOE identified 56 major municipal, industrial and agricultural groundwater users
within 20 miles of the center of SRS, and in 1992, the maximum tritium concentration measured in any
one of the 217 wells in the shallow aquifer units within the area designated as "Separations and Waste
Management" was 180,000 pCi/mL or 9,000 times the MLR, and

FURTHER, the Westinghouse Savannah River Company (SRC) has stated that "Actual or threatened
releases of hazardous substances from the site, if not addressed by the preferred alternative or one of the
other action measures considered, may present a current or potential threat to public health, welfare, or
the environment," but has not quantified the F- and H-Area Groundwater Operable Unit-specific risk(s) to
humans (or the wildlife) resulting from exposure to groundwater contaminated with hazardous and
radioactive constituents, including titrium, and

FURTHER, to the best of my knowledge, neither DOE, SRC, or any other entity has made available for public review in the SRS-area any recently de-classified Los Alamos National Laboratory or other studies involving human exposure to tritium and other radionuclides detected in the F-and H-Area groundwater in concentrations that require remediations.

FURTHER, the SRS Environmental Monitoring Section's Environmental Geochemistry Group (EGG), which regularly samples approximately 1,400 groundwater wells throughout SRS, has publicly stated "groundwater aquifers can be a major pathway for hazardous and radioactive substances to move beyond the site boundary, as well as into the Savannah River." However, to my knowledge, the public has not been made aware of the rate(s) of migration of the identical hazardous and radioactive substances toward the site boundaries and/or the six SRS tributaries that drain to the Savannah River and/or the Savannah River, nor has the total estimated volume of contaminated groundwater to be remediated been disclosed.

THEREFORE, BE IT REQUIRED THAT, DOE and/or SRC promptly and before proceeding with Phase 1 of the preferred alternative for groundwater remediation at the F-Area and H-Area Groundwater Operable Units (at and estimated Capital Cost of approximately #32 million plus an estimated on-going Maintenance & Operation cost of $4 to $6 million per year for an unknown number of years), take all necessary actions to further quantify the "current or potential threat to public health, welfare or the environment" associated with Alternatives 1, 2 and 3 and, concurrently, provide more complete information regarding the tritium and other radionuclide concentrations in the groundwater plumes, the SRS streams and the Savannah River, and publish a response to the following comments and questions:

1. Given that the half-life of tritium is approximately 12.5 years, how much of the tritium concentration recently recorded is attributable to the pre-November 1988 operations conducted at the Separations and Waste Management area? How many liters of contaminated water at what pCi/mL is being contributed daily, weekly, and/or monthly by the "processing of existing inventories of materials for a variety of purposes" within the F- and H-Area Groundwater Operable Units? Since seepage basins closure activities were reportedly completed on January 4, 1991 (F-Area) and on June 11, 1991 (H-Area), where, and in what manner are the contaminated wastes from continuing operations being stored? Is

this waste stream
being addressed by any of the alternatives?

2. Given that the geography/geology in question is located within portions of the SRS site that will
undoubtedly continue to be DOE-owned and contractor-operated for a very long time, it is not obvious to
me why the contaminated ground-water needs to be cleaned to residential drinking water standards to
satisfy DOE objectives, nor is it clear from the public information provided that the preferred alternative
for remediation will be able to meet this standard. Does DOE have in hand or has the U.S. Congress

budgeted sufficient ear-marked funds to fully implement all Phases of this project and still have funds
available to address other alleged severe environmental remediation on problems at SRS (i.e., the Canyons,
High Level Waste tank farms, Plutonium storage, etc.) at the same time?

3. Inasmuch as "there is no known effective method to remove tritium from the groundwater," it would
seem appropriate for DOE/Westinghouse SR to establish a Human Studies Project Team to coordinate
research efforts with the Los Alamos NL team and personnel/teams at other Research Laboratories (i.e.,
Argonne NL, Brookhaven NL, Idaho National Engineering Laboratory, Lawrence Berkeley Laboratory,
Lawrence Livermore NL, Oak Ridge NL, Pacific Northwest Laboratory, Sandia NL, etc.) in an effort to
determine the public health risks associated with absorption of tritium-contaminated water and water vapor
through the skin, inhalation of tritium-contaminated waste-vapor, ingestion of tritium-contaminated
liquids, etc., and document the findings in various public reports, press releases audio tapes, and video
taped presentations as soon as possible! Also, it will be important to educate the public with regard to the
origin of the radiation, the effects on humans and animals at different concentrations or dosages and how
to recognize the symptoms of tritium poisoning.

c: Drew Slaton, Public Involvement Coordinator, Westinghouse SRC
Brian Costner, Energy Research Foundation

pril 1995
Letter from Mr. W. F. Lawless to the DOE

Response: The specific comments addressed regarding the lack of a scientific justification for the project and concerns regarding cleanup to a residential standard have been previously addressed in the general response section. (Reference comment responses for numbers 2 and 4)

<IMG SRC 0495224F>

PAINE COLLEGE

Division of Natural Sciences and Mathematics 1235 Fifteenth Street Agusta, Georgia 30901-3182 (706)

Dr. Mario P. Fiori, Manager
Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, SC 29802

Dear Dr. Fiori: January 10, 1995

I was delighted last night to have the opportunity to attend the meeting in North Augusta on the proposed plans for remediation of contaminated groundwater beneath the F-Area and H-Area Seepage Basins. But I was disturbed by the lack of scientific justification provided to support what appears to be a high-minded fishing expedition by the EPA and DHEC. Both agencies repeatedly stated that the "pump-and-treat" method, at a capital and operating cost of $30-200 million dollars, is a five-year trial "to see what" happens" to the groundwater contamination in the area. That makes the project, in my opinion, an experimental enterprise insufficiently justified as a full-fledged environmental remediation capital project.

Another concern that I have is that the cleanup standard of the residential alternative for this project was mandated by EPA/DHEC, yet no scientific justification was provided to support their choice. Further, this EPA/DHEC choice may conflict with a motion moving through the SRS CAB to zone the area encompassing the Seepage Basins as industrial for cleanup purposes.

Before continuing with the Seepage Basin project, I recommend that it be submitted to independent scientific peer review to determine whether or not the project is jusfified on a scientific, engineering, and cost basis.

Sincerely,

W. F. Lawless
Associate Professor of Mathematics and Psychology

A College of The United Methodist Church and the Christian Methodist Episcopal

Church

<IMG SRC 0495224G> PAINE COLLEGE

Division of Natural Sciences and Mathematics 1235 Fifteenth Street Agusta, Georgia 30901-3182 (706) 821-8

Dr. Mario P. Fiori, Manager
Department of Energy
Savannah River Operaions Office
P.O. Box A
Aiken, SC 29802

Dear Dr. Fiori: January 25, 1995

Re: My last letter to you on F/H Seepage Basin Groundwater Cleanup

I recommended to you in a letter dated January 10, 1995, that before DOE continues with the Seepage Basin project, the project be subimitted to independent scientific peer review to determine whether or not it is justified on a scientific, engineering, and cost basis.

My recommendation was based on the following: there appeared to be a lack of scientific justification for the project; the cleanup standard of the residential alternative for the project was mandated by EPA/DHEC, yet no scientific justification was provided to support their choice: and the EPA/DHEC choice may conflict with a motion moving through the SRS CAB to zone the area encompassing the Seepage Basins as industrial for cleanup purposes.

As you are aware, the motion was passed by the SRS CAB. The reason that I am writing to you today is because the CAB's ER Subcommittee, of which I am Co-Chair, has described to consider the F&H groundwater remediation project as the subject of its next motion to be presented at the CAB's March meeting. Not knowing how this new motion will be drafted (e.g., it likely will have input from EPA, DHEC, and others), and because of its timeliness and the need to involve the public in importation discussions of SRS issues. I request that you extend the F&H Groundwater public comment period until after the March meeting.

Sincerely,

W.F. Lawless
Associate Professor of Mathematics and Psychology

A College of The United Methodist Church and the Christian Methodist Episcopal Church

1. We see no evidence at this time that remedial actions beyond those currently being implemented under the RCRA Post Closure Care Requirements are necessary to protect human health and the environment.

Response: The IROD has been modified and it is stated that the SRS RCRA permit is viewed as the primary decision-making authority and that the selected interim action under CERCLA is no further action beyond that required by the corrective action as identified in the SRS RCRA permit.

2. We respectfully take issue with the decision to seek public comment on a "No Remedial Action" option for the basins under CERCLA.

Response: The "No Remedial Action" alternative is included in the description of alternatives section as one of the three alternatives that were evaluated for remediation of the contamination at the F-Area Groundwater Operable Unit. Alternative 3 (groundwater recovery, treatment, and injection) is the corrective action described in the 1992 RCRA Permit. This action has been determined to be protective of human health and the environment. Therefore, no further action is required under CERCLA.

ENERGY
RESEARCH
FOUNDATION

January 31, 1995

Frances Close Hart
Board Chairwoman

Tim Connor
Associate Director

Theodore K Harris
President

Mr. Jeff Crane
U.S. Environmental Protection Agency, Region IV
345 Courtland Street
Atlanta, GA 30365

Dear Mr. Crane:

The Energy Research Foundation (ERF) has the following comments with respect to plans submitted in December of 1994 by the U.S. Department of Energy's Savannah River Site (SRS) to meet the requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as such

requirements pertain to the F and H Area seepage basins at SRS.

ERF's interest in the timely remediation of the F & H seepage basins and the contaminated groundwater associated with the basins goes back several years. During that time our views on the issues involved have been repeatedly conveyed to both the South Carolina Department of Health and Environmental Control (SCDHEC) and to SRS. Most recently, we submitted detailed comments on the Post Closure Care Requirements of the basins in October 1992 as part of the compliance process required by the federal Resource Conservation and Recovery Act (RCRA). This process led to SRS agreeing to install a remedial system at the basins designed to prevent the further spread of contamination into a surface stream at SRS which is a tributary to the Savannah River.

It was and remains our view that the evidence of the spread of contamination and its measureable impact on affected surface waters is a sound and compelling basis for the remedial action. Moreover, we believe the requirements imposed by SCDHEC are well-anchored in the law and settlement agreements negotiated with and signed by SRS.

The only question which should be on the table now is whether additional remedial actions to contain contaminants from the F & H seepage basins are necessary to satisfy the requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Our view on this is two-fold:

1) We see no evidence at this time that remedial actions beyond those currently being implemented under the RCRA Post Closure Care Requirements are necessary to protect human health and the environment.

537 Harden Street
Columbia, South Carolina 29205
803-256-7298

2) We respectfully take issue with the decision to seek public comment on a "No Remedial Action" option for the basins under CERCLA. In our view, the Federal Facility Agreement for SRS (Section 4, paragraph A) is clear that EPA's CERCLA process will be used to augment, rather than supplant, corrective measures reached under RCRA permit. In other words, the CERCLA process ought not be used to undermine RCRA or RCRA-based consent agreements and enforcement by the State of South Carolina of its hazardous waste laws.

The most sensible approach is one we thought the FFA laid out whereby RCRA and CERCLA activities are coordinated to ensure a minimum of duplication and conflicting requirements. We agree that it is appropriate to examine RCRA-based decisions to ensure they satisfy CERCLA requirements. Yet, we don't believe the process is well-served when a CERCLA review invites challenges to remedial actions already agreed to by all parties via an open decision-making process in which all parties, including the public, have had ample opportunity for input.

It is our hope that potential future conflicts and confusion can be avoided. We strongly recommend that in instances like that presented by the F & H seepage basins--where a RCRA-based remedial action has been developed and approved in accordance with the SRS RCRA permit and other applicable requirements-that EPA replace the "No Remedial Action" option with a "No Further Remedial Action" option.

Notwithstanding EPA's consideration of the "No Remedial Action" option at the F & H basins, we believe the process and the outcome of the RCRA Post Closure Care Requirements were fair to all parties and consistent with the consent agreements and

the law. We therefore urge EPA to accept the existing RCRA Post Closure Care Requirements as satisfying the requirements of CERCLA for the remediation of contaminated groundwater at the basins.

Sincerely,

cc. Tom Treger, DOE
Drew Slation, WSRC
Keith Collinsworth, SCDHEC
Brian Costner, ERF

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 04/13/1995
Operable Unit: 09
ROD ID: EPA/ROD/R04-95/225

Media: groundwater

Contaminant: Radionuclides

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The Savannah River Site (SRS) occupies approximately 300 square miles adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina. SRS is a secured facility with no permanent residents. The site is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina. SRS is owned by the United States Department of Energy (DOE). The original mission of the site was to produce nuclear materials for national defense. Recycling and reloading of tritium to keep the nation's supply of nuclear weapons ready is a continuing site mission. The Separations Facilities are processing existing inventories of materials for a variety of purposes, including supplying Plutonium-238 for deep space probes and processing inventoried liquid radioactive materials into solid form for storage and testing.

The H-Area Hazardous Waste Management Facility (HWMF), part of the Separations Facilities, consists of three hydraulically connected unlined basins (H-1, H-2, and H-4). Basins H-1, H-2, and

H-3 were constructed in 1955. Basin H-4 was built in 1962 to replace basin H-3. This ROD, for the H-Area Groundwater Operable Unit, addresses the groundwater contamination plume associated with these basins. The H-Area HWMF received waste effluents from H-Area chemical separations facilities such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose overheads. The waste stream contained hazardous constituents and low levels of radionuclides. Radioactivity released to these basins was due primarily to tritium. Basin H-3 was not used after 1962, and wastewater flow to the other basins was discontinued in 1988. The basins were closed by dewatering, physically and chemically stabilizing the remaining sludge on the bottoms and placing a multi-layer clay/soil cover over them. The cover reduces rainwater contact with the stabilized sludge and further contamination of the groundwater. The entire SRS was placed on the NPL in December 1989. Even though the H-Area HWMF is a Resource Conservation and Recovery Act (RCRA) -regulated unit, following the listing of the SRS on the NPL, all activities conducted in compliance with RCRA also must comply with CERCLA.

Remedy: The CERCLA selected cleanup alternative for the H-Area Groundwater outlined in this ROD is no further action beyond that required by the SRS RCRA permit. The remedy described in the 1992 SRS RCRA Permit provides for recovery of contaminated groundwater via extraction wells and treatment of hazardous constituents and radionuclides (except tritium and nitrates). The treated water under the conditions of the current permit will be injected into the shallow aquifer.

Text: Full-text ROD document follows on next page.

Text:

United States Department of Energy

Savannah River Site

Interim Action Record of Decision

Remedial Alternative Selection

for

H-Area Groundwater Operable Unit (U)

Revision.1 April 1995

Prepared by:

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Prepared for the U.S. Department of Energy Under

Contract DE-AC09-89SR18035

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Declaration for the Interim Action Record of Decision

Site Name and Location

H-Area Groundwater Operable Unit
Savannah River Site
Aiken County, South Carolina

The H-Area Groundwater Operable Unit is the groundwater associated with the H-Area Hazardous Waste Management Facility (HWMF). Both the H-Area Groundwater Operable Unit and the H-Area HWMF are part of the H-Area Fundamental Study Area. The H-Area HWMF (Building Numbers 904-44G, 904-45G, 904-46G, and 904-56G) is listed as a Resource Conservation and Recovery Act (RCRA) related unit in Appendix H of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS). These terms have been defined in the Interim Action Proposed Plan for the H-Area Groundwater Operable Unit. That document is part of the administrative record for this unit and is the document on which this declaration and the accompanying Record of Decision are based.

Statement of Basis and Purpose

The purpose of this Interim Action Record of Decision (IROD) is to address the potential concerns at the H-Area Groundwater Operable Unit under a program that comprehensively and responsively meets the needs of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and supports the SRS RCRA Permit as the primary decision-making authority. If the remedy appearing in the permit is significantly revised, a review of this interim action will be performed to determine whether requirements for continued protection of human health and the environment are being met.

This document presents the selected interim corrective action for the H-Area Groundwater Operable Unit at the SRS, which was developed in accordance with the FFA. This decision is based on the Administrative Record File for this specific unit. The selected interim action under CERCLA is no further action beyond that required by the corrective action as identified in the SRS RCRA Permit.

Assessment of the Site

The H-Area HWMF is a source specific operable unit within the H-Area Fundamental Study Area. The H-Area HWMF is located in the center of SRS, Southwest of Road E and North of Road 4 approximately 16 miles from the nearest plant boundary. The H-Area HWMF consisted of three unlined earthen basins that had a combined maximum operating capacity of 26.5 million gallons of waste water during

operation.
The groundwater contamination plume associated with these basins is called the H-Area Groundwater Operable Unit and is observed in a zone uhich extends from the water table surface to approximately 150 feet below land and surface an area of approximately 200 acres. The primary contaminants are tritium, alpha, and beta emitting radionuclides, and hazardous metals. The potential pathway for contamination from the H-Area Groundwater Operable Unit is through discharge of contamination into an onsite stream.

Remedical alternatives were developed for corrective action of the H-Area Groundwater Operable Unit as part of the SRS RCRA Permit process. Monitoring and investigation of the groundwater operable unit is being conducted. DOE is scoping a phased approach to identify the optimal sequence of activities for corrective action.

Description of the Selected Remedy

Closure of the H-Area HWMF was conducted under a RCRA closure plan approved by the South Carolina Department of Health and Environmental Control (SCDHEC). The corrective action of the groundwater operable unit associated with these basins is being addressed under the SRS RCRA Permit.

The CERCLA selected alternative for the H-Area Groundwater Operable Unit is no further action beyond that required by the SRS RCRA Permit. The remedy described in the 1992 SRS RCRA Permit provides for recovery of contaminated groundwater via extraction wells and treatment of hazardous constituents and radionuclides (except tritium and nitrates). The treated water under the conditions of current permit will be injected into the shallow aquifer at the upgradient extent of the plume. DOE has been proceeding to implement this action. On March 1, 1995, the renewal of the SRS RCRA Permit was issued as a draft for public/permittee review and comment.

Declaration Statement

Corrective action for thc H-Area Groundwater Operable Unit is specified by the SRS RCRA Permit issued by the State of South Carolina. Pursuant to the FFA, the permit addresses all identified constituents capable of harming human health and the environment. This action has been determined to be

protective
of human health and the environment under CERCLA Therefore, no further remedial action beyond or in addition to that established under the SRS RCRA Permit is necessary under CERCLA.

<IMG SRC 0495225>

Date

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<IMG SRC 0495225A>

Date

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I. Site and Operable Unit Names, Locations, and Descriptions

The Savannah River Site (SRS) occupies approximately 300 square miles (800 square km) adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina (Figure 1). SRS is a secured facility with no permanent residents. The site is approximately 25 miles (40 km) southeast of Augusta, Georgia, and 20 miles (32 km) south of Aiken, South Carolina SRS is owned by the United States Department of Energy (DOE). Westinghouse Savannah River Company (WSRC) is the managing and operating contractor for DOE.

The original mission of the site was to produce nuclear materials for national defense. Recycling and reloading of tritium to keep the nation's supply of nuclear weapons read is a continuing site mission. Today the Separations Facilities, of which H-Area is a part, are processing existing inventories of materials for a variety of purposes, including supplying Plutonium-238 for deep space probes and processing inventoried liquid radioactive materials into solid form for storage and testing. This activity is expected to continue for several years.

The H-Area HWMF is a RCRA-regulated unit (Figure 2). As an operable unit, the basins comprising the H-Area HWMF were stabilized and closed in 1991. The H-Area Groundwater Operable Unit is the Groundwater associated with the H-Area HWMF. Contaminatant plumes are shown on Figure 3.

II. Operable Unit History and Compliance History

Operable Unit History

The H-Area HWMF consists of a series of three hydraulically connected unlined basins (H-1, H-2, and H-4). Basins H-1, H-2 and H-3, were constructed in 1955. Basin H-4 was built in 1962 to replace basin H-3. Since basin H-3, was not used after 1962, it is considered Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site and uas not part of the Resource Conservation and Recovery Act (RCRA) closure. However, Basin H-3 was filled in and covered as part of the closure of the other three basins. This action satisfied the CERCLA requirements. Wastewater flow to the basins was terminated on November 7, 1988 in accordance with the requirements of RCRA. The H-Area HWMF received waste effluents from H-Area chemical separations facilities such as the nitric acid recovery unit waste storage system evaporator overheads, and general purpose overheads. The waste stream contained hazardous constituents and low levels of radionuclides. Radioactivity released to these basins was due primarily to tritium.

The basins were closed by dewatering, physically and chemically stabilizing the remaining sludge on the bottom of the basins and placing a multi-layer clay/soil cover over them. The cover system reduces rainwater contact with the stabilized sludge and further contamination of the groundwater.

Compliance History

The entire SRS was placed on the National Priorities List (NPL) in December 1989. Following that date, RCRA preventive activities at the H-Area HWMF have also been required to meet CERCLA regulations. The Federal Facilities Agreement, which became effective in 1993, formalized the integration of RCRA and CERCLA in remediations on the SRS. Remediation of environmental contamination on the SRS is directed bs a Federal Facility Agreement (FFA), which was signed by EPA Region IV, DOE, and SCDHEC and became effective August 16, 1993. The FFA identifies all sites that may require remediation and establishes an administrative process to set priorities and guide response actions. The FFA requires CERCLA Records of Decision for all RCRA decisions.

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Preventive actions at the H-Area HWMF were conducted pursuant to the requirements of RCRA per Settlement Agreement 87-27-SW between SCDHEC and DOE. In 1988, a RCRA Closure Plan was submitted to SCDHEC. The closure plan underwent revisions to address SCDHEC comments prior to approval in 1989. Closure of the H-Area HWMF was begun in 1989, completed in January 1991, and the unit was certified closed in February 1991. In April 1991, the closure certification was accepted by SCDHEC as being in compliance with RCRA requirements. Following a review of the SCDHEC RCRA action, EPA determined that it was protective of human health and the environment and that no additional actions were necessary. The three parties to the FFA then embodied this decision in a CERCLA Record of Decision on the closed basins which was signed on September 10, 1993. A RCRA Permit Application for Postclosure Care of the cover and to address groundwater contamination was submitted in December 1990 and revised in 1992. SCDHEC addressed the H-Area HWMF in the SRS RCRA Permit effective Novermber 1992. This permit required submittal of a corrective action plan for the groundwater associated with the H-Area HWMF. The Corrective Action Plan was included in the RCRA Permit Renewal Application (submitted in October 1993). On March 1, 1995, as part of renewal of the permit, a draft SPS RCRA Permit was issued for public/permittee review and comment. Issuance of the renewed SRS RCRA Permit is anticipated in the near term.

III. Highlights of Community Participation

The public comment period for the H-Area Groundwater Operable Unit Interim Action Proposed Plan was from December 14, 1994 to February 15, 1995. The comments received on the Interim Action Proposed Plan are addressed in the Responsiveness Summary found in Appendix B.

IV. Scope and Role of Operable Unit Within the Site Strategy

The description of the remedy addressing groundwater contamination at the H-Area Groundwater Operable Unit, summarized below, is from the SRS RCRA Permit.

As described in the SRS RCRA Permit the goal of remediation of the H-Area Groundwater Operable Unit is to lower contaminant concentrations in the groundwater associated with the H-Area HWMF to levels specified in the RCRA permit and to minimize the discharge of contaminants to the adjacent stream. In accordance with the current 1992 SRS RCRA Permit, the remediation program includes groundwater extraction, treatment, and injection at the upgradient extent of the contamination. The remediation follows the closure of the H-Area HWMF and precedes the investigation of smaller source-specifies units

in the H-Area Fundamental Study Area. The smaller source-specific sites will require investigation and possibly remediation in accordance with the FFA. The groundwater remediation is an interim measure pending an evaluation of its effectiveness in actual practice. The 1992 RCRA Permit specifies that the overall corrective action will be implemented in phases and will be periodically reevaluated. The scope of The phase I action coupled with possible future actions (i.e., Phase II, Phase III) will serve to provide protection to human health and the environment.

V. Summary of Operable Unit Characteristics and Contaminants

Waste effluents from H-Area chemical separations facilities including the nitric acid recovery unit, waste storage system evaporator overheads and general purpose evaporator overheads were discharged to the H-Area HWMF. Significant amounts of nitrate and caustic were discharged to the basins. Tritium was the primary radioactive constituent (99%) released to the basins. According to the RCRA Permit the following constituents have been detected at concentrations above the Groundwater Protection Standard (GWPS) established in the 1992 SRS RCRA permit:

Hazardous Constituents (South Carolinia Hazardous Waste Management Regulations 264.94 Table 1)

Arsenic	Barium
Cadium	Chromium
Lead	Mercury
Selenium	Silver
Lindane	

Hazardous Constituents (SCHWMR 261 Appendix VIII/264 Appendix IX)

Antimony	Benzene
Bis(2-ethylhexyl)phthalate	Cobalt
Copper	Cyanide
Methylene Chloride	Nickle
Tetrachloroethylene	Tin

Trichloroethylene	Trichlorofluoromethane
Vanadium	Zinc

Non-Hazardous Constituent

Nitrate

Specific Radionuclides + Indicators

Gross Alpha	Gross Beta (i.e., Nonvolatile Beta)
Total Radium (226 + 228)	Tritium
Americium-241	Carbon-14
Cobalt-60	Curium-242
Curium-243/244	Curium-246
Iodine-129	Nickle-63
Plutonium-238	Plutonium-239/240
Radium-226	Radium-228
Stontium-90	Technetium-99
Thorium-228	Thorium-230
Uranium-233/234	Uranium-234
Uranium-235	Uranium-238

VI. Summary of Operable Unit Risks and Basis for Remedial Action

The maximum detected level of several contaminants (e.g., tritium, cadmium, and lead) in the H-Area groundwater currently exceed the National Primary Drinking Water Standards, and applicable state standards. However, potential exposures to the general public are minimized by the distance from the operable unit to the site boundary, by natural attenuation and radionuclide decay, by institutional controls, and by dilution in receiving streams. In addition, all off-site contaminant concentrations are well below drinking water and other applicable standards. This corrective action will address the potential ecological

impacts at the seeplines along Fourmile Branch, and will also serve to address the ambient water quality standards in Fourmile Branch by remediating this operable unit. The remediation of the H-Area Groundwater Operable Unit will be designed to meet, as far as practicable, the Phase I groundwater protection standards outlined in the RCRA permit.

VII. Description of Alternatives

Three alternatives were evaluated for remediation of contamination at the H-Area Groundwater Operable Unit. Each alternative is described below.

1. No Remedial Action.

2. Groundwater Recovery and Hydraulic Control with treatment of mobile hazardous constituents and radionuclides (except tritium and nitrates) and discharge of treated water to a surface stream.

3. Remedy as provided in the SRS RCRA Permit, i.e., groundwater recovery and hydraulic control with treatment of mobile hazardous constituents and radionuclides (except tritium and nitrates) by treatment and injection of treated water into the shallow aquifer at the upgradient extent of the plume.

All three of the alternatives include groundwater monitoring, engineering and administrative controls to guard against inadvertent human and ecological exposure to contaminated water.

Alternative 1. No Remedial Action

Under Alternative 1, no groundwater extraction would be conducted. Concentrations and activity levels of the constituents of concern would gradually be reduced with time through natural attenuation processes such as dispersion and radioactive decay. Groundwater would continue to discharge low levels of contaminants into surface waters. Institutional controls and long term monitoring of groundwater, surface water, and ecological conditions would be components of the no remedial action alternative. These activities are already being implemented and associated costs are substantially lower than the other alternatives. The lower cost is due to the lack of capital expenditures, such as the procurement of a treatment system and the installation of wells. Potential risks to off-site receptors would be identified through monitoring and minimized by institutional controls.

Alternative 2. Groundwater Recovery, Treatment, and Discharge to a Surface Stream.

This alternative would consist of recovery of contaminated groundwater via extraction wells and treatment

to remove hazardous constituents and radionuclides (except tritium and nitrates). The treated water would be discharged through an NPDES permitted outfall into a surface stream at SRS. A practical technology to remove tritium from the groundwater does not exist. Therefore, tritium would be released to the surface water. Hazardous constituents and radionuclides removed from the groundwater would be immobilized and disposed in permanent disposal vaults at SRS.

Discharge of the treated water would shorten the flow path of tritium-contaminated groundwater to surface streams. This strategy would allow less time for tritium decay before water discharges to surface waters. In the short term this system could increase specific activities of tritium in the onsite receiving streams. However, the impact to the Savannah River would be negligible due to dispersion and dilution. (The specific activity of a radionuclide is equivalent to the concentration of a chemical).

Institutional and engineering controls, plus long-term monitoring of groundwater and surface water conditions would be part of Alternative 2, and anticipated to be lower in cost than Alternative 3.

Alternative 3. Groundwater Recovery, Treatment, and Injection

Alternative 3 is the remedy provided in the 1992 RCRA permit. It provides three phases for the recovery of contaminated groundwater via extraction wells and treatment of hazardous constituents and radionuclides (except tritium and nitrates). The extraction wells would capture the plume as defined by the 10,000 picoCuries per milliliter (pCi/mL) tritium contour (Figure 3). Groundwater modeling was used to determine optimal well locations and pumping rates. Unlike Alternative 2, the treated water would be injected into the shallow aquifer at the upgradient extent of the plume. Meeting treatment standards provided in the RCRA permit in the injected water is the remedial goal of Phase I.

Although tritium will not be removed from the groundwater, injection of the treated water will partially control the movement of tritium-contaminated water. Upgradient injection will lengthen the tritium flow path to the seep lines, allowing more time for tritium decay before the plume water discharges to the receiving stream. This will reduce tritium discharges to the onsite receiving surface stream.

Institutional and engineering controls, plus long-term monitoring of groundwater, surface water, and
ecological conditions would be part of Alternative 3. This alternative could be operational in accordance
with the schedules in the SRS RCRA Permit, and it would have the highest costs of the three alternatives.

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Table 1. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance

Actions	Requirements	Prerequisites	Federal Citation
South Carolina			
Code of Laws			
LOCATION - SPECIFIC			
Groundwater Remediation	Establish a Corrective action program	Measurement of hazardous constituents in the groundwater which exceed established concentration limits. - Substantive applicable	40 CFR 270.14 40 CFR 264-92-100
SC - R.61-79.270.14			
SC - R.61-79-264.92-100			
(Implemented by the SRS RCRA Permit)			
CHEMICAL - SPECIFIC			
Protection of the general public from all sources of radiation	The general public must not receive an effective dose equivalent dose equivalent greater than 100 mrem/year	Dose received by the general public from all sources of radiation exposure at a DOE facility - TBC guidance	DOE Order 5400.5
Worker Protection	Maintain worker exposures to "as low as reasonably	Internal and external source of continuous	DOE Order 5480.11

	achievable" (ALARA).	exposure to occupational workers at a DOE facility - TBC Guidance	
	Maximum exposure to occupational workers: 5 rem/year (stochastic); 50 rem/year (nonstochastic) effective dose equivalent	Internal and external sources of continuous exposure to occupational workers at a DOE facility - TBC guidance	DOE Order 5480.11

Table 1. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance (Cont'd)

Actions	Requirements	Prerequisites	Federal Citation
South Carolina			
Code of Laws			
ACTION - SPECIFIC			
Water Treatment SC - R.61-9	Discharge limits will be established in the permit	Discharge of regulated constituents in water - Substantive requirements applicable	
Stormwater SC Pollution discharge Control Act Title 48-1-10	Prepare a Notice of Intent in accordance with NPDES SC 1000000	Land Disturbance activities over 5 acres - Applicable	
Erosion Control SC 72-300	Develop a plan for erosion sediment control	Land disturbing activities - Applicable	

Well Construction SC R.61-71	Construction by a certified driller is required	Drilling water wells - Applicable	
	Standards for construction maintenance, and operation of all wells	Drilling Water wells - Applicable	40 CFR 144-147
SC R.61-87.4	Standards for construction of injection wells	Construction injection well - Applicable	
Discharge of treated water to groundwater	Injection of any waters to groundwater of the State by means of an injection well is prohibited except as authorized by a Department permit or rule	Discharge to injection wells - Substantive requirements applicable	
Wastewater S.C. Pollution Treatment Control Act Title 48-1-110	State of S.C. requires a permit to build and a wastewater facility	Construction and operation of industrial wastewater treatment facility - Substantive requirements applicable	

Table 1. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance (Cont'd)

Actions	Requirements	Prerequisites	Federal Citation
South Carolina Code of Laws			

Wastewater Treatment (cont'd)	A NESHAP evaluation to determine if source of radionuclide emission requires EPA approval	Radionuclides other than radon from DOE facilities (Air discharge may or may not be a part of the selected treatment process) - TBC Substantive requirements may be applicable	40 CFR 61.96
Secondary Waste Disposal	Disposal in a low level waste disposal facility	Generation of Low Level radioactive secondary waste - TBC guidance	DOE Order 5820.2A

Acronyms used in Table

TBC = to be considered
CFR = Code of Federal Regulations
DOE = Department of Energy
EPA = Environmental Protection Agency
NPDES = National Pollutant Discharge Elimination System
NESHAP = National Emissions Standards for Hazardous Air Pollutants
UIC = Underground Injection Control

VIII. Summary of Comparative Analysis of Alternatives

Each of the remedial alternatives was evaluated using nine criteria established by the National Contingency Plan. The criteria were derived from the statutory requirements of CERCLA, Section 121.
The results of the evaluation are presented in Table 2.

Description of Nine Evaluation Criteria

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) - addresses whether a
remedy will meet all of the ARARs of other federal and state environment statutes.

Overall Protection of Human Health and the Environment - addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or
controlled through treatment engineering controls or institutional controls.

Long-term Effectiveness and Permanence - refers to the magnitude of residual risk and the ability of a
remedy to maintain reliable protection of human health and the environment over time once

cleanup goals
have been met.

Short-term Effectiveness - refers to the speed with which the remedy achieves protection, as well as the potential for a remedy to create adverse effects on human health and the environment that may result during the construction and implementation period.

Reduction of Toxicity, Mobility or Volume Through Treatment - assesses reduction of toxicity, mobility, or volume through treatment including how treatment is used to address the principal threats posed by a media-specific operable unit.

Implementability - assesses the technical and administrative feasibility of a remedy, including the availability of materials and services that may be used to implement the chosen solution.

Cost - includes capital and operation and maintenance costs.

State Acceptance - indicates whether the state concurs with, opposes, or has no comment on the preferred alternative based on its review of the proposed action.

Community Acceptance - will be assessed in the Record of Decision following a review of the public comments received on the proposed interim actions.

IX. Selected Remedy

The SRS RCRA permit is viewed as the primary decision-making authority. Alternative 3 (groundwater recovery, treatment and injection) is the corrective action described in the 1992 RCRA permit. This action has been determined to be protective of human health and the environment under CERCLA, and therefore, no additional corrective action under Phase I is necessary at this time.

Table 2. Evaluation of Alternative Actions Considered for Remediation of Groundwater Contamination.

Evaluation Criteria	Alternative 1	Alternative 2	Alternative 3
	No Action	Pump-treat-discharge to stream	Pump-treat-inject (RCRA permit)

Overall Protection of Human Health and the Environment	This alternative will minimize tritium discharge to the wetlands, streams, and ultimately to the Savannah River. This alternative is protective of human health and environment.	This alternative is the least protective of human health and the environment. If groundwater above the GWPS continues to seep along Fourmile Branch uncontrolled, then some measure of human and ecological impact may occur	In the short term, this alternative will increase tritium flux to the Savannah River (levels will remain below DWS).
Compliance with ARARs	The water treatment unit will be constructed in full compliance with wastewater treatment regulations. Treated groundwater will meet Underground Injection Control (UIC) permit requirements and off-gas from the treatment unit will meet Clean Air Act regulations. Clean up goals for this alternative will meet RCRA permit levels.	This alternative will not be in compliance with the Groundwater Protection Standards as contaminant concentrations in the groundwater and local onsite surface water exceed primary drinking water standards.	This water treatment unit will be constructed in full compliance with wastewater treatment regulations. Treated groundwater will meet NPDES requirements and off-gas from the treatment unit will meet Clean Air Act regulations. Clean up goals for this alternative will be based on drinking water standards (with the exception of tritium).

Long-term effectivess and permanence	Adequacy of this alternative will be assessed by monitoring.	Contaminants (except tritium and nitrates) will be removed from the groundwater and disposed of in low level radioactive waste vaults at SRS. Residual risk is expected to be minimal. Adequacy of this remediation will be assessed by monitoring.	Contaminants (except tritium and nitrates) will be removed from the groundwater and disposed of in low level radioactive waste vaults at SRS. Tritium discharge to surface water will be minimized. Residual risk is expected to be minimal. Adequacy of this remediation will be assessed by monitoring.

Table 2. Evaluation of Alternative Actions Considered for Remediation of Groundwater Contamination.
(cont')

Evaluation Criteria	Alternative 1	Alternative 2	Alternative 3
	No Action	Pump-treat-discharge to stream	Pump-treat-inject (RCRA permit)
Reduction of toxicity, mobility, or volume through treatment	None	Water treatment process will remove contaminants (except tritium and nitrates)	Water treatment process will remove contaminants (except tritium and nitrates)

from the groundwater, reducing toxicity. Tritium release to surface water will be reduced by allowing a longer time for radioactive decay of tritium before it discharges to surface water.

from the groundwater, reducing toxicity. Tritium release to surface water may be increased; however, tritium levels in the Savannah River will remain well below drinking water standards.

Short-term effectiveness

Groundwater recovery and treatment will immediately reduce the amount of contaminants from discharge to wetlands and streams. Tritium release to surface water will immediately be reduced by allowing a longer time for radioactive decay of tritium before it discharges to surface water.

This alternative does not provide a short-term remedy for preventing discharges of contaminated groundwater to wetlands, surface streams and ultimately the Savannah River.

Groundwater recovery and treatment will immediately reduce the amount of contaminants (except tritium and nitrates) from discharging to wetlands and streams. Tritium release to surface water will be increased; however, tritium levels in the Savannah River will remain well below drinking water standards.

S

ince risks to the offsite population are minimal,

Since risks to the offsite

		population are minimal, no measures to protect the community will be required during remediation and during the time period before remedial goals are met. Protection of workers will be required to eliminate risks associated with handling and treatment of radioactive materials.

Table 2. Evaluation of Alternative Actions Considered for Remediation of Groundwater Contamination.
(cont't)

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Pump-treat-discharge to stream	Alternative 3 Pump-treat-inject (RCRA permit)
Implementability	This alternative is already in place.	Water treatment processes to remove contaminants of concern (except tritium and nitrates) are commercially available.	Water treat processes to remove contaminants of concern (except tritium and nitrates) are commercially available.

Technology to inject reated water into an quifer exists; however, here may be operational roblems with such a ystem. Some evelopment may be equired before the njection system design an be finalized.		
Cost Capital Cost = approximately $16 million. Maintenance & Operation = estimated to be between $2 and $3 million per year.	Capital Cost = None Maintenance & Operation = Groundwater Monitoring and Reporting Costs	Capital Cost = approximately $16 million. Maintenance & Operation are probably less than the preferred alternative because surface discharge is less expensive to operate than an injection field.
State Acceptance This alternative has been accepted by SCDHEC. A RCRA permit requiring a corrective action plan for pump-treat-inject to remediate groundwater	During negotiations with regulators, it was indicated that this alternative would not be acceptable to SCDHEC.	During negotiations with regulators, it was indicated that this alternative would not be acceptable to SCDHEC because it would not minimize tritium discharge to surface

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contamination has been issued.		waters.
Community Acceptance	This criterion will be completed following public review.	This criterion will be completed following public review.
This criterion will be completed following public review.		

X. Statutory Determination

The National Contingency Plan (40 CFR 300.430(e)(9)) sets forth nine evaluation criteria that provide the basis for evaluating alternatives and subsequent selection of a remedy. The selected alternative, Alternative 3, was evaluated with respect to the five statutory findings, as required for interim actions under CERCLA. The results of the evaluation are as follows:

Protection of Human Health and the Environment. Alternative 3 will mitigate risks of exposure to contaminated surface water by minimizing discharge of contaminated groundwater to the adjacent wetlands and stream. In addition, removal of hazardous constituents and radionuclides (except tritium and nitrates) will reduce the future risk of exposure to contaminated groundwater by ingestion.

Attainment of ARARs. All ARARs, as identified in Table 1, pertaining to the treatment and disposal of contaminated groundwater and injection of treated water will be met by the proposed alternative.

Cost Effectiveness. Alternative 3 has significantly higher operating and maintenance costs than the other alternatives, because the injection system is expected to be a long-term and high maintenance operation. However, operation of any treatment facility which will handle radioactive will be costly.

Use of Treatment Technologies and Permanent Solutions to the Maximum Extent Practicable. The chemical water treatment process represents utilization of treatment technologies to the maximum extent practicable. No practicle treatment is available for tritium.

Reduction of Mobility, Toxicity, and Volume. The selected alternative utilizes extraction and treatment of contaminated groundwater in a way that minimizes migration of contaminants to surface waters and reduces the mass of contaminants in the plume. Hazardous constituents and radionuclides removed from

the groundwater will be immobilized and deposed in permanent disposal vaults at SRS. The system will
be designed to ensure that the secondary waste sludge will not be a hazardous waste.

XI. Explanation of Significant Changes

There were no significant changes.

APPENDIX A

References for Development of ROD Format

EPA, 1991. "Guide to Developing Superfund No Action, Interim Action, and Contingency Remedy RODs," OSWER Publication 9355.3-02FS-3, U.S. Environmental Protection Agency, Washington, D.C., April 1991.

Weeks, Victor, 1993. "Regarding Records of Decision, H-Area and H-Area, Savannah River Site, Aiken,
South Carolina", Letter to Goidell (DOE), Savannah River Site, Aiken, SC, April 14, 1993.

WSRC, 1992. "Draft RCRA Facility Investigation/Remedial Investigation Program Plan," WSRC-RP-89-
994, Rev. 1, Chapter 15, Westinghouse Savannah River Company, Aiken, South Carolina, May 1992.

APPENDIX B

RESPONSIVENESS SUMMARY

During the 34 day public comment period, a request for a public meeting was received. The public
meeting was held on January 9, 1995, in the North Augusta Community Center, North Augusta, South Carolina. The public comment period was extended an additional 30 days so that comments could be
submitted.

DOE has received comments regarding the F&H Areas Groundwater Operable Units and they have been addressed in this Responsiveness Summary. These comments are available for review in the Administrative Record.

During the public comment period, several letters were submitted from individiuals and groups regarding
the proposed interim action. This Responsiveness Summary addresses the general comments and

concerns from the public meeting and specifically addresses the written comments received. The summary is divided into three sections: 1) general responses to specific comments and questions raised during the public meeting, 2) responses to written comments received on questionnaires at the public meeting, and 3) specific responses to written comments received during the public comment period.
Please note that some of the specific comments are addressed in the general response section due to common questions and concerns.

Many of the comments that DOE has received relating to this type of project question the soundness of the planned remediation. DOE is required to continue the groundwater remediation project under the terms of the Resource Conservation and Recovery Act (RCRA) Hazardous Waste Permit that is issued by the State of South Carolina in conjunction with the United States Environmental Protectien Agency (EPA).
This permit sets forth all the requirements with which DOE is obligated to comply. Prior to issuance of the permit, the South Carolina Department of Health and Environmental Control (SCDHEC) issues a draft permit that is made available to the public and the DOE for a 45 day comment period. Any interested party can request a public hearing to discuss concerns regarding the conditions set forth in the draft permit. SCDHEC will evaluate these concerns prior to issuing a final hazardous waste permit.
Many of the comments received are in regards to the appropriateness of this corrective action. These comments will be addressed through the SCDHEC RCRA renewal permitting process during the 45 day public comment period

The following questions were extracted from the public meeting transcript and are numbered sequentially for ease of reference as they appeared in the transcript.

1. How does the cost effectiveness of this program relate to Grumbly's six goals?

Response: Grumbly's six goals are:

Eliminate and manage the urgent risks in our system
Emphasize health and safety for our workers and the public
Establish a system that is managerially and financially in control
Demonstrate tangible results
Focus technology development efforts on identifying and overcoming obstacles to progress
Establish a stronger partnership between the DOE and its stakeholders

These six Grumbly goals are Department of Energy programmatic goals. In terms of these goals the F- and H-Area projects do not rate highly in terms of managing urgent risks. However, SRS

must work within the framework of exising laws and regulations in making decisions regarding the cleanup of F- and H-Area Groundwater Operable limits.

2. Provide scientific justification?

Response: As part of the development of the Corrective Action Program contained in the RCRA Part B HWMF Permit, 12/3/90, SRS evaluated several potential ground water remediation technologies for implementation at the F&H Seepage Basins. Based on a thorough evaluation of serious treatment alternatives, which included evaluation of Treatment Effectiveness, Constituents Treated, Treatment of Seep Area, Regulatory Requirements, Implementation Schedule, Capital Cost, etc., SRS selected the ground water removal with the surface treatment remediation alternative. Further studies were performed to evaluate the potential surface treatment technologies, and potential treated effluent discharge alternatives. A request for proposal has be a sent out for bid 12/28/94. A commercially available water treatment unit will be selected based on technical evaluation of the vendor bids, cost, and the ability of the unit to meet or exceed the clean up levels.

Alternate remedial technologies have been evaluated as part of technology selection for the RCRA corrective action plan. Evaluation criteria included treatment effectiveness, feasibility, ability to satisfy regulatory requirements, and capital cost. Pump and treat was chosen largely because it is a developed technology for groundwater remediation. A demonstrated technology can be implemented more quickly (and usually more inexpensively) than an innovative technology which would require extensive laboratory and field testing prior to implementation.

Potentially applicable technologies which have been considered include immobilization techniques such as deep soil mixing and in-situ vitrification. Other potentially applicable technologies are those which remove or immobilize contaminants in-situ (such as electrokinetic migration and magnetic separation.) Introduction of chemicals into the subsurface which would cause precipitation of contaminants or mobilize them for faster removal have also been considered. All of these were eliminated from consideration because of the expense involved in development and testing of these technologies, and because of the uncertainty of their effectiveness.

3. How long will the process take?

Response: The duration of the entire remedial process has not yet been determined. The

RCRA
Part B permit application calls for remediation to be accomplished in phases. Phase I is expected to operate for five years. The effectiveness of the corrective action will be evaluated at the conclusion of Phase I. At that time, a decision will be made whether to discontinue operation of the remedial system, to continue operation without modification, or to modify the system to enchance its performance in the next phase.

4. What kind of a standard are you cleaning up to? Residential or Industrial? Are you cleaning up to a residential standard? If this is being cleaned up to an industrial standard, would this even have to be done? So the reason to do this is to reduce the levels in the GW and at the seepline to get it to a residential standard? And if we were talking about an Industrial standard, it would strictly be for the tritium contamination, is that right? Discussion on land use including if industrial use, a different standard should be applied. Is that land use policy before you go in and spend money?

Response: The clean up levels, Groundwater Protection Standards (GWPS) are based on drinking water standards and background levels. These values are mandated by the RCRA permit and do not reflect either an industrial or residential standard as defined by EPA Risk Assessment Guidance for Superfund sites (RAG's). Residential standards are considerably more stringent than the GWPS for some constituents and less restrictive for others. Industrial standards as defined by EPA guidance are more restrictive than the GWPS for some constituents and less restrictive for others.

RCRA does not recognize any difference between residential and industrial scenarios. RCRA is a regulation that was developed to address mainly active, industrial sites--so there was not a need to make distinctions between residential and industrial for the regulated units under the RCRA permit.

5. Ability to Capture Contaminants? (referring to which COC's, ie. metals and radionuclides, will be cleaned up)

Response: The remedial system is being designed to extract contaminated water from the ground,

treat it to remove hazardous constituents and radionuclides (except tritium and nitrates), and inject the treated water back into the shallow aquifers. In order to achieve clean up goals, the contaminants must be captured by the extraction well network. Any contaminants which are in the water and are mobile are expected to be captured and treated by the pump and treat system.

Radionuclides and hazardous metals generally adsorb onto soil particles, which can inhibit their capture by a pump and treat system. However, during operation, solutions with very low pH were placed in the basins. The low pH facilitated the movement of hazardous metals and radionuclides into the groundwater. Hazardous metals and radionuclides are present in the groundwater downgradient of the basins, and in surface water at the seepline (wetlands), indicating that these constituents are in the water and are mobile. Therefore, these constituents are expected to be captured and treated by the proposed corrective action while the pH remains low in portions of the plume. However, the pH is expected to rise as the system begins to operate which will reduce the mobility of many of the metals and radionuclides.

Evaluation of the corrective action will take place at the conclusion of Phase I. Modification of the system to enhance capture of any contaminants which remain in the groundwater will be considered at that time.

6. There is essentially no difference in the metals between the Four Mile Creek and the Savannah River?

Response: The levels of hazardous metals are below primary drinking water standards in the Savannah River. Cadmium has been measured above the primary drinking water standard in Four Mile Creek. Lead, cadmium and zinc exceed ambient water quality standards in Four Mile Creek.

7. When tritiated water is injected upgradient, how long will it take to reach the surface water and at what rate will it be decaying? To what degree will the tritiated water reinjected upgradient decay? Do we have a model as to what degree the tritium will decay by the time it gets to the surface water? Can you supply how much tritium will ultimately go into the creek?

Response: The pump-treat-inject system takes advantage of the short half life of tritium to minimize the migration of tritium from the F and H Area seepage basin plumes to surface water and ultimately the Savannah River. The half life of tritium is 12.3 years. This means that every 12.3 years half of the tritium has decayed. Groundwater extracted as the downgradient edge

of the
plume will be treated to remove hazardous constituents and radionuclides except tritium and nitrates. The treated water will be injected into the shallow aquifer upgradient of the plume. Based on groundwater modeling contained in the 1992 Part B Permit Application, It is estimated that it will take 3-5 years for injected water to travel back to the extraction network and be recaptured and reinjected for another 3-5 year cycle.
This system will provide a measure of hydraulic control which will minimize tritium discharge to adjacent wetlands, steams, and ultimately the Savannah River. The total estimated reduction in tritium discharged to surface water due to implementation of the proposed Phase I corrective action based on groundwater modeling is approximately 3000 curies. The total estimated tritium release

from F&H Areas to Founrule Creek between the years of 1997 to 2027 is estimated to be 16,690 curies.

8. Describe the treatment system that takes place at the surface? Have you specified particular treatment technology?

Response: The actual treatment process has not been determined. A commercially available water treatment unit will be used. A particular treatment technology has not been specified. Selection of the actual unit will be based on a technical evaluation of vendor bids and cost considerations.
Technical evaluation will be based on the ability of the unit to meet or exceed clean up levels.
Performance specifications will require that any secondary waste generated will be non-hazardous.
However, it will ultimately be up to the supplier to provide a commercial treatment technology that will meet the water clean up standards and the requirements of the specification. SRS has performed an evaluation of various treatment technologies, which included evaporation, reverse osmosis, ion exchange, chelation, and chemical precipitation.

9. Has the RFP gone out for bid?

Response: The RFP went out for bid on December 28, 1994.

10. "Found tritium 1500 feet down in wells in Georgia."

Response: The results of the tritium underflow study indicate that there is not any tritium migrating from the SRS to Georgia under the Savannah River. The tritium in the wells in Georgia was found to come from rainwater. The rainwater contained small amounts of tritium from atmospheric releases of tritium.

11. Will the drawdown and reinjection increase the migration? If so, how much? What effect will drawdown and migration have on migration of radionuclides and other chemicals in the soil? Will drawdown (and reinjection) increase the flow of nuclides more so than if you had left it the way it is? Will drawdown increase rate of migration? soil effects? radionuclides?

Response: The extraction / injection system is designed to change the flow path and increase the migration rate of contaminated plume water. Flow towards the extraction wells will be increased by pumping and drawdown. This will enhance delivery of the contaminants to the treatment unit. It is not expected to increase migration of contamination towards surface water or any environmental receptors.

The effect of pumping and drawdown on migration of radionuclides and chemicals in the soils is expected to be minimal. In the saturated zone, the greatest fraction of contamination is thought to exist in the groundwater and is not expected to be adsorbed onto saturated sediments. Any contamination which is bound to sludge and soils in the unsaturated zone at the waste sites has been isolated from the groundwater by source control measures. Low permeability caps provide source control by deflecting rainwater from infiltrating into the closed waste site and thus protecting against transportation of contaminants into the groundwater. Pumping and drawdown will have no direct effect on the unsaturated zone.

12. "...this IAPP position is very negative and very techically oriented and very difficult for the common person who does not work on the site to understand." Why was Rev 1 (IAPP) so negative and difficult to read when Rev 0 as much easier?

Response: SRS will attempt to make these type of documents easier to read in the future. It can be a difficult balance to insert the appropriate amount of technical discussion for the regulators and reviewers, and at the same time summarize the proposed action in clear and concise manner. The Rev 1 document incorporated DOE-HQ, EPA and SCDHEC comments. Some of the comments requested incorporation of more technical discussion.

13. "...public can influence the decision-making process.."

Response: EPA, SCDHEC and DOE encourage and support public participation in the environmental restoration process. Both RCRA and CERCLA require public review of the remediation decisions. These Proposed Plans document that the RCRA remedy chosen to remediate contaminated groundwater at F&H-Areas is protective of human health and the environment and meets the requirements of CERCLA. The RCRA decision had already been subject to the public review process and had been deemed acceptable. The public will be allowed another opportunity to provide comment in the RCRA process in the near future when the draft permit renewal is issued for public comment.

14. "Why does the Bulletin indicate that our minds are made up for the selected alternative when the IAPP says the public will be given the opportunity to participate in the selection of the remedial action."

Response: The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) are the regulations implementing CERCLA. The NCP gives specific requirements for selecting a remedy for a site. After identifying the alternative that best meets the requirements, the lead agency presents the alternative to the public. The proposed plan describes the remedial alternatives analyzed by the lead agency, presents a preferred remedial action alternative and summarizes the information relied upon to select the preferred alternative. The proposed plan is then made availabie to the public for review.

After review by the public the proposed plans are then re-evaluated to see if the preferred alternative provides the best balance of trade-offs, factoring in any new information or public perspective. The Bulletin identified the preferred remedy in the Proposed Plan and gave information about the public comment period.

15. "...the only action is the one done under RCRA 2 years ago or do we have a right to say which alternative we wish to have brought up before you folks.."

"...What makes me think that my opinion in the selection of the alternatives counts? Has anyone listened to what DOE is saying.?"

Response: The Proposed Plans for the F&H Groundwater Operable Unit state that no additional actions are necessary under CERCLA to address the contaminated groundwater. The RCRA proposed for the F&H-Area Groundwater Operable Unit at the public meeting.

16. How was SRS scored for placement on the National Priority List?

Response: The SRS was placed on the NPL December 21, 1989. SRS commented on the proposed listing to EPA during the allowable comment period. Specific comments regarding how the site was ranked are not specifically relevant to these Proposed Plans. However, this information can be obtained from Region IV EPA.

17. The H-3 Basin does not fall under RCRA and it is also the primary source for the release of mercury, and this has not been addressed?

Response: Basin H-3 was not considered a regulated unit under RCRA. However, the NCP gave EPA broad authority to determine how best to use its authorities under CERCLA, RCRA, or both to accomplish appropriate cleanup action at a site, even where the site is listed on the NPL. When the site is an active, RCRA-permitted facility, EPA may consider whether the use of RCRA or CERCLA authorities (or both) is most appropriate for the accomplishment of cleanup at the site. The cleanup plan would be discussed in the InterAgency Agreement, or the Federal Facility

Agreement (FFA) at the SRS. The DOE, EPA and SCDHEC agreed that cleanup would be best accomplished by integrating it into the existing RCRA action. This not only accomplished it faster and cheaper, but allowed the entire complex to be closed and monitored as one unit.

18. The National Academy of Sciences finds pump and treat an incomplete remedial activity? What would it recommend as an alternative?

Response: The National Academy of Sciences (NAS) performed an extensive review of alternatives for groundwater cleanup, which included a review of pump and treat systems. The NAS stated that based on a review of these systems, that the effectiveness of the pump and treat technology to restore contaminated aquifers seems quite limited and subsequently, this has led to a widely held view that pump and treat systems should not be used for groundwater remediation. The conclusions of this report are based on a review by the NAS of only 77 sites utilizing the pump and treat technology. The NAS has indicated that there are greater than 3000 pump and

treat units
currently in operation. Based on a review of the 77 listed sites and their associated hazardous wastes, only 3 sites were identified to contain metals, and the remainder all contained primarily organic hazardous wastes. Consequently, the results reported certainly do not represent the overall effectiveness of the pump and treat technology for all hazardous waste streams. Although the pump and treat technology appears to be limited, the NAS identifies several factors to be considered in utilizing pump and treat as a possible remediation method. The key technical reasons for the difficulty of cleanup include the following:

Physical heterogeneity: The subsurface environment is highly variable in its composition and contaminant migration pathways are often extremely difficult to predict.
Presence of nonaqueous-phase liquids (NAPL's): This includes many common contaminants like oils, gasolines, etc., that do not dissolve readily in water.
Migration of contamination to inaccessible regions: Contaminants migrate to inaccessible areas of the flowing groundwater.
Sorption of contaminants to subsurface materials: Contaminants adhere to solid materials in the subsurface.
Difficulties in characterizing the subsurface: The subsurface cannot be viewed in its entirety and is usually only viewed through a small number of drilled holes.

Based on a review of the above technical difficulties and the 77 sites reviewed by the NAS, which all contained primarily organic waste streams, it is apparent that the effectiveness of the pump and treat technology is very site specific. The difficulties noted above are not of major concern at the F&H Groundwater Operable Units, ie., the subsurface environment and contaminated pathways have been extensively characterized, groundwater monitoring indicates no presence of NAPLs, the plumes exist in shallow easily accessible aquifer units, and studies indicate that sorption of contaminants to subsurface materials in minimal. Finally, the NAS provides several alternative technologies or "enhanced pump and treat systems", i.e. soil vapor extraction, bioremediation, air sparging, etc., and states that these methods, show promise, but they are in the development stage, and their long term effectiveness has not yet been determined. These techniques are applicable to remediation of volatile organics (ie. TCE, PCE), but are not effective for cleaning up metals and radionuclides such as those that exist at F&H seepage basins.

19. How much will the proposed remediation cost? $270 million? Have any alternatives to

reduce the
operating cost by reducing the life cycle primarily been investigated as part of this? What
technologies for reducing operating costs were looked at, if any, and at what point in the future
operating scheme or phases is that expected to be done?

Response: Table 2 in each of the interim Action Proposed Plans for F&H Areas addresses the
estimated costs for each of the alternatives. Alternative 3 (pump and treat system) capital costs are
estimated at $16 million per area ($32 million combined) and the annual operating costs are
estimated at $3 million per area ($4 million to $6 million combined). Phase I will

operate for 5 years. Capital costs and operation of Phase I are estimated at approximately 45
million dollars. Future phases may incur additional costs. Total life cycle costs are dependent
upon further evaluation of subsurface conditions and evaluations of the effects of pump and treat
once the system is operational. Studies are underway across the DOE complex to identify and
develop technologies which will enhance remediation and reduce life cycle costs.

20. "Did you purposely plan the public comment period over Christmas? Why was this meetings so
hurriedly called?

Response: The public comment period is always scheduled as soon as possible after concurrence of
the Proposed Plans by the three agencies. The comment period is usually only 30 days and it was
extended because of the holidays.

21. "Now that we've had the request for 90 days, I'm sure the comment period will be extended."

Response: The public comment period was extended through February 15, 1995.

22. What amounts of heavy metals & nuclides are reaching the surface waters and how much, what
sort of level?

Response: In the report titled "Semi-Annual Sampling of Fourmile Branch and Its Seeplines in the
F and H Areas of SRS: February 1993, July 1993, and April 1994," results from these sampling
events suggest that the seeplines in both F and H Areas and FMB continue to be influenced by
contaminants migrating from the F and H Area Seepage Basins. The analytes exceeding
groundwater protection standards or maximum concentration limits as indicated in this report are

shown below;

Analyte	FMB	F-Seep	H-Seep	Standard	Units
Gross Alpha	3	20	16	15	pci/l
Non-Vol. Beta	28	614	426	50	pci/l
Tritium	1070	2030	4470	20	pci/ml
Sr-90	10	227	80	8	pci/l
Ra-226	5	14	32	20	pci/l
I-129	2	2	9	1	pci/l
Cadmium	6	15	16	5	æg/l
Lead	3	3	3	15	æg/l
Iron	668	28,300	7570	300	æg/l
Aluminum	109	5650	90,000	50	æg/l
Manganese	41	2760	891	50	æg/l
Nitrate	2000	50,000	31,000	10000	æg/l
Zinc	21	184	222	5000	æg/l

23. What contaminants exceed the ambient water quality standards that effect ecological issues?

Response: All analytes listed in the response to question #22 are also listed as ecological chemicals of concern. The metals that have exceeded the Ambient Water Quality Criteria (AWQC) for these locations are Cadmium, Lead, and Zinc. The radionuclides listed do not have a corresponding AWQC standard.

24. Does water in the wetlands (seepline) exceed drinking water standards?

Response: See response to question #34.
Levels of radionuclides and hazardous metals have been measured above primary drinking water standards at the seepline in both F and H Areas.

25. Explain gross alpha and gross beta measurements? p.70.

Response: The gross alpha measurement is representative of alpha emitting radionuclides (ie. Uranium, Plutonium), and the nonvolatile beta measurement is representative of the beta emitting radionuclides (ie. Strontium, Cesium). The EPA has set drinking water standards for these measurements, which are 15 pci/l for gross alpha and 4 mrem (approximately 50 pCi/l) for nonvolatile beta.

26. "Considering that treatment for this site has already progressed to the point where there's procurement underway, under the RCRA decision, what in reality does this process under CERCLA have to do with the ultimate treatment of the site?"

Response: To fullfill the requirements under the CERCLA process, the proposed plans state that no further action under CERCLA is required to protect the human health and the environment.

27. How come the six treatment alternatives weren't presented to the regulators? How come they are not in the public document?

Response: The six treatment alternatives were presented to EPA and SCDHEC in the Proposed Plans for F&H Areas Groundwater Operable Units, Revision 0. During comment review and negotiations with the Regulators, it was determined that the alternatives that had been previously rejected should be removed.

28. "Are you familiar with the 11/8/94 Federal Register? Is it true that EPA is proposing to remove the current requirement for postclosure permits?"

Response: The proposed provisions actually expands the authority of EPA to mandate post-closure care requirements. The proposal would allow EPA or an authorized State to use any other available legal authority as an alternative to the post-closure permit, as long as that authority provides the same level of protection and public participation as does the post-closure permit. The EPA and States had found that for closed or closing facilities they had very little incentive to submit the post-closure care permit applications. They did not want or need a permit to operate. The proposed rule would allow EPA and authorized states to bring an uncooperative facility into compliance through an enforcement action. Facilities that need an operating permit such as SRS, would still have to obtain post-closure care permits for their closed RCRA facilities. This proposal does not change the requirements for corrective action.

29. Haven't you heard lately that everybody's budgets are being cut? Haven't you heard that DOE's budget and that Secretary O'Leary as well as Mr. Grumbly are saying we want prioritization? What is the worst risk?

Response: We acknowledge budgets across the DOE complex will be reduced in the near term. SRS is no exception to the mandate from the Administration and Congress to use fiscal responsibility in planning its work. As such, SRS is evaluating its programs from a total risk standpoint, rather than risk posed to human health and the environment as a sole consideration. The parameters being used to determine total risk include: 1) public health and safety, 2) environmental protection, 3) worker health and safety, 4) compliance with standards, 5) clean-up mission and business efficiency, 6) safeguards and security, 7) public and community relations,

and 8) cost efficiency.

30. What about the GAO report (which criticized the progress of the DOE's cleanup programs and calls for consideration of alternatives such as creating a separate government cleanup commission)?

Response: The GAO Report, entitled Superfund, Status, Cost, and Timeliness of Hazardous Waste Cleanups and dated September 1994 was a general report evaluating the Superfund program across the nation (including federal and private cleanups). This report noted that expenditures for the

Superfund programs are higher than expected and that the actual number of sites deleted from the NPL remains small. Additionally, federal facility cleanup is slower than nonfederal facility cleanup. No reference could be found regarding creation/formation of a separate cleanup commission.

Another GAO report (GAO/RCED-95-66, Coordinating Activities Under RCRA and CERCLA, December 12, 1994), examined how DOE coordinated cleanup activities under RCRA and CERCLA and outlines some problems encountered to date with those coordination efforts. The report notes that DOE intends to issue guidance in the spring of 1995 to facilitate this coordination and develop, with EPA and state involvement, model interagency agreement language. Again, no reference regarding the creation/formation of a separate government cleanup commission was found in this report.

31. SCDHEC and EPA, are you aware of any time that you granted SRS authority to pump tritium into the streams at levels that exceed 10,000 pCi? How about ETF? Isn't that (32K Ci) significantly higher than the 10,000 we are supposedly treating? Tritium is the primary radionuclide in the effluent at the ETF and can not be separated and is currently being discharged to surface streams. What's the difference?

Response: In its implementing regulations (40 CFR 122 in particular), EPA refined the definition of "pollutant" to exclude radioactive materials regulated under the Atomic Energy Act of 1954 (AEA). Currently all discharges of tritium into sitewide SRS steams are regulated by the Department of Energy in accordance with ALARA program. This information is provided to EPA and SCDHEC in an annual Environmental Report as well as in National Pollutant Discharge

Elimination System (NPDES) permit applications. The level of tritium discharged from the F/H Effluent Treatment Facility into Upper Three Runs Creek are 1-5% of the maximum allowable levels (ie. 20 pci/ml), well within the safe levels for maintaining all applicable stream uses.

32. "Are we going to have another one of these meetings after you respond to the comments."

Response: Another meeting on the IAPP's is not currently planned.

Written comment received on questionnaire from the F&H Groundwater Public Meeting.

"There must be a better way to get public involvement than this kind of meeting."

Response: As part of the CERCLA process it is required to involve the public in selection, review, and comment of a proposed remedial action. This type of public meeting allows the public the opportunity to openly communicate their concerns, comments, and to go on record with any specific questions. Additionally, the public is given the opportunity to review and provide written comments on a proposed remedial action such as that contained in the F&H Groundwater Interim Action Proposed Plan documents. SRS would welcome any suggestions from the public on how to possibly improve the Public Involvement Program. Please submit any suggestions to:

Mrs. Mary A. Flora
WSRC
1995 Centennial Avenue
Aiken, SC 29803

Written comment received on questionnaire from the F&H Groundwater Public Meeting.

"What is the impact off site if no action is taken? Quantify impacts if any against federal criteria and actual risk to public compared to other industries along river. Does the risk justify cost?"

Response: Environmental monitoring and risk assessment work indicate that there is minimal risk to the public if no corrective action is taken.

Interim Action ROD WSRC-RP-94-1163
H-Area Groundwater Operable Unit Revision 1
April 1995

Letter #1 from Mr. Philip Brandt to the EPA

3325 Berkshire Circle
Johnson City, TN 37604
January 16, 1995

U.S. EPA Region IV
Attn: Jeff Crane
345 Courtland Street
Atlanta, Georgia 30365

Dear Mr. Crane:

A public meeting was held at North Augusta, South Carolina on January 9, 1995 on the Savannah River Site F&H Groundwater Proposed Plans. At that time I submitted written comments, however, due to time constraints those comments were incomplete. Attached please find a complete set of comments. Please disregard the original comments.

I am in the process of obtaining additional technical information relevant to the proposed alternative and request an extension of public comments for 90 days due to the time required to obtain information through the Freedom of Information process. In addition, I am requesting that a second public meeting be held after a formal response to all commentors have been completed.

If you need to speak with me directly you can call me at work (615) 734-9141 ext 1316 or home (615) 282-5239.

Sincerely,

<IMG SRC 0495225E>

Philip Brandt

COMMENTS
ON
F&H GROUNDWATER
PROPOSED PLANS

My name is Philip Brandt. I have a BS in Wildlife and Fisheries Science and there years of graduate study training in zoology and terrestrial ecology. I have over 15 years experience in the regulatory and environmental field including six years at the SRS. Three of those years was spent working for a consultant under contract to the DOE. During that time I provided expert environmental regulatory support to the DOE. My last three years at SRS, I was employed by the DOE as Senior Waste Management Specialist and as Acting Branch Chief, Environmental Restoration.

During my tenure three I was responsible for the RCRA Interim Status closure of the F and H Area Seepage basins and 58 acres of the mixed waste burial ground. Since leaving DOE and the SRS I have continued my environmental career in the commercial sector and have continued to work with both hazardous and radioactive contaminants. Most recently, I managed a removal action involving radioactive and hazardous waste which resulted in a release of the property with no restrictions by the regulating agency. My areas of expertise include both RCRA and CERCLA.

Over the Christmas holidays I became aware of this public meeting and have driven over five hours to be here to present my comments. The direction the regulatory process has taken and how the public is kept informed and involved, or more importantly not informed, is of a great concern to me.

First I want to provide comments on the environmental facts concerning the Savannah River Site, the F and H area seepage basins and the proposed environmental remedy, facts which have not been properly identified or communicated to the public by the DOE or the regulatory agencies. At issue is whether the contaminated groundwater from the seepage basins pose a threat to human health and the environment. This threat is examined from the perspective of (1) impact on the Savannah River which is a recreation source in the area and a drinking water source for Beaufort, South Carolina and Savannah, Georgia, (2) impact to Four Mile Creek on the SRS reservation into which contaminated groundwater from the basins seep, (3) impact on wildlife and vegetation along the area between Four Mile Creek and where contaminated water seeps onto the land, and (4) impacts on the groundwater and its affects to both onsite and offsite users.

Facts on F and H Area Seepage Basin Operations

Wastewater flows from the F and H Area Separations to the F and H-Area Seepage Basins ceased on November 7, 1988. Liquid effluent that was discharged into the seepage basins is now processed at the H-Area Effluent Treatment Facility. Tritium is the primary

radionuclide in the ETF effluent. Because tritium is a hydrogen atom it cannot be separated from a water molecule which is made up of two hydrogen atoms and an oxygen atom. There is no known practical method for treating tritium contaminated water whether its ground water or surface water. Consequently, tritium is discharged along with the treated effluent into Upper Three Runs Creek under an NPDES permit. In 1989, the first year of full operation for the treatment facility, over 2,000 Curies of tritium were discharged to UpperThree Runs Creek (1). FACT: There is absolutely no difference in the health and environmental impacts from the tritium that is discharged from the permitted treatment facility and the tritium that seeps into the Four Mile Creek. Unlike opther radionuclides, tritium does not bioaccumulate in

animal or plant tissues or in the ecosystem. There is absolutely no documentation or research that tritiated water onsite has harmed or ever will harm land and aquatic plants and animals. The concern over tritium is the potential dose to people when tritiated water is used as a drinking water source.

Facts on Regulatory Authority Over Basin Closure and Ground Water Cleanup

Regulatory authority over the closure of the basins is fairly complex and is devided between the State of Sourth Carolina and the EPA under two major laws, RCRA and CERCLA. The state enforces portions of RCRA and includes the regulation of contaminated groundwater from hazardous contaminants such as metals and organic chemicals. However, RCRA dos not regulate radionuclides. Authority to regulate radionuclides comes under CERCLA which is administered by EPA. Basin H-3, which last received waste in 1962, is also regulated under CERCLA. RCRA was not enacted then and its rules cannot be applied retroactively. Consequently, any decisions made on groundwater cleanup actions for Basin H-3 fall under CERCLA regulations. Section 121(a) of CERCLA requires EPA to make certain remediation solutions are cost effective. The total life cycle costs for this project exceed $270 million and will be demonstrated not to be cost effective (5). The State regulates other groundwater contaminants not included under RCRA such as nitrates (same as fertilizer) and sodium (same as salt). The State also sets and regulates water quality standards for surface streams. Streams on the SRS have the same water quality designation as does the Savannah River, Class B (7). This dual regulatory authority and who was going to be the lead agency was a source of problems in negotiating closure and post basin closure activities with the State and EPA when I was there five years ago. State's rights were a big issue and sometimes during negotiations I thought we had traveled back in time 134 years to Fort Sumter in Charlston, South Carolina.

After waste water discharges ceased in 1988, a formal permit under RCRA was agreed upon by all parties and physical closure activities begun. After inspection by an independent engineer, the State and EPA agreed and confirmed in 1991 that the basins had been closed based on the conditions of the RCRA permit. EPA reviewed the closures and formally determined that the closures were protective of human health and the environment (10). How the ground water was to be treated was decided in a separate permit action from the closure action.

F and H Area Basin Ground Water Facts (7, 8 & 9)

Simplified, there are three aquifers in the F and H seepage basin area. The shallow water table is characterized by low flow and is not used onsite or offsite for drinking water or irrigation

purposes. Some of the monitoring wells are located in perched aquifers which cannot provide a sustained yield of water. In other words, they would not support the water needs for a home. For example, the Federal home loan programs require that you have a well that provides a sustained yield of six gallons per minute. If you don't have a well that yields the minimum amount you will not get the loan. Water from the water table or shallow aquifer discharges into Four Mile Creek through a seep line near the creek. There is an aquitard that separates the shallow water table aquifer from the middle aquifer, however, it is not complete and contaminated groundwater also moves from the shallow aquifer into the middle aquifer. Groundwater from the middle aquifer discharges several miles away into Upper Three Runs Creek which is also on the SRS. A second, more complete aquitard, exists between the middle and lower aquifer. This aquitard provides significant protection from the contaminated groundwater in the middle aquifer from entering the lowest aquifer. In addition, this lowest aquifer is under higher hydraulic pressure due to geologic conditions than the middle aquifer. This means that if the aquitard is breached the ground water will flow up towards the surface and not down. Ground water from the deepest aquifer discharges into the Savannah River. FACT: Geologically, water from the contaminated aquifers have not migrated into the groundwater beyond the site's boundary nor can it ever contaminate offsite groundwater aquifers because they all discharge into on site streams.

The primary ground water contaminants are radionuclides (principally tritium), nitrates, metals (principally cadmium in F-Area and mercury in H-Area), and sodium. Tritium, sodium, and nitrates are very mobile contaminants whereas metals will not move concentrations exceeding 200,000 ug/L are found. Other contaminants such as plutonium move very little, if at all.

With the closure of the basins, two major positive impacts to the ground water occurred: (1) a waste source comprising many millions of gallons of waste water was eliminated and (2) further movement of contaminants from the basins into the groundwater were virtually eliminated due to the clay cap constructed over the basins (the clay cap isolates the waste from coming into contact with rainwater that would have infiltrated the soil above the waste). FACT: Groundwater sampling from over 240 monitoring wells has confirmed that the water quality from the contaminated aquifers has improved dramatically and will continue to improve without any further

action regarding ground water treatment.

Surface Water Facts (7, 8, &9)

Contaminated ground water from the F and H area seepage basins discharge into Four Mile Creek along a seep line. In 1993, the only radionuclides detected in Four Mile Creek were tritium and strontium. Estimated values have been reported for iodine 129 but

I am personally aware that the source document used to develop the iodine inventory was of poor quality. The field work that resulted in quantifying the iodine inventory was superficial at best. In addition, there was a calculation error in the reported inventory which results in an over estimate of the iodine 129 inventory. Strontium concentrations have been declining every year since 1988 and decreased by 23% from 1992 to 1993 in the F area (194 mCi to 150 mCi) and 17% in the H area (78 mCi to 65 mCi). Based on measured inventory, tritium is the largest contributor to the creek. There is no known environmental impact to the environment that tritium at the existing concentrations can cause (for example, it has had no impact on plant or animal species (for example, it has had no impact on plant or animal species diversity or abundance). Tritium migration or flux from the basins have also decreased dramatically since closure and capping. From 1992 to 1993 there has been a 49% decrease in the Curies of tritium seeping from the F basins. For the same time period there has been a 31% decrease from the H basins. This trend of improving water quality will continue without any additional action such as pump and treat with reinjection. In 1993 an estimated 2,180 Curies of tritium seeped from the F basins and 1,020 Curies from the H basins (1,2, and 3 only). Due to plume mingling it is not possible to differentiate tritium from H-4 and the nearby radioactive burial ground, 643G (a CERCLA site). However, it is projected that from 1994 on that 4,500 Curies of tritium, which represents two thirds of the tritium flux that seeps into four Mile Creek, will come from the old burial ground and not the seepage basins. By way of comparison, there were 11,300 Curies of tritium released in liquid form from all sources. Releases from the F and H seepage basins accounts for only 3,200 Curies or only 28% of the total. Liquid releases are completely dwarfed by air releases. In 1993, 191,000 Curies of tritium was released to the atmosphere which is sixty times greater than the release from the F and H basins and seventeen times greater than all liquid releases. Most of the tritium released to the atmosphere combines with water molecules in the air and returns to the surrounding areas both on and offsite in the form of rain or snow. This phenomenon has been confirmed through the drilling and testing of groundwater wells and shallow springs on the Georgia side of the Savannah River where well water concentrations of 2,000 pCi/L have been found and onsite where rainwater with tritium has been found in concentrations exceeding 42,000 pCi/L (over two times current drinking water standards). This tritiated rainwater either runs off to surface streams such as Four Mile Creek or becomes part of the groundwater on site, or under goes evapotranspiration. This is why you can find detectable, but acceptable, levels of tritium in drinking water supplies for cities such as Aiken, North Augusta, new Ellenton,

Jackson, and Augusta,

Water samples from Four Mile Creek, other surface streams on SRS, and the Savannah River are routinely collected and analyzed. The

Savannah River is an important recreational source and drinking water source for Beaufort, South Carolina and Savannah, Georgia. Radiological contaminant concentrations including such parameters as gross alpha and nonvolatile beta are the same above and below the SRS with two exceptions: (1) tritium and (2) cesium 137. Cesium is not released from the seepage basins. Tritium, some of which originates from the F and H area basins, is well below EPA established health based standards. If the tritium that originates from the F and H Area basins could be eliminated completely (they can't) there would be an insignificant change in the tritium concentration in the drinking water systems in Beaufort and Savannah. This is due to the ETF discharges (2,000 Curies in 1989), discharge from other seepage basins and the burial ground, and down washing of tritiated rainwater from the over 190,000 Curies per year of tritium released to the atmosphere. The prestigious Academy of Natural Sciences of Philadelphia has monitored water quality on the Savannah River since 1951 and in 1990 conducted a special study on plant and animal life including sensitive indicator species. There was no difference in species richness or abundance due to SRS activities and no detectable difference in water quality factors due to SRS activities that could affect the species richness and abundance. This documentation of no impact to the Savannah River over the past forty years is in spite of the fact that the discharge of radionuclides and other contaminants were much higher in the past. In fact, the amount of tritium released to the river has been higher by a factor of ten (approximately 150,000 Curies) in 1963. If the river or human health was being negatively impacted a marked improvement would have been observed due to the continuous and intensive monitoring by the Academy of Natural Sciences. The fact is no environmental impact has been observed because there has been no impact. Over thirty parameters affecting stream water quality are routinely sampled on Four Mile Creek including organics, gross alpha/beta, nitrates, sodium, and heavy metals. There is no difference in water quality for these parameters (samples taken from Road A and A7) when compared to the Savannah River except for tritium. The only measurable radionuclides discharging from the seep area are tritium and strontium. FACT: Tritium and other contaminants released from the F and H Area seepage basins have no impact on human health or the environment in the Savannah River or to sources down stream that use the Savannah River as a drinking water source.

Environmental and Health Risks from the F and H Area Seepage Basin Groundwater Facts (7, 8, &9)

The EPA sets the drinking water standards for communities. Limits prescribed are conservatively derived i.e. they err on the side of over protecting individuals. For radioactivity in drinking water, EPA has determined that concentrations that provide a dose of 4

mrem per year is protective of human health and the environment.

The maximum dose received by the public from drinking tritium contaminated water is 0.04 mrem (1% of the allowable dose) and 0.05 mrem per year (1.25% of the allowable dose) at Beaufort, South Carolina and Port Wentworth, Georgia. This is in contrast to water wells in Georgia that have tritium concentrations that are 10% of the allowable limits (the source of which tritium released from air emission sources on the site which are in turn over sixty times greater than that released from the F and H area seepage basins. These doses measurements are based on a tritium limit of 20,000 pCi/L and will decrease by a factor of three when the proposed limits of 60,900 pCi/L are implemented by EPA. Cesium, which does not originate from the F and H basins, is found in the water system but it too is also well below allowable drinking water standards. In summary, there is no unacceptable human health or environmental risk to the Savannah River as a drinking water supply. If the F and H area seepage basin radionuclide contribution to the Savannah River was completely removed there would be an insignificant change in the radiounuclide due to other regulated emissions and discharges from the SRS. There is no unacceptable human health or environmental risk to the onsite workers. Over 20,000 personnel work onsite on a regular basis. There are twenty seven onsite drinking water systems, some of which have been in operation since plant startup. Over 1,400 samples for chemical analysis were performed in 1993 and all systems met EPA's primary health based standards. In other words, the personnel onsite use drinking water taken from the same aquifers onsite that supposedly are in danger of being contaminated and have done so for over forty years while meeting all drinking water standards established by EPA and SCDHEC. Even under worst case conditions, where a theoretical "Bubba" spent most of his time living on the site boundary swimming, water skiing, hunting and fishing, drinking water from the Savannah River, eating contaminated fish and wildlife, could only receive an estimated 0.25 mrem per year dose. If someone would pay me to live this life style I'll do it. This way the site could collect real data and I could then justify why I wear white socks. This 0.25 mrem per year dose compares to an average dose of 300 mrem per year from natural causes. In other words, if the SRS could cease emitting all radioactivity (it can't) people would still be exposed to over 99.92% of the radiation that they are currently being exposed to. A measure of the risk 0.25 mrem/year presents is provided through the loss of life expectancy (LLE) calculation. LLE is the average amount by which one's life is shortened by the risk under consideration. For example, being overweight reduces your life expectancy one month for each pound you are over weight. Unless I lose weight I have shortened my life by over three years. Being poor and/or unskilled reduces your life expectancy from semi-skilled, clearical/sales people by 2.4 years and an additional 1.5 years when compared to professional/managerial personnel. The LLE for a person in Harrisburg, Pennsylvania from the Three Mile Island nuclear power reactor was 1.5 minutes. The LLE for 0.25 mrem/year is functionally equivalent to a regular smoker smoking one extra cigarette every fifteen years or an over weight person like myself increasing my weight by eight tenths of an ounce, about half a

candy bar.

Environmental damge is typically determined through a decline in the number plant/animal species and the abundance or total numbers of plants and animals. The only environmental damage noted had been some very minor vegetative stress along the seep line between where the basins seep into Four Mile Creek. The source of the vegetation stress is not known. However, it is highly likely that the stress is due to elevated soil/water concentrations of aluminum, sodium, and nitrates and not radionuclides or heavy metals. What is important is that since the basins were closed the vegetation has begun to recover and continues to recover. It is also important to note that the plant and animal populations along Four Mile Creek are not unique and do not support any threatened for endangered species. With the exception of very localized areas described above, the plant and animal species and populations along Four Mile Creek, are both diverse and abundant which is indicative of a healthy ecosystem.

FACT: There has been no significant impact to the environment in the vicinity of the F and H seepage basins. What damage that has been noted is recovering naturally. Water quality in Four Mile Creek continues to improve. There is no difference in species richness or abundance above and below the seep areas or in Four Mile Creek.

Proposed Mitigation (Pump/Treat/Reinject) Facts (5, 10)

The SCDHEC and the EPA are requiring the DOE install a series of interceptor groundwater wells, pump down the aquifer, treat the water, and reinject the treated groundwater upgradient to the basins. SCDHEC requires that reinjected groundwater meeting drinking water standards before it is reinject. They both admit that tritium cannot be removed from the treated water, therefor it cannot meet drinking water standards, but will be reinjected anyway. Nitrates, which also exceed drinking water standards, will also be reinjected without treatment even though treatment technology exists for nitrates.

Normally under RCRA, regulated contaminants must be cleaned up to drinking water standards. Under specified conditions, a variance is allowed called an Alternate Concentration Limit. ACL's are allowed when the hazardous constituents (not radionuclides-they're regulated under CERCLA) are not capable of posing a substantial threat currently or a potential hazard to human health and the environment in the future. DOE pursued this approach and was prepared to evaluate in the field some innovative technologies but was denied the ACL. Consequently, DOE was required to implement ground water cleanup. One of the treatment options rejected was to install the pumping wells, pump to a collection/treatment tank, adjust the pH, and discharge the water to the Savannah River under

a NPDES permit. This approach meets all regulatory requirements under RCRA for treatment and discharge. However, SCDHEC and the EPA required that a more expensive treatment system be implemented and the water reinjected. The purpose for the reinjection is to allow for the natural decay of tritium. However, as pointed out before there is no health or environmental risk for discharging the tritiated water or for allowing it to continue to seep out. In fact, a technical evaluation (5) conducted by DOE's Office of Environmental Restoration (EM-40) concluded that after 2005 (ten years) there would be no difference in the off site tritium flux to the Savannah River whether the corrective action was implemented or not (see previously discussed facts). DOE estimates (1993) that $12.6 million has already been spent on this project with an estimated $24 million budgeted for 1994/1995 and an estimated life cycle cost of $270 million.

The proposed ground water treatment may in fact cause additional problems. In response to questions at the public meeting on January 9, 1994, Ms. Kathy Lewis indicated they will not be able to intercept or control the contaminant plumes in their entirety nor can they guarantee that relatively immobile contaminants that don't presently show up in Four Mile Creek, such as plutonium, will be mobilized.

FACT: Reinjection to control tritium flux is a fallacious argument by SCDHEC and EPA. Tritium ground water contamination in the contaminated aquifers has improved dramatically over the past six years and will continue to improve. Tritium, because of its half life of 12.3 years, will continue to be removed permanently through decay. In 24.6 years 75% of the existing tritium inventory will permanently "go away" through radioactive decay. Offsite and onsite drinking water quality are already protected with no further action, that is, without having to spend over a quarter of a billion dollars.

The proposed action has a high probability of failure and does not address one of dominant ground water contaminants, nitrates. Under the proposed remedy, the major contaminants (tritium, nitrates) will not be treated. Minor contaminants such as mercury and cadmium are in most cases just slightly above drinking water standards. The National Academy of Science has recently reviewed pump and treat technology (1). Their conclusion is that remediation by pump and treat is a slow process which can easily take tens, hundreds, or thousands of years and that the ability to restore contaminated groundwater to drinking water standards is uncertain at many sites. According to the NAS, geologic factors and the contaminants may make restoring contaminated ground water to drinking water standards technically infeasible. In addition, in public documents EPA has acknowledged "some ground water contaminants cannot be completely eliminated, no matter how long we pump and treat". As of 1990, based upon research performed by the Oak Ridge National Laboratory (3), there has been no documented

case where a single aquifer in the United States has been confirmed to have been successfully restored through pumping and treating.

There is already onsite, documented evidence that pump/treat cannot restore an aquifer to drinking water standards. Ground water cleanup of organics using pump and treat has been ongoing since 1985 in the M-Area. There is no technically competent person onsite (or off site) that will state or predict that the aquifer in the M-Area will be restored to drinking water standards for organics using pump and treat only.

DOE's Office of Environmental Restoration (EM-40) recognizes the futility of the F and H Area pump and treat system (5). DOE identified all proposed pump and treat projects within the complex and categorized them into three categories: (1) technically sound and reduces risk to the public, (2) limited risk reduction to the public, and (3) little or no risk reduction and may be technically unsound. The proposed pump and treat system for the F and H seepage basins falls into category three. "No measurable risk" with a recommended path forward to "negotiate with regulators for combined institutional control and innovative technology demonstration". This approach has been rejected by the regulators. It is most important to note that in 12.3 years of institutional control, half of the tritium decays away, in 24.6 years 75% - without taking into account any loss of tritium through seepage.

Comments and Questions

In order for the public to fully understand the impact, or lack of impact, to the environment please provide the following information in your response to my questions. What has been the water quality trends over the last six years on Four Mile Creek at sampling stations 1B, 1C, 2B, 2, 3A, 3, 6, and A7 while describing the source terms that contribute to the contaminants? What data indicates that the contribution of hazardous substances to Four Mile Creek, including radionuclides, will increase over time with no further action. Over thirty water quality parameters are sampled routinely. Identify those parameters that do not meet SCDHEC water quality standards for Class B streams on a consistent basis (50% of the time or more). For noncompliant parameters provide documentation that the impact is due to releases from the seepage basins, that is there is a significant difference between upgradient and downgradient values from the F and H area basin seep lines along Four Mile Creek. Provide documentation that the flora and fauna on Four Mile Creek downgradient from the seepage basin are significantly different based on species diversity and abundance. Provide similar documentation for the area between the seep line and Four Mile Creek. Provide a map showing the ecotypes and acreage along the Four Mile Creek and calculate the acreage and percent of the total ecotype harmed by discharge from the basins. Provide documentation on the presence and/or bioaccumulation of all those contaminants found in wells above drinking water standards in

the water, flora and fauna from the seep line to Four Mile Creek and along Four Mile Creek (for example, gross alpha/beta, heavy metals, transuranics, etc.)? Finally, tritium production is currently at an all time low. However, at some future time tritium production may have to increase. Please document the maximum

allowable tritium emissions from air sources and the H Area Effluent Treatment Facility and compare them to current discharges to Four Mile Creek from the F and H area seepage basins (excluding the contribution from the old burial ground) and in 12.3 years (assuming no seepage from the basins). Numerous wells in the F and H area seepage basins are poor quality, low yield yields from perched water tables. How many of the water table wells provide less than six gallons per minute continuous yield, that is, are unsuitable for home use as a drinking water source? What is the water quality for these wells? How many of these wells do not yield enough water to provide a representative sample (minimum of three casing volumes)? How many of the wells evidence faulty well installation? Does SCDHEC and EPA require the same ground water protection for perched water tables which are unsuitable for a drinking water supply system as for legitimate aquifers? Provide documentation on the level of contaminantion that is discharged from the Congaree aquifer to Upper Three Runs Creek. Provide similar documentation for the deeper aquifer that discharges into the Savannah River. Finally, provide trend data over the past six years for those RCRA contaminants and radionuclides that are discharged to Four Mile Creek on select but key downgradient groundwater wells for the shallow water table and Congeree aquifers. As a comparison, include upgradient wells particularly those that show contamination from the old burial ground. Discuss and comment on whether the data trends support an improving or deteriorating groundwater quality. Provide the same information for nitrates and sodium. If the water quality is improving and there is no longer a source term recharging the basins does the risk of contamination of the deepest aquifer increase or decrease? Similarly, for the Congaree does the risk of contaminated discharge to the Upper Three Runs Creek increase or decrease? Numerous wells have been identified where gross alpha and nonvolatile beta are above drinking water standards and/or drinking water standards for other radionuclides are exceeded based on a maximum dose. Radiological dose is based on an average dose - not a single maximum datum point. What has been the average gross alpha and beta values? Is the data normally distributed or is a geometric mean more representative? If the geometric mean is more represenative, is it above the established standard?

The EPA has determined that capping is protective of human health and the environment capping. Is capping and institutional control an allowable remedial alternative under CERCLA? Since implementation of capping, groundwater has improved dramatically thus decreasing future risk to human health and the environment through institutional control. What period of institutional

control was considered by SCDHEC/EPA in evaluating the no action alternative under CERCLA. If it wasn't evaluated why not? As a means for comparing the effectiveness of pump and treat onsite as a viable technology, how long will it take the existing pump and treat system to clean up the ground water in the M-Area to drinking water standards and at what cost?

SCDHEC requires that ground water used in the reinjection wells

meet drinking water standards. How can SCDHEC allow tritiated groundwater that is 1,000 times drinking water standards be reinjected. How can it allow nitrates that are 10-100 drinking water standards be reinjected when treatment technology exists to treat nitrates.

Pumped water can simply be adjusted for low pH and discharged to the Savannah River meeting all health and safety requirements of both EPA and SCDHEC at significant cost savings over the required remedy. What is SCDHEC's and EPA's justification, under RCRA, for not requiring the most cost effective remedy which meets all drinking and surface water quality standards?

The remedial action for H area includes Basin H-2. This site is a CERCLA site and not a RCRA site. Based on groundwater monitoring data it also the primary source of the metal contaminants down gradient from the basin complex. Under what authority was this site included under the RCRA regulations and where was the public input. Why isn't this site considered separately?

A different environmental remedy for the same site can be arrived at under CERCLA versus RCRA. In fact, the DOE submittal to SCDHEC and EPA for the proposed remedy under CERCLA is that no action be taken (10). What has been SCDHEC's and EPA's response to DOE's proposed remedy under CERCLA of no further action (Rev. 0, Proposed Plan for F and H Area Groundwater Operable Units). What was your basis for rejecting the proposal, particularly for basin H-3 which is not regulated under RCRA.

The risk assessment process used is flawed. Proposed tritium standards are three times higher than current standards. When performing your risk assessments you used proposed concentration limits when they were higher than existing limits. However, in the case of tritium you used the existing limits when proposed limits are over three times higher. There is no rational basis for ignoring nitrates in the risk assessment process nor is there any health/environmental based reason for pumping/treating and recirculating the tritium plume to maintain a 20,000 pCi/mL contour. If you are not maintaining the drinking water standard isopleth then 200,000 pCi/mL or current levels are as equally valid as the 20,000 pCi/ml isopleth for tritium. Why weren't the proposed tritium standards used (60,900 pCi/L)?

The State and the EPA have specific areas of regulatory authority. The State does not regulate ground water contaminated by radionuclides. Does SCDHEC claim regulatory authority over radionuclides? Under what authority and has the Federal government given up its sovereign immunity?

Besides the DOE SRS, SCDHEC regulates municipalities, private businesses, and other State and Federal agencies. For example, there is tritium contaminated groundwater at the adjacent Chem Nuclear facility in Barnwell. Municipalities frequently fail to meet solid waste and groundwater requirements. Federal military

bases have a variety of environmental problems. Dos the DOE SRS receive equal treatment under the law relative to enforcement or fines? What other facilities are being required to pump/treat and reinject as a remedial action? How many are allowed to reinject contaminated water above drinking water standards? What concentrations? How many ACL's have been granted by SCDHEC in the last five years? How many by EPA Region IV in past five years? Given the number of approvals, are ACL's in fact a viable alternative to restoring aquifers to drinking water standards? How many pump and treat actions of similar scope in South Carolina have resulted in the return of the contaminated aquifer to drinking water stanards?

Regulatory oversite by SCDHEC at SRS is funded by a grant from DOE. How many municipalities, private industries, and other government agencies fund their own regulatory oversight? How does SCDHEC avoid a conflict of interest, that is, the more remedial actions required the higher the funding level for SCDHEC?

As expensive and futile as the proposed remedy is there was another solution which met the requirements under RCRA, complied with all other environmental laws, presented so significant risk, and was a lot cheaper. The remedy is to pump the shallow aquifer, adjust for Ph, and discharge to the Savannah River. Has the SCDHEC/EPA required municipalities, priviate businesses, or other State/government agencies in South Carolina to implement the most expensive ground water treatment option when a second, less costly alternative would meet all of the State and EPA requirements for protection of human health and the environment? Would the State be willing to pay the incremental cost between the two options? Under the law, can the EPA ever conclude under CERCLA that no further action was required where RCRA requires that a remedial action be implemented? Has the DOE been asked/requested/pressured to include the CERCLA site, 643G (Old Burial Ground), under RCRA? What has been DOE's response? If yes, what was the justification?

SUMMARY AND CONCLUSIONS

Due to the holidays I was unable to obtain additional data supporting the position that no further action is required.

Consequently, I have asked that comments be held open for an additional 90 days (given the lengthy time required to obtain documents under the Freedom of Information Act) and that a second public meeting be held so that all questions can be addressed.

I have polled friends and family in the Aiken, South Carolina area. When I describe what is being proposed and how much it will cost they are dumb founded. They have seen the public notices regarding these activities but they do not highlight the facts I have included nor do they address the questions I have posed nor do they make the public aware of the costs. I am appalled at the lack of effective public communication.

I will be forwarding my comments to my Congressional representatives from Tennessee. Copies will also be sent to Senator Strom Thurmond and the Governor of South Carolina. Incumbents were removed from office because of governmental actions such as this and new people elected to make government accountable. This process reminds me of the EPA proposed action for the ski resort town in Colorado which has lead contaminated soil from a mining operation in the 1800's. EPA's remedy was to dig up four feet of the town and backfill with clean dirt. It wasn't until after several years of arguing with the residents that they finally looked at lead blood levels in children and found that they were below the national average. The selected remedial action is still being disputed. Signs have been posted in the town by the residents - the stake holders - those who are impacted by the site the most - for EPA to go home. This type of action at SRS does not enhance a person's belief or confidence that the regulators are here to help you. The proposed remedy at SRS appears to be along the same line as the Colorado incident. However, this is just the first of many ground water remedial actions that will be implemented by SCDHEC and EPA and SRS. In other words, the quarter of a billion action is just a down payment. Wasteful expenditures on this scale, without a real benefit or enhancement of the environment of human health, undermines and distorts the productivity or human health, undermines and distorts the productivity of our economy. I'm hopeful that during a time of huge Federal deficits I will get an audience with the new Congress as they seek methods to cut the Federal budget and make government accountable. One method is to have Congress with hold funding for this activity. Under the Federal Facility Agreement, the DOE can only be held accountable for activities that are funded. I will also be encouraging my Congressional representatives not to support DOE funding in general for projects of this type. A quarter of a billion dolars could achieve measurable, quantifiable improvements to human health and the environment through a myriad of other programs such as education, job training, weight reduction programs, etc. It won't achieve measurable, quantifiable improvements to human health and the environment through the proposed remedial action of pump, treat, and reinject.

Finally, I would like to address the issue of effective public participation, or lack of it, in the decision making process for selecting environmental remedies. It is not working and the response is narrowly orchestrated by such groups as the Energy Research Foundation an the NRDC who don't speak for the general public in the area. For example, how many comments were received from the public on the F and H Area post closure permit. How many of those originated from the EDF, other special interest groups and their members, other regulatory agencies, and how many originated from the public in general from the Aiken, Barnwell, and Allendale area? I had hopes that the Citizens Advisory Board would have addressed the issue of expensive remediation without environmental benefit but it appears that they too are unsuccessful in identifying and effectively communicating the concept of risk and the cost of cleanup to the public. I understand; however, there has been some lively discussion between some members over who gets reimbursed for meals. Is a possible reason for this immutable wall of silence that key Citizens Advisory Board chairs dealing with risk assessment are held by ERF personnel?

I have a great faith in the American public. Give them the facts and they will make the right decisions. Simplify the regulatory mumbo jumbo and put in a context that the public understands. I believe once the citizens of the area understand what is really happening to them, the right decision will be reached and it won't involve squandering a quarter of a billion dollars.

REFERENCES

1. Alternatives for Ground Water Cleanup, National Academy of Sciences, June, 1994

2. Before It's Too Late A Scientist's Case for Nuclear Energy, Dr. Bernard L. Cohen, 1983

3. Curtis C. Travis and Carolyn B. Doty, Can Contaminated Aquifers at Superfund Sites Be Remediated, 24 Environmental Science and Technology 1465, 1990

4. Environmental Bulletin, Savannah River Site, Volume 5, Number 28, December 14, 1994

5. Groundwater Pump-And-Treat Activities, Office of Environmental Restoration (EM-40), August, 1993

6. Proposed Plan for F and H Area Groundwater Operable Unit, Rev. 0, November, 1993

7. Savannah River Site Environmental Report for 1990

8. Savannah River Site Environmental Report for 1992

9. Savannah River Site Environmental Report for 1993

10. Savannah River Site Interim Actions Proposed Plans for the F- and H-Areas Groundwater Operable Units, November, 1994

<IMG SRC 0495225F>

United States Government Department of Energy

memorandum

DATE:
REPLY TO
ATTN OF: EM-42 (J. Fiore, 903-8141)

SUBJECT: Ground-water Pump-and-Treat Notebook

TO: R. P. Whitfield, EM-40
J. Baublitz, EM-40
R. Lightner, EM-45
W. Wisenbaker, EM-43
S. Mann, EM-44

I an pleased to forward the attached notebook on ground-water pump-and-treat activities managed by the Office of Environmental Restoration (EM-40). The notebook has been compiled as a result of data collected to support a July 25, 1993, senior managers' review panel which met to critique all of EM-40's pump-and-treat projects.

<IMG SRC 0495225G>

James J. Fiore
Director
Office of Eastern Area Programs
Office of Environmental Restoration

Attachment

cc:
N. Larson, EM-45
J. Lehr, EM-44
W. Murphie, EM-42

G. Turi, EM-43

Background

IRB briefing identified pump-and-treat systems not cost effective for protection o human health and safety.

EM-40 was tasked to review all pump-and-treat projects to determine thei contribution to off-site risk reduction.

25 projects identified across EM-40

Senior Manager's review panel met on July 25, 1993 to critique all 25 projects

Identified

Three Category A projects - Technically sound; reduces risk to public health & safety;
Sixteen Category B projects - Limited risk reduction to public health & safety; and,
Six Category C projects - Little or no risk reduction to public health & safety; may not be technically sound.

Category C projects are proposed for potential "Push Back.

Results From Review Board

Six Category C projects

Two in the Eastern Area:

- General Separations Area (includes F&H) at Savannah River; and,
- TNX Area at Savannah River.

One in the Northwest Area:

- Lawrence Livermore National Laboratory, Main Site.

Three in the Southwest Area:

- South Valley in Albuquerque, NM;
- UMTRA site in Monument Valley, AZ; and,
- UMTRA sites at Tuba City, AZ.

Two "low end" Category B projects

Site 300, Eastern General Services Area, Lawrence Livermore National Laboartory;
Groundwater Treatment & Monitoring, Kansas City Plant

Results From Review Board

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Two "low end" Category B projects

Site 300, Eastern General Services Area, Lawrence Livermore National Laboartory;
Groundwater Treatment & Monitoring, Kansas City Plant

PUMP AND TREAT WORK SHEET

ADS: SR-515	Project: General Separations Area	Location: Savannah River	Office: EM-422

Purpose of Pump & Treat	Cleanup of contaminated GW
Groundwater Treatment	Currently proposed is neutralization, settling, filtration and reinjection of the effluent as well as air stripping with catalytic oxidation off-gas.
Principal Contaminants(s)	Tritium; Trichloroethylene (TCE); lead; mercury; radionuclide metals
Other Contaminant(s)	Nitrate
Baseline Risk	1 x 10-7
Post-Action Risk	No measurable risk reduction off-site
Amount of Water Contaminated (gal)	> 100 million
Pumping Rate (gal/day)	500,000 (347 gpm)

Estimated Initial Mass of Principal Contaminant(s) [lbs]	Further characterization required
Estimated Removed Mass (to date) of Principal Contaminant(s) [lbs]	None - Corrective action not yet underway
Cost of Construction ($M)	$37.2
Cost of Operation ($M)	$186.0
Other Cost ($M)	$228.0
Start Date (FY)	1992
Completion Date (FY)	2040
Legal Driver	SCHW Part B permit issued in 1992 requires F&H CAP (Oct 1993); MWMF CAP (Nov 1993) per Settlement Agreement
Other Pertinent Information	FY 95 Cost - $20 million Total Cost - $270 million Pump-and-Treat Operational in FY 97 Category C

July 27, 1993

<IMG SRC 0495225H>

TRITIUM MIGRATION IN GROUNDWATER

Refer to figure titled: Conceptual Behavior/Response of Tritium during F & H Groundwater Remediation.)

Concentration of Tritium in 1990 was at 15,000 Ci/yr

Concentration of Tritium in 1997 would be at 6,000 Ci/Yr with no actio

Concentration of Tritium would decrease rapidly with pump and treat, but woul surpass the no action level in 2005 due to reinsertion.

In the long run (2015) Tritium concentration levels would be the same with or withou pump and treat

[SRS Data 1994]. Like tritium migration, strontium iodine-129, will be analyzing for migration is expected to continue to decline from these closed seepage basins.

In 1993, no cesium-137 migration was detected from the F-Area or H-Area seepage basins. However, 160 mCi (5.9E+09 Bq) of cesium-137 were detected at the sampling location near the Four Mile Creek mouth over and above the 246 mCi (9.1E+09 Bq) cesium-137 detected in direct process discharges. This additional cesium-137 is attributed to desorption of past cesium releases from the stream bed.

An estimated 22 mCi (8.2E+08 Bq) of iodine-129 were projected to have migrated from the F-Area and H-Area seepage basins during 1993. Because io-dine-129 emits very low energy beta/gamma radiation it cannot be detectedÄÄusing common radioanalytical methodsÄÄin dilute streams. However, as releases of other radionuclides from SRS continue to decrease, the percentage of the maximum individual off-site dose attributed to iodine-129, which has a long half-life of 1.57E+07 years, is unlikely to increase in future years. Therefore, beginning in 1994, the SRTC environmental laboratory, which has the sensitive instrumentation capable of detecting iodine-129 in the F-migration samples.

Migration of L-Area Seepage Basins

P-Area, L-Area, and C-Area disassembly basins have been released periodically to their respective seepage basins since 1978. Purge water is released to the seepage basins to allow a significant part of the tritium to decay before the water outcrops to surface streams and flows into the Savannah River. The delaying action of the basins reduces the dose that users of water from downriver water treatment plants receive from SRS tritium releases. The seepage basins were used for purging the disassembly basins from the 1950s until 1970, but disassembly basin purge water was released directly to SRS streams between 1970 and 1978. The earlier experience with seepage basins indicated that the extent of radioactive decay during the holdup was sufficient to recommend that the basins be used again in P-Area, L-Area, and C-Area. However, because these reactor areas have been shut down, no purges to the basins occured during 1993.

<IMG SRC 0495225I>

3325 Berkshire Circle
Johnson City, TN 37604
February 15, 1995

EPA Region IV
Attn: Jeff Crane
345 Courtland Street
Atlanta, GA 30365

Dear Mr. Crane:

Attached please find additional comments on the proposed F&H Groundwater Remediation.

Sincerely,

Philip Brandt

Letter #2 from Mr. Philip Brandt to the EPA

ADDITIONAL COMMENTS TO THE PROPOSED F&H GROUNDWATER REMEDIATION

1. During the extended comment period, I was able to ascertain that the NPDES permitted F&H area Effluent Treatment Facility (ETF) is allowed to discharge to onsite surface streams up to 30,000 Curies of tritium per year. Will the regulators explain to the public the difference in potential environmental impact from the permitted discharge of 30,000 Curies of tritium and the estimated (1993) 3,200 Curies of tritium seeping from the F&H Seepage Basins and the estimated (1993) 12,200 Curies of tritium released to the Savannah River from all sources (discharge and all seepage basins)? If there is documented environmental harm from 3,200 Curies of tritium discharging to a surface stream then how can 30,000 Curies be allowed to discharge to a surface stream? If the RCRA decision making process selected determined that pump/treat/reinjection was the lowest risk option how can you justify or allow a potential 30,000 Curies of tritium be released to a surface stream?

2. The costliest and technologically weakest option, pump/treat and reinject, was selected under RCRA in 1992. At the public meeting held in North Augusta, South Carolina on January 9, 1995, the question was asked why wasn't pump/treat and discharge to a surface stream or Savannah River selected since it was (a) much

cheaper and (b) met all regulatory requirements. The response was that there was concern over increasing the tritium dose to down stream users. Under a no action alternative and a pump/treat and discharge alternative wouldn't the drinking water standards of downstream water users be met? Aren't the EPA regulations

governing drinking water standards protective of the human health and the environment? On a relative risk basis, isn't there more risk from a 30,000 Curies tritium discharge than the 3,200 Curies from the F&H Area Seepage Basins? What is the legal basis for requiring the additional expenditures for remedial actions that are more protective to human health and the environment than required by status particularly when the environmental threat is only 10% or that from the F&H ETF?

3. The 1992 RCRA permit required that groundwater be treated to the 10,000 pCi/L isopleth line. Based on the data I have received, which is two years old, the water quality has improved so dramatically that the proposed intercaptor walls are already at or below the 10,000 pCi/L isopleth line in the F Basin area and rapidly approaching it at the H Basin area. In the H Area, Basin H-3 is the most significant contributor to groundwater contamination. What is the basis for now continuing with the pump/treat/reinject system when the groundwater quality has already improved and continues to improve beyond what was required in the RCRA permit? What is the basis for ignoring Basin H-3 under CERCLA in the remedial selection process when RCRA does not apply to it and it is the principal source term for groundwater degradation?

4. Given the dramatic and continuing improvement in the quality of the groundwater, it appears in retrospect that the State of South Carolina and the EPA used either (a) overly conservative risk assumptions in their analysis of remedial options or (b) made some sort of grievous error. The F&H Part B permit is up for renewal in March of 1995. Now that this "new" data is available which directly contradicts the conclusions and assumptions originally used and the RCRA permit is so close to renewal, shouldn't the remedial alternative selected be re-evaluated to reflect reality? Given the timing of the RCRA permit renewal, shouldn't this re-evaluation be coordinated and integrated with the CERCLA public participation process? The overly conservative assumptions used were justification for rejecting DOE's Alternate Concentration Limit submittal. Shouldn't the ACL application be revisited based on the "new" data? Doesn't this "new" data completely and significantly change the risk conclusions reached in the earlier RCRA permit? Aren't we all seeking to find the least cost option that is protective of human health and the environment?

5. At the public meeting on January 9, 1995, the EPA Region IV representative stated that the SRS was placed on the National Priorities List (the EPA list of the worst sites that are or present a threat to human health and the environment) and that she

personally knew that the offsite drinking water risk alone was sufficient justification for placing SRS on the NPL. Can the EPA explain how an offsite drinking water dose that is only 1% of EPAs allowable drinking water standards qualify it for inclusion on the NPL? The EPA establishes radionuclide limits for drinking water that are protective of human health and the environment. Can the EPA explain how 30,000 Curies of tritium potentially discharge

from the F&H Area ETF can be legally allowable under an NPDES permit whereas a 12,200 Curie discharge (from all sources) is justification for placing the site on the list of the worst environmental sites in the country? I hope in the EPA response to this question that the EPA is astute enough to recognize there is sufficient real data to demonstrate that there is no credible mechanism for concluding that there is a measurable off site chemical or radiological risk other than tritium.

6. I have never been involved in a CERCLA public meeting in which the selected remedy has been presented in such a circuitous manner. Ostensibly, the public meeting was held to see if there were any comments as to whether additional treatment was required above and beyond pump/treat and reinject. Has the NEPA process been subverted? Weren't alternatives, including a no action alternative, considered? Where has the public been involved in the CERCLA review process in the selection of the remedial alternative? As part of the NEPA process, a Citizens Advisory Board (CAB) was created to obtain representative comments from the affected communities. The Co-Chair, Mr. W. F. Lawless, of the Environmental Restoration Subcommittee of the CAB indicated that they had serious concerns over the proposed remedy i.e "no scientific justification" to support the choice. Mr. Lawless stated that the proposed remedy will be the subject of the CABs March meeting and requested an extension on public comments until after their meeting. Isn't it reasonable to extend the comment period so that the citizens group created under the CERCLA process can respond to and participate in the CERCLA decision making process? I request an even further extension since a draft RCRA permit is expected to be available from SCDHEC by March 1, 1995. The public will then have a 45 day comment period based on the latest facts. The environmental data clearly indicate improving water quality and that small, localized areas of stressed vegetation are coming back so there is no environmental harm in waiting. By postponing the CERCLA decision making process a more reasoned and logical conclusion can be arrived at, one that may be equally protective of human health and the environment but costs much less than a quarter of a billion dollars. What is the reason or basis for the State and EPA to reach a conclusion so quickly given the timing of the RCRA permit renewal and the concerns raised by the CAB? Do individuals at the state or Federal level receive any sort of merit award for the number of RODs completed? Is there a statutory requirement that requires the ROD to be completed within a certain time?

7. Would the State of South Carolina please explain to the public at what point in the geohydrological cycle that precipitation becomes waters of the state? Is it when it infiltrates the soil but prior to evapotranspiration? Is it after evapotranspiration? Does it include all soil water? Does it include near surface groundwater that discharges to surface streams? Are all shallow groundwaters considered waters of the state regardless of sustained yield and water quality parameters? If the answer to the last question is yes, is the State consistently enforcing the regulations to agricultural users, municipalities, other industrial entities, and the general public? For example, is there equal enforcement in the protection of waters of the state to rural, private residences that utilize septic systems with leach fields or the farmer that utilizes compost and/or animal manure for fertilizer?

8. There have been recent, significant reductions in funding through out the DOE complex. Funding for environmental restoration has been cut. There is not enough funding to support all the currently identified environmental restoration activities. There are sites within the complex that do propose a real or potential threat to human health and the environment. If DOE prioritizes how the funding is distributed and there is not sufficient funding to support continuing the F&H groundwater remediation, what will be the State of South Carolina and EPA's response? From a chemical and radiological perspective there are a number of sites at SRS that should be "ahead of" sites like the F&H Basins and other sites such as the TNX basins. How about the old R Reactor disassembly basins whose water levels rise and fall with changes in the ground water table. What is the radiological water quality in those basins? Can you document that there aren't any source terms in the sediments and sludges in the bottom of the basin? What radionuclides and what are their concentrations along the canal system and intervening ponds that discharged contaminated water from the reactors to the Parr Pond? What steps are being taken to prevent biological uptake and concentration in the flora and fauna in these areas?

9. The Energy Research Foundation in their January 31, 1995 response stated that the public has "had ample opportunity for input". Technically, I would have to agree with the statement that the requirements of the law regarding public comment have been complied with. However, has the intent of the law been complied with? How successful have you been in communicating the intent of your actions. At any time was the public informed in plain English as to how much the clean up would cost or that the contamination could never contaminate offsite groundwater? Exactly how many response were there from the stakeholders around SRS in Aiken, Jackson, Barnwell, etc. to the F&H groundwater permit? Considering the population base for that area does any one believe that there was a significant public response? I strongly disagree with the

ERF statement "the evidence of the spread of contamination and its measurable impact on affected surface waters is a sound and compelling basis for the remedial action". What Class B water parameters were exceeded in Four Mile Creek and for the ones exceeded which showed a significant difference upgradient and down gradient from the seepage basins? Valid, scientific data supports the position that no further action is justified. The ERF believes that CERCLA should simply validate a prescriptive solution under RCRA. Does the ERF also believe that the CAB should have no input under CERCLA when the Environmental Restoration Subcommittee also questions the proposed remedy? Does the ERF also believe that there should be no meaningful CERCLA evaluation for Basin H-3 which is not a RCRA regulated unit? I would say to the ERF that the

intent of RCRA and CERCLA is to protect human health and the environment and that sometimes this can occur under a no further action scenario. I would counter argue that it is entirely appropriate to challenge under CERCLA a bad decision arrived under RCRA due to procedural requirements. By illuminating such differences, may be at some point in the future we can inject some common sense and reality into the remedial process instead of needlessly wasting resources on "improvements" in environmental quality that exist only on paper and benefit absolutely no one.

Response: Several of the comments identified in Mr. Brandt's letters have been previously addressed as part of the comment responses prepared for comments summarized from the public meeting transcript, and therefore, are not repeated. The following responses are provided for comments that have not been previously addressed and are numbered in order as they were extracted from the letters. The numbering sequence does not correspond to the question numbers that appear in letter #2.

1. What has been the water quality trends over the last six years on FMC at sampling stations 1B, 1C, 2B, 2, 3A, 3, 6, and A7 while describing the source terms that contribute to the contaminants? What data indicates that the contribution of hazardous substances to FMC, including radionuclides, will increase over time with no further action? Discuss and comment on whether the data trends support an improving or deteriorating groundwater quality? Does the risk of contamination of the deepest aquifer and discharge to Upper Three Runs Creek increase or decrease?

Response: In the most recent report "Semi-Annual Sampling of Fourmile Branch and Its Seeplines in the F and H Areas of SRS: February 1993, July 1993, and April 1994", a summary of the water quality is provided in the introduction section with a comparison of analytes detected in 1989 samples. It is stated in this report and the 1993 Environmental Report that the sources contributing to these contaminants are the F&H Seepage Basins. There is no data that indicates that the radionuclides will increase over time with no further action.

Levels of tritium in the groundwater plumes have been generally decreasing since use of the basins for disposal of wastewater was discontinued in 1988. Construction of the low permeability caps over the basins has served to control any further migration of contaminants to the groundwater. These source control measures have resulted in decreasing the risk of contamination to the deeper aquifer and Upper Three Runs Creek. However, levels of contaminants in the groundwater continue to be measured at levels which exceed primary drinking water standards.

2. Numerous wells in the F&H area seepage basins are poor quality, low yields from perched water tables. How many of the water table wells provide less than six gallons per minute continuous yield, that is are unsuitable for home use as a drinking water source? What is the water quality for these wells? How many of these wells do not yield enough water to provide a representative sample (minimum of three casing volumes)? How many of the wells evidence faulty well installation? Does SCDHEC and EPA require the same groundwater protection for perched water tables which are unsuitable for a drinking water supply system as for legitimate aquifers?

Response: Wells at the F and H Area seepage basins have been installed to provide representative samples from the aquifer units that they monitor. No perched water zones are monitored. Low yield is not an indication of an inadequate monitoring well. Many of the wells monitor zones that have a high percentage of clays and fine grained materials. In some locations the water table surface is very close to the underlying confining unit; this results in a very thin water table aquifer. Wells in these zones (high clay content an thin water table) tend to produce a low yield. This is in contrast to wells which are installed to provide water for domestic use, which are specifically designed to extract water from thick units of coarse grained materials in order to ensure a high yield.

The integrity of the monitoring network is evaluated regularly, and corrective actions are

taken to repair and/or replace any wells which do not provide representative samples or show evidence of faulty hardware or construction.

3. Provide documentation on the level of contamination that is discharged from the Congaree aquifer to Upper Three Runs Creek? Provide similar documentation for the deeper aquifer that discharges into the Savannah River?

Response: Environmental monitoring indicates that contamination which is discharged to Upper Three Runs Creek and to the Savannah River from deeper aquifers is negligible.

4. The EPA has determined that capping is protective of human health and the environment. Is capping with institutional control an allowable remedial alternative under CERCLA? Since implementation of capping, groundwater has improved dramatically thus decreasing future risk to human health and the environment through institutional control. What period of institutional control was considered by SCDHEC/EPA in evaluating the no action alternative under CERCLA?

Response: A future land use policy for the Savannah River Site is currently being prepared. Until future land use issues are resolved and a policy is implemented, institutional control cannot be considered as a remedial alternative under CERCLA.

5. SCDHEC requires that groundwater used in the reinjection wells meet drinking water standards. How can SCDHEC allow tritiated groundwater that is 1000 times drinking water standards to be reinjected? How can it allow nitrates that are 10-100 times drinking water standards to be reinjected when treatment technology exists to treat nitrates?

Response: Injection of water which contains tritium and nitrate in levels which exceed drinking water standards can be allowed in the context of this RCRA corrective action because overall groundwater quality in the aquifer will be improved.

6. Pumped water can simply be adjusted for low pH and discharged to the Savannah River meeting all health and safety requirements of both EPA and SCDHEC at significant cost savings over the required remedy. What is SCDHEC's and EPA's justification under RCRA for not requiring the most cost effective remedy which meets all drinking and surface water quality standards?

Response: It would not be acceptable to extract contaminated groundwater that is currently not used as a drinking water source and to only adjust for low pH and then discharge it to the Savannah River. One of the remedial alternatives considered for the F and H Seepage basins was to extract groundwater and pump it directly to the Savannah River with minimal treatment. It was estimated that levels in the Savannah River would remain below drinking water standard if this alternative were implemented. However, this alternative was not selected. It seemed to be counter intuitive to pump contaminated water out of the ground water it is relatively isolated from environmental receptors and place it directly in the Savannah River which serves as a public drinking water source.

7. A different environmental remedy for the same site can be arrived at under CERCLA versus RCRA. In fact, the DOE submittal to SCDHEC and EPA for the proposed remedy under CERCLA is that no action be taken: What has been SCDHEC's and EPA's response to DOE's proposed remedy under CERCLA of no further action (Rev. 0, Proposed Plan for F and H Area Groundwater Operable Unit). What was your basis for rejecting the proposal, particularly for basin H-3 which is not regulated under RCRA.

Response: DOE is subject to the Federal Facility Agreement which mandates that all RCRA regulated units should be addressed under RCRA and then reviewed under CERCLA to determine if additional action is necessary to protect human health and the environment. (Reference comment response number 17 in the general response section)

8. The risk assessment process used is flawed. Proposed tritium standards are three times higher current standards. When performing your risk assessment you used proposed concentration limits when they were higher than existing limits. However, in the case of tritium you used the existing limits when proposed limits are over three times higher. There is no rational basis for ignoring nitrates in the risk assessment process nor is there any health/environmental based reason for pumping/treating and recirculating the tritium plume to maintain a 20,000 pCi/mL contour. If you

are not maintaining the drinking water standard isopleth then 200,000 pCi/mL or current levels are

as equally valid as the 20,000 pCi/ml isopleth for tritium. Why weren't the proposed tritium standards used (60,900 pCi/L)?

Response: Quantitative Risk Assessment based on the most current data has not been performed. Risk assessment work performed to evaluate the potential risk associated with groundwater contamination at the F and H Area Seepage Basins is based on an extensive list of hazardous and radioactive constituents. The primary drinking water standard for tritium (whether proposed or current) is not a significant factor in the estimation of risk.

9. The state and EPA have specific areas of regulatory authority. The state does not regulate groundwater contaminated by radionuclides. Does SCDHEC claim regulatory authority over radionuclides? Under what authority and has the Federal government given up its sovereign immunity?

Response: SRS signed a Memorandum of Agreement on April 8, 1985, agreeing to comply with the substantive requirements of the South Carolina Pollution Control Act (PCA); the South Carolina Hazardous Waste Management Act (SCHWMA) and regulations promulgated thereunder. The definition of pollutants under the PCA can be interpreted to include radionuclides. In addition, to the above, SRS entered into a Settlement Agreement (87-27-SW), as amended on June 14, 1989, in which DOE agreed to address the hazardous constituent contaminants in the groundwater as defined by RCRA as well as groundwater contamination by other constituents such as nitrates and radionuclides as defined by the SC PCA. These actions were taken as a matter of comity rather than as a waiver of sovereign immunity.

10. Besides the DOE SRS, SCDHEC regulates municipalities, private businesses, and other State and Federal agencies. Does the DOE SRS receive equal treatment under the law relative to enforcement or fines? What other facilities are being required to pump/treat and reinject as a remedial action? How many are allowed to reinject contaminated water above drinking water standards? How many ACL's have been granted by SCDHEC in the last five years?

Response: SRS receives equal treatment under the law as compared to other industrial and governmental facilities. The F and H Areas Seepage Basins groundwater plumes contain both hazardous and radioactive constituents that differ greatly from those found at most facilities requiring groundwater remediation. Therefore, the proposed corrective action is unique. No other facilities are currently required to pump/treat and reinject, or to reinject water which exceeds drinking water standards.

No ACL's have been approved by EPA Region IV or SCDHEC in the past five years. However, ACL's are a viable alternative to complete restoration of aquifers to drinking water standards. In fact, the corrective action required by the RCRA permit specifically allows for evaluation of an

ACL demonstration at the conclusion of Phase I.

11. Regulatory oversight by SCDHEC at SRS is funded by a grant from DOE. How many municipalities, private industries, and other government agencies fund their own regulatory oversight? How does SCDHEC avoid a conflict of interest, that is, the more remedial actions required the higher the funding level for SCDHEC?

Response: Through permit fees and other funding mechanisms, all municipalities, private industries, and other government agencies fund their own regulatory oversight. There is no conflict of interest. The grant is based on a scope of work submitted by SCDHEC and approved by DOE on an annual basis so more remedial actions do not necessarily mean more funding as both parties must agree as to the level of work necessary for the year.

GEORGE M. MINOT
3 Bateau Road
Hilton Head Island, SC 29928-3012
803-363-5150

Memorandum

To: SRS Remedial Project Manager, U.S. EPA, Region IV

From: George M. Minot

Date: February 6, 1995

Subject: Resolution Regarding SRS F- and H-Area Groundwater Operable Units

WHEREAS, the F-Area Hazardous Waste Management Area consists of a series of three hydraulically connected, unlined basins (F-1, F-2 and F-3) to which wastewater flow was terminated on November 7, 1988 and the H-Area Hazardous Waste Management Area consists of a series of three hydraulically connected, unlined basins (H-1, H-2 and H-4) to which wastewater flow was terminated on November 7, 1988, and

WHEREAS, the radioactivity released to the unlined basins constituting the F-Area Hazardous Waste Management Facility and the H-Area Hazardous Waste Management Facility is due primarily to tritium, a radioactive form of Hydrogen with a half-life of about 12.5 years, and

WHEREAS, currently, there is no known effective method to remove tritium from groundwater, and

WHEREAS, F- and H-Areas and vicinity are on a surface and groundwater divide; shallow groundwater flows toward either Upper Three Runs or Fourmile Branch, both of which discharge directly into the Savannah River, and

WHEREAS, the Maximum Containment Level (MCL) for tritium (i.e. the maximum permissible level of tritium in water that is delivered to a user of a public water system) is 20 picocuries per milliliter (pCi/mL). and

WHEREAS, the Savannah River supplies domestic and industrial water for the Port Wentworth (Savannah, GA) water treatment plant and for Beaufort and Jasper Counties in SC and analytical results of calendar 1993 water studies indicated that the water in the Savannah River downstream from SRS showed a maximum reading during one sampling event of 1.92 pCi/mL of tritium (approximately 10% of MCL), and

WHEREAS, analytical results of calendar 1993 water studies indicated that the water quality of the Upper Three Runs and Fourmile Branch was "generally acceptable, with the exception of the tritium concentrations" (i.e., Fourmile Branch maximum reading during one sampling event was 68.9 pCi/mL or approximately 3.5 times the MCL; Upper Three Runs maximum reading was 17.9 pCi/mL or approximately 90% of MCL), and

WHEREAS, in mid-1993, the contaminated groundwater plume, as defined by the 1,000 pCi/mL tritium isoactivity contour (i.e., 50 times the MCL), in the F-Area was less than 400 feet from the Fourmile Branch and the contaminated groundwater plume in the H-Area was approximately 135 feet from the Fourmile Branch. At the same time, it was reported that the F-Area plume contained zones of tritium concentrations as high as 30,000 pCi/mL or 1,500 times the MCL and the H-Area plume contained zones of tritium concentrations as high as 16,000 pCi/mL or 800 times the MCL. In addition, it should be noted that the aforementioned contaminated groundwater plumes are generally confined to the shallow aquifer

(i.e., Steed Pond, Upper Three Runs, and Gordon a.k.a. the Floridan Aquifer System)

which are the
primary source of domestic water supplies in Aiken County, SC, and

FURTHER, in 1987, DOE identified 56 major municipal, industrial and agricultural groundwater users within 20 miles of the center of SRS, and in 1992, the maximum tritium concentration measured in any one of the 217 wells in the shallow aquifer units within the area designated as "Separations and Waste Management" was 180,000 pCi/mL or 9,000 times the MLR, and

FURTHER, the Westinghouse Savannah River Company (SRC) has stated that "Actual or threatened releases of hazardous substances from the site, if not addressed by the preferred alternative or one of the other action measures considered, may present a current or potential threat to public health, welfare, or the environment," but has not quantified the F- and H-Area Groundwater Operable Unit-specific risk(s) to humans (or the wildlife) resulting from exposure to groundwater contaminated with hazardous and radioactive constituents, including tritium, and

FURTHER, to the best of my knowledge, neither DOE, SRC, or any other entity has made available for public review in the SRS-area any recently de-classified Los Alamos National Laboratory or other studies involving human exposure to tritium and other radionuclides detected in the F-and H-Area groundwater in concentrations that require remediation.

FURTHER, the SRC Environmental Monitoring Section's Environmental Geochemistry Group (EGG), which regularly samples approximately 1,400 groundwater wells throughout SRS, has publicly stated "groundwater aquifers can be a major pathway for hazardous and radioactive substances to move beyond the site boundary, as well as into the Savannah River." However, to my knowledge, the public has not been made aware of the rate(s) of migration of the identified hazardous and radioactive substances toward the site boundaries and/or the six SRS tributaries that drain to the Savannah River and/or the Savannah River, nor has the total estimated volume of contaminated groundwater to be remediated been disclosed.

THEREFORE, BE IT REQUIRED THAT, DOE and/or SRC promptly, and before proceeding with Phase 1 of the preferred alternative for groundwater remediation at the F-Area and H-Area Groundwater Operable Units (at an estimated Capital Cost of approximately $32 million plus an estimated on-going Maintenance & Operation cost of $4 to $6 million per year for an unknown number of years), take all

necessary actions to further quantify the "current or potential threat to public health, welfare or the environment" associated with Alternatives 1, 2 and 3 and, concurrently, provide more complete information regarding the tritium and other radionuclide concentrations in the groundwater plumes, the SRS streams and the Savannah River, and publish a response to the following comments and questions:

1. Given that the half-life of tritium is approximately 12.5 years, how much of the tritium concentration recently recorded is attributable to the pre-November 1988 operations conducted at the Separations and Waste Management area? How many liters of contaminated water at what pCi/L is being contributed daily, weekly, and/or monthly by the "processing of existing inventories of materials for a variety of purposes" within the F- and H-Area Groundwater Operable Units? Since seepage basin closure activities were reportedly completed on January 4, 1991 (F-Area) and on June 11, 1991 (H-Area), where, and in what manner are the contaminated wastes from continuing operations being stored? Is this waste stream being addressed by any of the alternatives?

2. Given that the geography/geology in question is located within portions of the SRS site that will undoubtedly continue to be DOE-owned and contractor-operated for a very long time, it is not obvious to me why the contaminated groundwater needs to be cleaned to residential drinking water standards to satisfy DOE objectives, nor is it clear from the public information provided that the preferred alternative for remediation will be able to meet this standard. Does DOE have in hand in hand or has the U.S. Congress

budgeted sufficient ear-marked funds to fully implement all Phases of this project and still have funds available to address other alleged severe environmental remediation problems at SRS (i.e., the Canyons, High Level Waste tank farms, Plutonium storage, etc.) at the same time?

3. Inasmuch as "there is no known effective method to remove tritium from the groundwater," it would seem appropriate for DOE/Westinghouse SR to establish a Human Studies Project Team to coordinate research efforts with the Los Alamos NL team and personnel/teams at other Research Laboratories (i.e., Argonne NL, Brookhaven NL, Idaho National Engineering Laboratory, Lawrence Berkeley Laboratory,

Lawrence Livermore NL, Oak Ridge NL, Pacific Northwest Laboratory, Sandia NL, etc.) in an effort to determine the public health risks associated with absorption of tritium-contaminated water and water vapor through the skin, inhalation of tritium-contaminated water-vapor, ingestion of tritium-contaminated liquids, etc., and document the findings in various public report, press releases, audio tapes, and video taped presentations as soon as possible! Also, it will be important to educate the public with regard to the origin of the radiation, the effects on humans and animals at different concentrations or dosages and how to recognize the symptoms of tritium poisoning.

c: Drew Slaton, Public Involvement Coordinator, Westinghouse SRC
Brian Costner, Energy Research Foundation

Letter from Mr. George M. Minot to the EPA

Response:

1. Levels of tritium in the groundwater plumes have generally decreased since operation of the basins was discontinued in 1988. Additionally, the installation of the low permeability caps over the basins has further controlled the migration of contaminants into the groundwater. All of the tritium currently contained in the F&H Seepage Basins is due to pre-1988 operations. There is no contaminated water currently being contributed to the F&H Area Seepage Basins. Contaminated effluent water and any contaminated water due to processing of existing inventories is transferred to the Effluent Treatment Facility for processing.

As stated in the WSRC Report, "Assessment of Tritium in the Savannah River Site Environment, is a tritium balance for SRS operations from 1952 to 1991. The F&H Seepage Basins have received 669,790 Curies of tritium, released 268,533 to Fourmile Creek, released 202,567 Curies to the atmosphere through evaporation, and currently (as of 1991) the basins contain 37,618 Curties. Subtracting the last three numbers from the first gives a difference of 161,072 Curies, which is the amount of radioactivity eliminated through the radioactive decay process.

2. Currently, only funding for Phase I of the F&H Groundwater Remediation Project has been budgeted. Additional funding would be requested for the remaining phases, if required

following a
technical evaluation the Phase I Operations.

3. Since the early fifties, a significant amount of research has been conducted on the transport, metabolism, and radiation dose due to tritium in the environment. One of the better references was published by the National Council on Radiation Protection and Measurements (NCRP) as NCRP Report No. 62, Tritium in the Environment. It may be ordered from:

NRCP Publications
7910 Woodmont Avenue
Suite 800
Bethesda, MD 20814-3095

The International Commission on Radiological Protection (ICRP) has developed a quite thorough, although somewhat complicated system for calculating radiation dose from ingestion, inhalation, and absorption of tritium through the skin. ICRP Publication 30, Part 1, contains tritium information in addition to a description of the radiation dose calculation system. It can be ordered through your local bookstore by referring to the identifier, ISBN 0 08 022638 8.

During the approximately 40 years of SRS operation, the tritium dose for customers of the Beaufort-Jasper Water Treatment Plant was about 3 millirem (WSRC-TR-93-214, Table 4-7). During the same time period, the very conservative EPA limit of 4 millirem per year would have allowed a dose of 160 millirem. Future liquid releases of tritium will decline since all reactors are shut down and the inventory of tritium in the seepage basins will be depleted by the natural decaying process.

Letter from Mr. W. F. Lawless to the DOE

Response: The specific comments addressed regarding the lack of a scientific justification for the project and concerns regarding cleanup to a residential standard have been previously addressed in the general response section. (Reference comment responses for numbers 2 and 4)

PAINE COLLEGE
<IMG SRC 0495225J>

Division of Natural Sciences and Mathematics 1235 Fifteenth Street Augusta,

Georgia 30901-3182 (706)

Dr. Mario P. Fiori, Manager
Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, SC 29802

Dear Dr. Fiori: January 10, 1995

I was delighted last night to have the opportunity to attend the meeting in North Augusta on the proposed plans for remediation of contaminated groundwater beneath the F-Area and H-Area Seepage Basins. But I was disturbed by the lack of scientific justification provided to support what appears to be a high-minded fishing expedition by the EPA and DHEC. Both agencies repeatedly stated that the "pump-and-treat" method, at a capital and operating cost of $30-200 million dollars, is a five-year trial "to see what happens" to the groundwater contamination in the area. That makes the project, in my opinion, an experimental enterprise insufficiently justified as a full-fledged environmental remediation capital project.

Another concern that I have is that the cleanup standard of the residential alternative for this project was mandated by EPA/DHEC, yet no scientific justification was provided to support their choice. Further, this EPA/DHEC choice may conflict with a motion moving through the SRS CAB to zone the area encompassing the Seepage Basins as industrial for cleanup purposes.

Before continuing with the Seepage Basin project, I recommend that it be submitted to independent scientific peer review to determine whether or not the project is justified on a scientific, engineering, and cost basis.

Sincerely,

<IMG SRC 0495225K>

W. F. Lawless
Associate Professor of Mathematics and Psychology

A College of The United Methodist Church and the Christian Methodist Episcopal Church

<IMG SRC 0495225L>
PAINE COLLEGE

Division of Natural Sciences and Mathematics 1235 Fifteenth Street Augusta, Georgia 30901-3182 (706) 821-

Dr. Mario P. Fiori, Manager
Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, SC 29802

Dear Dr. Fiori: January 25, 1995

Re: My last letter to you on F/H Seepage Basin Groundwater Cleanup

I recommended to you in a letter dated January 10, 1995, that before DOE continues with the Seepage Basin project, the project be submitted to independent scientific peer review to determine whether or not it is justified on a scientific, engineering, and cost basis.

My recommendation was based on the following: there appeared to be a lack of scientific justification for the project; the cleanup standard of the residential alternative for the project was mandated by EPA/DHEC, yet no scientific justification was provided to support their choice; and the EPA/DHEC choice may conflict with a motion moving through the SRS CAB to zone the area encompassing the Seepage Basins as industrial for cleanup purposes.

As you are aware, the motion was passed by the SRS CAB. The reason that I am writting to you today is because the CAB's ER Subcommittee, of which I am Co-Chair, has decided to consider the F&H groundwater remediation project as the subject of its next motion to be presented at the CAB's March meeting. Not knowing how this new motion will bee drafted (e.g., it likely will have input from EPA, DHEC, and others), and because of its timeliness and the need to involve the public in important discussions of SRS issues. I request that you extend the F&H Groundwater public comment period until after the March meeting.

Sincerely,

<IMG SRC 0495225M>

W. F. Lawless
Associate Professor of Mathematics and Psychology

A College of The United Methodist Church and the Christian Methodist Episcopal Church

Letter from Mr. Tim Connor to the EPA

1. We see no evidence at this time that remedial actions beyond those currently being implemented

under the RCRA Post Closure Care Requirements are necessary to protect human health and the environment.

Response: The IROD has been modified and it is stated that the SRS RCRA permit is viewed as the primary decision-making authority and that the selected interim action under CERCLA is no further action beyond that required by the corrective action as identified in the SRS RCRA permit.

2. We respectfully take issue with the decision to seek public comment on a "No Remedial Action" option for the basins under CERCLA.

Response: The "No Remedial Action" alternative is included in the description of alternatives section as one of the three alternatives that were evaluated for remediation of the contamination at the F-Area Groundwater Operable Unit. Alternative 3 (groundwater recovery, treatment, and injection) is the corrective action described in the 1992 RCRA Permit. This action has been determined to be protective of human health and the environment. Therefore, no further action is required under CERCLA.

ENERGY
RESEARCH
FOUNDATION

January 31, 1995

Frances Close Hart
Board Chairwoman

Tim Conner
Associate Director

Theodore K Harris
President

Mr. Jeff Crane
U.S. Environmental Protection Agency, Region IV
345 Courtland Street
Atlanta, GA 30365

Dear Mr. Crane:

The Energy Research Foundation (ERF) has the following comments with respect to plans submitted in December of 1994 by the U.S. Department of Energy's Savannah River Site (SRS) to meet the requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as such requirements pertain to the F and H Area seepage basins at SRS.

ERF's interest in the timely remediation of the F & H seepage basins and the

contaminated groundwater associated with the basins goes back several years. During that time our views on the issues involved have been repeatedly conveyed to both the South Carolina Department of Health and Environmental Control (SCDHEC) and to SRS. Most recently, we submitted detailed comments on the Post Closure Care Requirements of the basins in October 1992 as part of the compliance process required by the federal Resource Conservation and Recovery Act (RCRA). This process led to SRS agreeing to install a remedial system at the basins designed to prevent the further spread of contamination into a surface stream at SRS which is a tributary to the Savannah River.

It was and remains our view that the evidence of the spread of contamination and its measureable impact on affected surface waters is a sound and compelling basis for the remedial action. Moreover, we believe the requirements imposed by SCDHEC are well-anchored in the law and settlement agreements negotiated with and signed by SRS.

The only question which should be on the table now is whether additional remedial actions to contain contaminants from the F & H seepage basins are necessary to satisfy the requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Our view on this is two-fold:

1) We see no evidence at this time that remedial actions beyond those currently being implemented under the RCRA Post Closure Care Requirements are necessary to protect human health and the environment.

537 Harden Street
Columbia, South Carolina 29205
803-256-7298

2) We respectfully take issue with the decision to seek public comment on a "No Remedial Action" option for the basins under CERCLA. In our view, the Federal Facility Agreement for SRS (Section 4, paragraph A) is clear that EPA's CERCLA process will be used to augment, rather than supplant, corrective measures reached under RCRA permit. In other words, the CERCLA process ought not be used to undermine RCRA or RCRA-based consent agreements and enforcement by the State of South Carolina of its hazardous waste laws.

The most sensible approach is one we thought the FFA laid out whereby RCRA and CERCLA activities are coordinated to ensure a minimum of duplication and conflicting requirements. We agree that it is appropriate to examine RCRA-based decisions to ensure they satisfy CERCLA requirements. Yet, we don't believe the process is well-served when a CERCLA review invites challenges to remedial actions already agreed to by all parties via an open decision-making process in which all parties, including the public, have had ample opportunity for input.

It is our hope that potential future conflicts and confusion can be avoided. We strongly recommended that in instances like that presented by the F & H seepage basins--where a RCRA-based remedial action has been developed and approved in accordance with the SRS RCRA permit and other applicable requirements--that EPA replace the "No Remedial Action" option with a "No Further Remedial Action" option.

Notwithstanding EPA's consideration of the "No Remdial Action" option at the

F & H basins, we believe the process and the outcome of the RCRA Post Closure Care Requirements were fair to all parties and consistent with the consent agreements and the law. We therefore urge EPA to accept the existing RCRA Post Closure Care Requirements as satisfying the requirements of CERCLA for the remediation of contaminated groundwater at the basins.

Sincerely,

<IMG SRC 0495225N>

cc: Tom Treger, DOE
Drew Slation, WSRC
Keith Collinsworth, SCDHEC
Brian Costner, ERF

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 09/11/1995
Operable Unit: 12
ROD ID: EPA/ROD/R04-95/252

Text: Full-text ROD document follows on next page.

PB95-964036
EPA/ROD/R04-95/252
March 1996

EPA Superfund
Record of Decision

Savannah River (USDOE) M-Area, West Unit (631-21G), Aiken, SC
9/11/1995

United States Department of Energy

Savannah River Site

Record of Decision
Remedial Alternative Selection
for the
M-Area West Unit (631-21G) (U)

WSRC-RP-95-626
Revision 0
August 1995

Westinghouse Savannah River Company
Savannah River Site
Aiken, South Carolina 29808

Prepared for the U.S. Department of Energy Under Contract DE-AC89-SR18035

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

M-Area West Unit (631-21G)

WSRC-RP-95-626
Revision 0
August 1995

Savannah River Site
Aiken County, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U.S. Department of Energy Under Contract DE-AC89-SR18035
Savannah River Operations Office
Aiken, South Carolina

DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

M-Area West unit (SRS Bldg. # 631-21G)
Savannah River Site
Aiken, South Carolina

The M-Area West unit (631-21G), is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) solid waste management unit/Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site.

Statement of Basis and Purpose

This decision document presents the selected remedial action for the M-Area West unit located at the Savannah River Site in Aiken, South Carolina. The selected action was developed in accordance with CERCLA, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record file for this specific RCRA/CERCLA unit.

Description of the Selected Remedy

The results of the Resource, Conservation and Recovery Act Facility Investigation/Comprehensive Environmental Response Compensation and Liability Act Remedial Investigation, indicate that the M-Area West unit poses no unacceptable risk to human health or the environment. Therefore, no action is needed at the M-Area West unit. This is the final RCRA/CERCLA action for the M-Area West unit.

Declaration Statement

Based on the results of the remedial investigation, no action is necessary at the M-Area West unit to ensure the protection of human health and the environment. Since M-Area West poses no threat to human health or the environment, and no action is needed, the CERCLA Section 121 requirements are not applicable. This action is protective of human health and the environment and is meant to be a permanent solution, final action, for the M-Area West unit. No five-year remedy review is needed or will be performed.

8/28/95
Date

Thomas F. Heenan
Assistant Manager for Environment Restoration and Solid Waste
U.S. Dept. of Energy, Savannah River Operations Office

9-11-95
Date

for John H. Hankinson, Jr.
Regional Administrator
U.S. Environmental Protection Agency, Region IV

9/29/95
Date

R. Lewis Shaw
Deputy Commissioner
Environmental Quality Control
South Carolina Department of Health and Environmental Control

DECISION SUMMARY
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A. Responsiveness Summary 13

I. Site and Operable Unit Name, Location, and Description

The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina (Figure 1). SRS is a secured U.S. government facility with no permanent residents. The Site is located approximately 25 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina.

SRS is owned by the Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided nuclear materials for the space program and for medical, industrial, and research efforts. Chemical and radioactive wastes are by-products of nuclear material production processes.

The Federal Facility Agreement (FFA) for SRS lists the M-Area West unit (631-21G) as a Resource, Conservation and Recovery Act (RCRA) / Comprehensive Environmental Response Compensation and Liability Act (CERCLA) unit that required further evaluation. An investigation/assessment process that integrates and combines the RCRA Facility Investigation (RFI) with the CERCLA Remedial Investigation (RI) to determine the actual or potential impact to human health and the environment was performed.

The M-Area West unit (631-210) is located west of the M-Area Production Facility on a dirt road approximately 1.8 kilometers (1.1 miles) north of Silverton Road (Figure 2). There are no structures of any type located at or near M-Area West. The only nearby man-made feature is a dirt access road located about 9.2 to 12.2 meters (30 to 40 feet) west of the waste areas. The topography of the unit is relatively flat with an elevation of approximately 106.7 meters (350 feet) above mean sea level (msl). The nearest surface water body is approximately 304.9 meters (1000 feet) away. The unit soils were identified as Orangeburg loamy sand (a well drained, highly acidic soil).

The unit consists of two small areas (Figure 3). The southern debris area covers 6.1 meters x 6.1 meters (20 feet x 20 feet) and the northern debris area (located 67.1 meters [220 feet] to the north of the southern area) covers 3.05 meters x 3.05 meters (10 feet x 10 feet). Several drums and other small innocuous debris were found on the land surface adjacent to a dirt road approximately 1 kilometer (3300 feet) west of the M-Area production facility. The total waste at the unit consisted of six empty 55-gallon drums, four 1-gallon cans and a 1-gallon glass jar. The cans and the jar were originally contained in one of the larger drums. With the exception of a crushed drum and small amounts of metal debris, all other materials were removed from the site in 1992 with concurrence from the EPA and SCDHEC. The remaining crushed drum and debris will be removed from the unit as a maintenance action.

II. Operable Unit History and Compliance History

Operable Unit History

There is no documented information available regarding past hazardous or non-hazardous waste disposal activities at M-Area West. Markings on the drums found at the unit suggest that they once contained oil and solvents, and that they are approximately 37 years old. There is no evidence that any recent disposal activity has occurred or that the disposal activity was more widespread. Also, there is no evidence of any burning or excavation at this waste unit.

Compliance History

At SRS, waste materials are managed which are regulated under the Resource Conservation and Recovery Act (RCRA). Certain SRS activities have required Federal operating or post-closure permits under RCRA. SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control (SCDHEC) on September 30, 1987. Part V of the permit mandates that SRS establish and implement a RCRA Facility Investigation (RFI) Program to fulfill, the requirements specified in Section 3004(u) of the Federal permit.

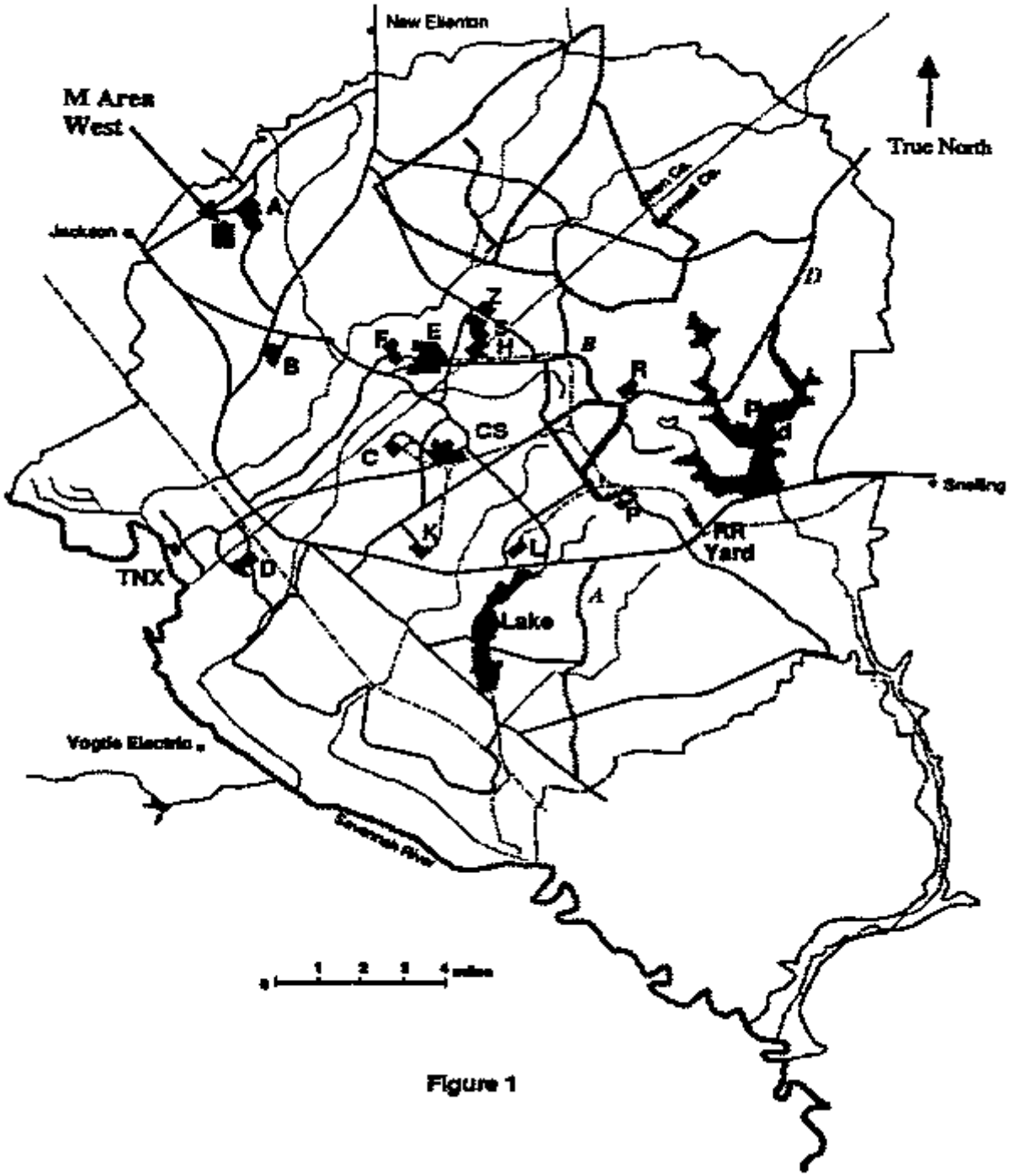

Figure 1. Location of the M-Area West waste unit at the Savannah River Site.

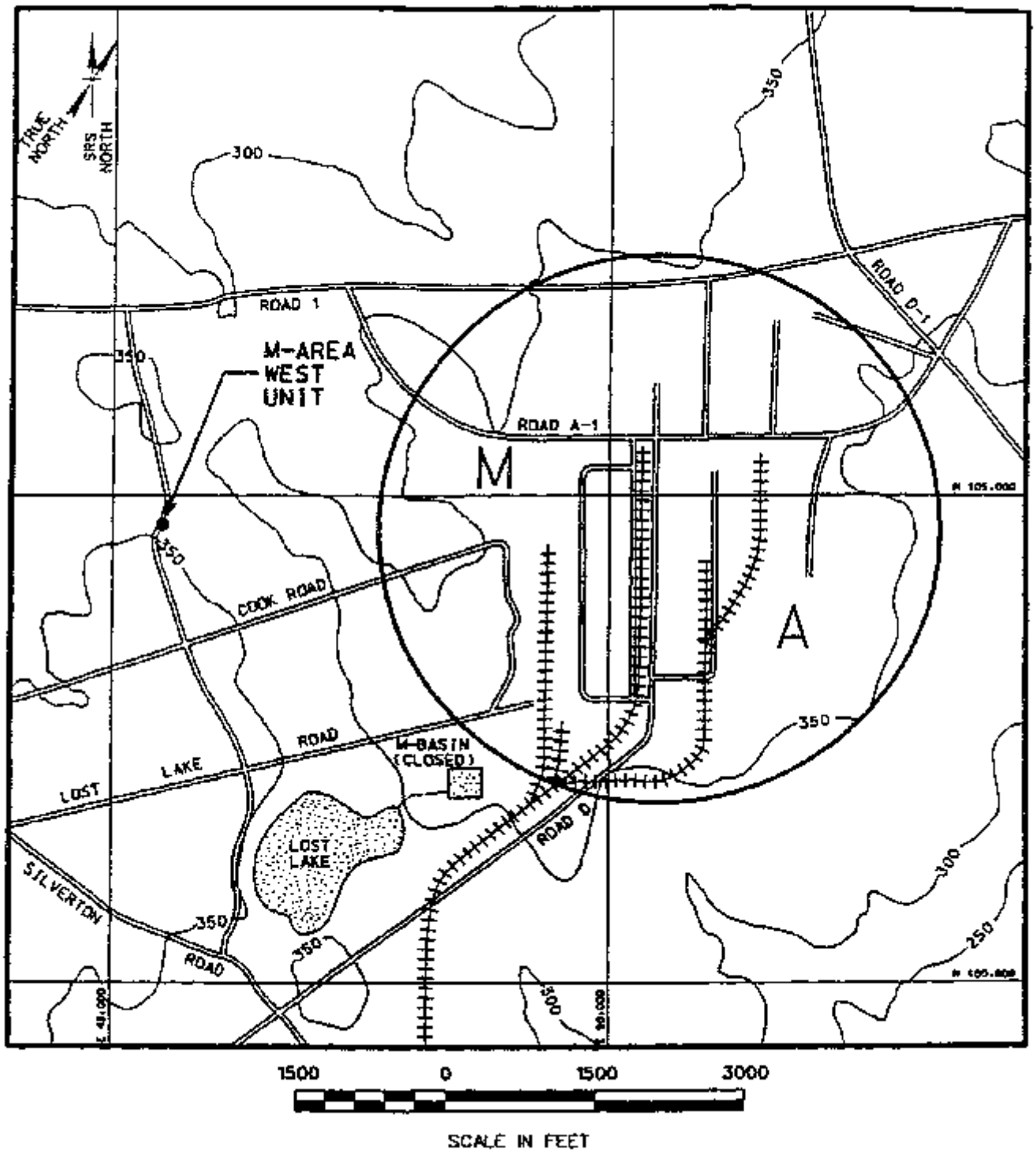

Figure 2. Location of M-Area West M Area.

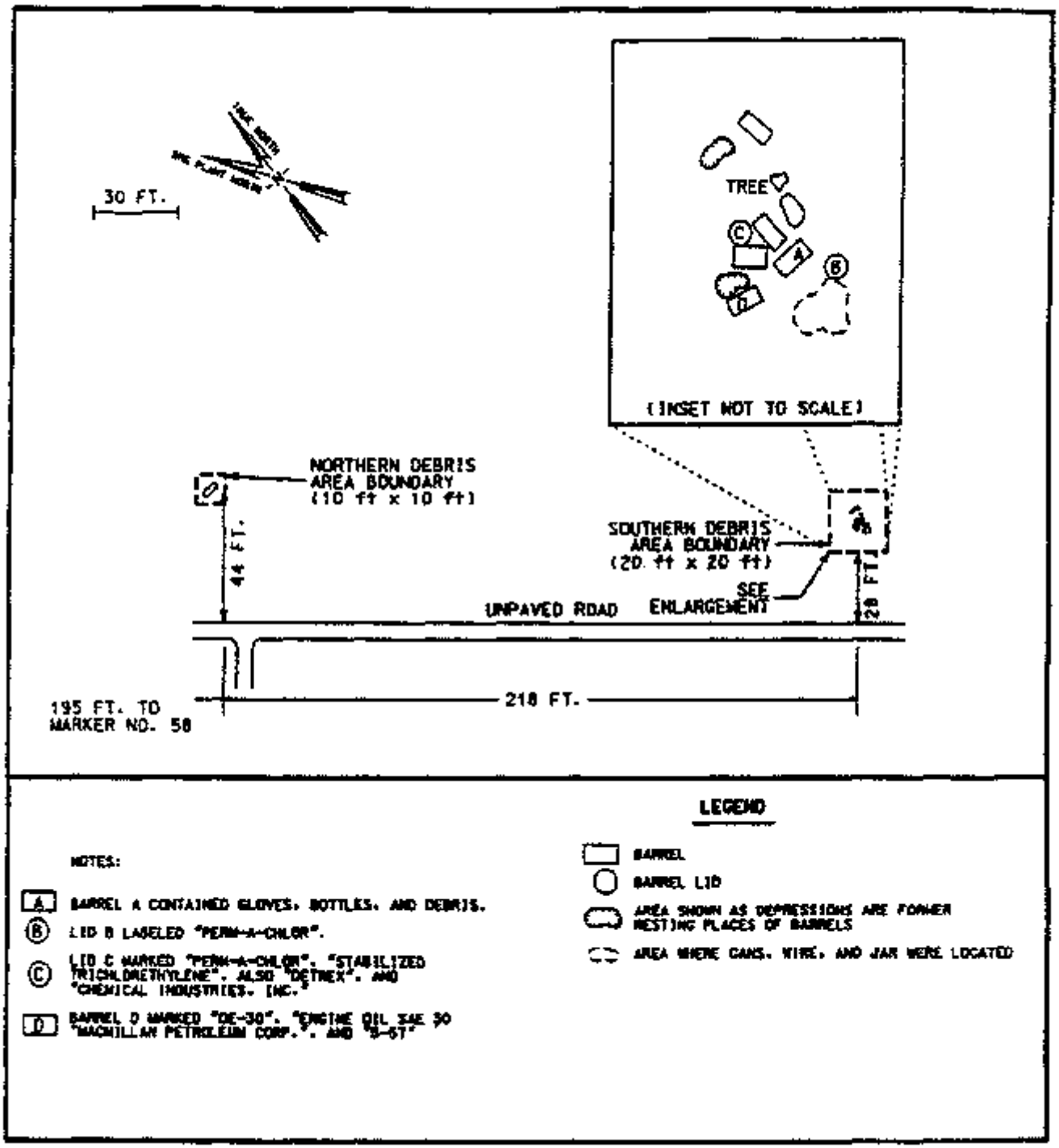

Figure 3. General configuration of the M-Area West unit.

Hazardous substances, as defined by CERCLA, are also present in the environment at SRS. On December 21, 1989, SRS was placed on the National Priorities List (NPL). A site placed on the NPL comes under the jurisdiction of CERCLA. In accordance with Section 120 of CERCLA, DOE has negotiated a FFA with the U.S. Environmental Protection Agency (EPA) and SCDHEC to coordinate cleanup activities at SRS into one comprehensive strategy that fulfills RCRA Section 3004(u) and CERCLA assessment, investigation and response action requirements.

The remedial investigation for M-Area West was completed in 1994. The results of the investigation indicate that the M-Area West unit poses no current or future risk to human health or the environment. Therefore, no action is warranted at the M-Area West unit. No other alternatives were considered. This is a final CERCLA action.

According to EPA guidance, if there is no current or potential threat to human health and the environment and no action is warranted, the CERCLA 121 requirements are not triggered. This means that there is no need to evaluate other alternatives or the no action alternative against the nine criteria specified under CERCLA.

Public participation requirements are listed in Sections 113 and 117 of CERCLA. These requirements include the establishment of an Administrative Record File that documents the selection of remedial alternatives and allows for review and comment by the public regarding those alternatives. The Administrative Record File must be established "at or near the facility at issue." The SRS Public Involvement Plan (DOE, 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives.

A proposed plan (PP) was submitted that fulfills the requirements of CERCLA Section 117(a) by providing the public an opportunity to participate in the selection of a remedial action. The PP presented the preferred alternative and the rationale for selecting the alternative. DOE, in consultation with EPA - Region IV and SCDHEC, selected the final action for M-Area West unit following the public comment period.

III. Highlights of Community Participation

Public participation requirements are listed in Sections 113 and 117 of CERCLA. These requirements include the establishment of an Administrative Record File that documents the investigation and selection of the remedy for addressing M-Area West. The SRS public involvement plan (DOE, 1994) is designed to facilitate public involvement in the decision-making processes for permitting, closure, and the selection of remedial alternatives. The SRS public involvement plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act (NEPA). Section 117(A) of CERCLA, as amended, requires the preparation of a proposed plan as part of the site remedial process. The Proposed Plan for the M-Area West Unit (PP) (WSRC, 1995), which is part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing of the M-Area West unit.

The Administrative Record File, which contains the information pertaining to the selection of the response action, was made available at the EPA-Region office and at the following locations:

U.S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

Similar information was made available through the following repositories:

Reese Library
Augusta College
2500 Walton Way

Augusta, Georgia 30910
(404) 737-1744

Asa R Gordon Library
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The public was notified of the comment period for the PP through mailings of the *S R S Environmental Bulletin*, a newsletter sent to more than 1400 citizens in South Carolina and Georgia, and through notices in local newspapers including the *Aiken Standard, The State,* and the *Augusta Chronicle*.

The public comment period began on July 19, 1995 and ended on August 18, 1995. Comments received are addressed in the Responsiveness Summary (Appendix A).

IV. Scope and Role of Operable Unit within the Site Strategy

The overall strategy for addressing the M-Area West unit was to: (1) characterize the waste unit delineating the nature and extent of contamination and identifying the media of concern (perform the RFI/RI); (2) perform a baseline risk assessment to evaluate media of concern, chemicals of concern, exposure pathways and characterize potential risks; and (3) evaluate and perform a final action to remediate, as needed, the identified media(s) of concern.

The investigation and risk assessment have been completed for the M-Area West unit. Since the results of the investigation indicate that M-Area West poses no risk to human health or the environment, no action was recommend.

The M-Area West unit is part of a larger integrator Operable Unit (IOU) consisting of several surface units and the A/M Area Groundwater unit. Since it has been determined that the M-Area West unit does not contribute contamination to the area groundwater or surrounding soils, it has no impact to the larger IOU and will not be addressed as part of the overall strategy for the IOU. The proposed action for M-Area West unit is a final action.

V. Summary of Operable Unit Characteristics

There is no documented information available regarding past hazardous or non-hazardous waste disposal activities at M-Area West. Markings on the drums found at the unit suggest that they once contained oil and solvents, and that they are approximately 37 years old. There is no evidence that any recent disposal activity has occurred or that the disposal activity was more widespread. Also, there is no evidence of any burning or excavation at this waste unit.

Preliminary Investigation / Unit Screening

A preliminary soil gas survey was conducted in March 1988 and a unit screening consisting of four soil borings was completed in November 1989. The unit characterization which consisted of an extensive soil gas survey was performed in July 1993. Confirmatory soil sampling was performed in January 1994.

The preliminary soil gas survey, 1988, was conducted to determine if hazardous substances had been managed at the unit. Sample analyses showed extremely low concentrations [< 4.2 ng/g] of trans-1,2-dichloroethylene (a chlorinated solvent daughter compound). This was the only constituent detected suggesting that if solvent was disposed of at the unit or had been present in the drums, the quantity was either extremely low or that the concentrations measured represent residual contamination remaining after years of volatilization to the atmosphere. The presence of low levels of volatile organic compounds in the soil gas survey suggested the presence of some minimal residual contamination for which additional investigations were performed.

In 1989 a unit screening consisting of sample collection from four borings was completed. Each soil boring was drilled to an approximate depth of 6.1m (20 feet) below ground surface. Sampling intervals were selected to (1) provide a sufficient screening to assess whether a release had occurred and, if so, what compounds are present, and (2) provide a sufficient representation of the shallow

subsurface conditions at the site. One shallow soil boring was located intermediate to and across the road from the two areas of the unit to assess background soil characteristics.
The samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds, radionuclide indicators, total metals, soil pH, TOC, and CEC.

Trace levels of VOCs and semi-volatiles were detected.

RFI/RI Characterization

In July 1993, an extensive soil gas survey for shallow and deep soil gas analysis was performed. Ninety-six locations were sampled.

The surveys investigated the presence and distribution of the C1-C4 hydrocarbons, the C5-C10 gasoline range normal paraffins, the C11-C18 diesel range hydrocarbons, the aromatic hydrocarbons [benzene, toluene, ethylbenzene, xylene (BTEX)], and selected chlorinated hydrocarbons (such as vinyl chloride, methylene chloride, trans-1,2 dichloroethylene, chloroform, and carbon tetrachloride).

Levels of chlorinated hydrocarbons and diesel range hydrocarbons (C11-C18) were below detection levels. Levels of light hydrocarbons were mostly below detection with values above detection levels being consistent with background sample levels across the unit. Levels of octane (< 1.3 ppm) and o-xylene (< 5.5 ppm) were thought to be related to natural products such as pine resin from the pine trees at the unit. A low level anomaly of toluene (0.143 ppm), ethyl benzene (0.113 ppm), and propane (1.4 ppm) was found in a sample adjacent to the road. The source of these compounds was not certain; however, it is suspected that hydrocarbon fluid may have leaked from the tractor involved in the soil gas survey or brush cutting operations that was parked overnight at the unit. A detailed summary of the soil gas survey report is included in the Phase II RFI/RI Plan (WSRC, 1993).

A Ground Penetrating Radar (GPR) survey was conducted at the unit on July 21, 1993. Soil sampling was performed on August 16, 1993 to determine if any anomalies detected by the GPR were buried materials. A summary of the geophysical data and the GPR survey report are included in the Phase II RFI/RI Plan (WSRC, 1993). Based on a review of the GPR data, there are no obvious pits, trenches, or areas of disturbed soil within the grid utilized.

A magnetometer survey was also conducted at M-Area West in June of 1993. Standard magnetic surveying techniques were followed. No additional surface debris, buried debris, trenches or other objects are evident from the data provided by the magnetometer survey.

Based on the results of the unit screening activities and combined with the detection of low level semivolatiles in soil borings, additional soil sampling activities were recommended to sufficiently characterize this unit.

A confirmatory soil assessment sampling plan was designed for M-Area West to further assess the horizontal extent and vertical migration of any hazardous constituents at the unit. Additional purposes of the soil assessment included the generation of sufficient data for risk assessment, corrective measures alternatives assessment, and remedial action, if required. Locations for soil samples were based on potential migration pathways and sampling results from preliminary studies. Relevant background samples were specified for comparison.

Surface water/sediment sampling was not conducted because the nearest surface water body is approximately 304.9 meters (1000 feet) away and disposal activities at the unit were not extensive and would not have an impact on surface water. Groundwater sampling was not conducted because of the low level of contaminants and the depth to groundwater (approximately 39 m).

Seven soil borings were drilled at the unit during the soil assessment phase. Three samples were collected from each borehole; one surface sample and two subsurface samples. Three boring were located within the larger of the two debris grew and one was located in the

smaller (northern) area. The remaining three soil borings were located outside the unit to provide background data.

All samples were analyzed in accordance with EPA-approved protocols. The detailed analytical results am contained in the Quality Control Summary Report for the M-Area West Unit RFI/RI Unit Assessment Report, (Appendix B of RFI/RI report WSRC 1994). Validation and verification of the analytical data were performed as part of the RFI/RI data review process; therefore, the data were considered acceptable for this evaluation.

Data from the 0.3-0.9 m (1.0-3.0 feet) interval were used to evaluate surface soil for the risk assessment. Data from the 1.2-1.8 m and 2.4-3.0 m (4.0-6.0 and 8.0-10.0 feet) depth intervals were evaluated to determine if there is potential for contribution of contamination to the groundwater.

The concentration level of the analytes, with the exception of arsenic, at different intervals was very low and insignificant in terms of having an effect on human health and the environment. The concentration level of arsenic at different depth intervals ranged from 2.9 to 9.3 mg/kg with a mean value of 5.6 mg/kg while the background concentrations ranged from 2.2 to 10 mg/kg with a mean value of 4.8 mg/kg. Arsenic was only detected once in the 1.0 - 3.0 ft. interval. The level detected was 2.1 mg/kg (which was a J value or estimated value). No arsenic was detected in the 1.0 - 3.0 ft. background sample. Both the site specific samples and the background arsenic concentrations are of the same order of magnitude and are consistent with SRS arsenic levels.

VI. Summary of Operable Unit Risks

Human Health Risks

As part of the RI/FS process for M-Area West, a risk assessment was performed using the data generated during the assessment phase. Detailed information regarding the development of chemicals of potential concern, the fate and transport of contaminants and the risk assessment can be found in the RFI/RI Report for M-Area, West (631-21G), December 1994.

After assembling the analytical data and eliminating those analytes not detected in any samples, the chemicals of potential concern (COPCs) were selected based on criteria specified in EPA risk assessment guidance.

As a result of comparing the unit sample concentrations background concentrations, four constituents (arsenic, manganese, xylene, cyanide) wore found to be above unit background and nine were detected in the unit specific samples but were not detected in the background samples. These analytes were further screened in the process.

The remaining analytes were identified following the methods and rationale described by EPA risk assessment guidelines. Table 1 lists the potential contaminants following the data screening.

The Risk-Based Concentrations (RBCs) were developed using protective default exposure scenarios suggested by EPA and the best available reference doses and carcinogenic potency slopes, and represent protective environmental concentrations at which EPA would typically not take action. The table contains levels of nearly 600 contaminants in air, drinking water, fish tissue, and soil, which correspond to a systemic hazard quotient of 1.0 or a lifetime cancer risk of one in one million (1.0×10^{-06}).

The EPA developed guidance is intended to identify and to focus on dominant chemicals of potential concern and exposure mutes at the earliest feasible point in the baseline risk assessment. The use of these methods, selecting exposure routes and contaminants of concern by RBCs, assist in focusing the assessment on the significant contaminants.

For the remaining analytes in Table 1, the risk-based concentration screen was used to further reduce the list. The RBC values as shown in Table 2 were taken from the EPA Region III Risk-Based Concentration table dated March 7, 1995. Sample concentrations detected were compared to the RBCs and screened out as COPCs if they were below the RBC levels.

As a result of comparing the constituents to the

risk-based concentration values, only arsenic exceeded a risk of one in one million ($1.0 X 10^{-06}$) but was less than one in one hundred thousand ($1.0 x 10^{-05}$) and remained as a COPC. Arsenic was detected only once in the site specific samples and was not detected in any of the background samples in the 1.0-3.0 feet interval.

Sources of contamination, releases, fate and transport mechanisms, exposure points, and routes were integrated in order to the complete exposure pathways that exist at the unit. If any of these elements were missing, the pathway was incomplete and not considered in the baseline risk assessment (BRA) for M-Area West.

Cancer risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of pathway-specific exposure to carcinogenic contaminants. The risk to an individual resulting from exposure to non-radioactive chemical carcinogens is expressed as the increased probability of a cancer occurring over the course of a 70 year lifetime. Cancer risks are related to the EPA target range of $1 x 10^{-04}$ to $1.0 x 10^{-06}$ for incremental cancer risk at NPL sites. Risk levels at or above $1 x 10^{-04}$ are generally considered significant. In order to account for simultaneous, exposure to multiple carcinogens through a given pathway, the risks calculated for each individual carcinogen in that medium were summed to obtain an estimate of the total cancer risk for the pathway.

Non-carcinogenic effects were evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a reference dose (RfD) derived for a similar exposure period. To evaluate the non-carcinogenic effects of exposure to soil contaminants, the hazard quotient, HQ (the ratio of the exposure dose to the RfD) is calculated for each contaminant. The non-carcinogenic HQ assumes that below a given level of exposure (i.e., the RfD), even sensitive populations are unlikely to experience adverse health effects. If the exposure level exceeds this threshold (1.0) there may be concern for potential noncarcinogenic health effects.

HQs are summed for each exposure pathway to create a pathway specific hazard index (HI) for each exposure scenario. T'he more the Hazard Index exceeds unity, the greater the concern that adverse health effects will occur. The hazard quotient is not a percentage or probability.

The maximum concentration value was used as the exposure point concentration.

Current Land Use

Under the current land use scenario, there was no determination of carcinogenic risks and noncarcinogenic hazards because no worker activity occurs in the area

Future Land Use

Under the future land use scenario, carcinogenic risks and non-carcinogenic hazards associated with non-radioactive COCs were calculated for exposure of the future on-unit resident (adult and child) to surface soils and air.

Total cancer risk at M-Area West is $9.8 x 10^{-06}$. Table 3 shows the individual results for the future resident scenario.

Non-carcinogenic Hazard

HIs for the soil pathways were calculated for adulthood and childhood exposures combined and for childhood exposure only. All of the exposure pathways for the on-unit resident have HIs less than one.

Table 1. Analytes Remaining After Comparison to Background - 1.0 - 3.0 Feet Only.

		Sample Number				
Analyte	**Unit**	**05-01**	**06-01**	**07-01**	**08-01**	**09-01A**
Arsenic	mg/kg	U	U	ND	J 2.1	ND
Manganese	mg/kg	J 42	J 180	ND	J 2.6	ND
Chloromethane	mg/kg	U	J 0.071	U	U	U
Ethylbenzene	mg/kg	J 0.072	U	U	U	U
Xylene	mg/kg	J 0.69	U	U	J 0.14	U
Cyanide	mg/kg	J 170	J 190	ND	J 2,500	ND
Benzoic acid	mg/kg	U	640	U	U	U
2-Hexanone	mg/kg	U	J 0.25	U	U	U
Acetone	mg/kg	U	U	U	J 8.9	J 3.9
Carbon Disulfide	mg/kg	J 0.47	U	ND	U	J 0.15
2-Chlorophenol	mg/kg	J 5.7	U	U	U	U
Dichloromethane	mg/kg	J 0.43	J 0.49	J 0.68	U	J 0.72
Toluene	mg/kg	J 0.14	U	U	U	U

U-The result qualifier is assigned to analytical results below the sample quantification limit
J-The result is an estimated value.
ND-No Data/Not Applicable

Table 2. Estimated Risk-Based Concentrations - Hypothetical Future Resident Adult and Child

	Carcinogenic Risk Hazard Index				
Contaminant	**1.0×10^{-06}**	**1.0×10^{-05}**	**1.0×10^{-04}**	**0.1**	**1.0**
Arsenic(mg/kg)	0.37	3.7	37	ND	ND
Manganese(mg/kg)	ND	ND	ND	1095	10.950
Chloromethane(mg/kg)	49,000	490,000	4,900,000	ND	ND
Ethylbenzene(mg/kg)	ND	ND	ND	780,000	7,800,000
Xylene(mg/kg)	ND	ND	ND	16,000,000	160,000,000
Cyanide(mg/kg)	ND	ND	ND	160,000	1,600,000
Benzoic acid(mg/kg)	ND	ND	ND	31,000,000	310,000,000
2-Hexanone(mg/kg)	ND	ND	ND	ND	ND
Acetone(mg/kg)	ND	ND	ND	780,000	7,800,000
Carbon Disulfide(mg/kg)	ND	ND	ND	780,000	7,800,000
2-Chlorophenol(mg/kg)	ND	ND	ND	39,000	390,000
Dichloromethane(mg/kg)	85,000	850,000	8,500,000	ND	ND
Toluene(mg/kg)	ND	ND	ND	1,600,000	16,000,000

ND - No Data/Not Applicable

Table 3. Summary of risk assessment results for arsenic.

	Carcinogenic Risk		**Non-Carcinogenic (Hazard)**	
Pathway	Adult/Child	Child Only	Adult/Child	Child Only
Dermal Contact	2.5×10^{-08}	7.0×10^{-09}	2.7×10^{-04}	1.7×10^{-04}
Ingestion	5.8×10^{-06}	4.0×10^{-06}	1.0×10^{-01}	9.0×10^{-02}
Inhalation	4.0×10^{-06}	2.6×10^{-06}	.36	0.02
Total	9.8×10^{-06}	6.6×10^{-06}	5.0×10^{-01}	1.0×10^{-01}

Ecological Risks

The ecological information base for M-Area West consists of a unit-specific threatened, endangered and sensitive species survey and a unit-specific ecological reconnaissance. Review of this information can be summarized as follows:

- The unit occurs within a 40 year old loblolly pine plantation and there is no obvious evidence of vegetation stress or ecological impact related to the unit;

- There are no threatened or endangered species known to exist at or in the vicinity of the unit;

- Review of the unit characterization data indicates that there are no constituents in the physical media analyzed at M-Area West which are significantly different from the unit specific background condition.

Based on the physical and analytical data obtained for this unit, there is no compelling evidence that waste materials were managed or disposed at the M-Area West operable unit. Therefore, it is reasonable to conclude that the unit as it is currently characterized, presents no ecological risk.

VII. Description of the No Action Alternative

According to the EPA guidance document *Guidance on Preparing Superfund Decision Documents,* (EPA, 1989) if there is no current or potential threat to human health and the environment and no action is warranted, the CERCLA 121 requirements are not triggered. This means that there is no need to evaluate other alternatives or the no action alternative against the nine criteria specified under CERCLA.

Under the No Action alternative, no treatment will be performed because there is no waste to treat. No new institutional controls or engineering controls will be implemented and there is no cost associated with implementing the alternative. According to CERCLA regulations, Section 121, if no action is the preferred action, then no ARARs apply to the waste unit.

Since M-Area poses no risk and the no action alternative is warranted, it does satisfy the CERCLA criteria. The no action alternative is intended to be the final action for M-Area West. This solution is meant to be permanent and effective in both the long and short term. The no further action decision is the least cost option with no capital, operating, or monitoring cost and is protective of human health and the environment.

VIII. Explanation of Significant Changes

No significant changes were made ot the Record of Decision based on the public comment period for the proposed plan. Only one public comment was received and had no impact on the no action preferred alternative.

IX. References

DOE (U.S. Department of Energy), 1994. *Public Involvement, A Plan for the Savannah River Site*. Savannah River Operations Office, Aiken, South Carolina.

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EPA (U.S. Environmental Protection Agency), 1991 *Guide to Developing Superfund No Action, Interim Action and Contingency Remedy RODs* Office of Solid Waste and Emergency Response - 9355.3-02FS-3.

FFA, 1993. *Federal Facility Agreement for the Savannah River Site,* Administrative Docket Number 89-05-FF (effective date: August 16, 1993).

WSRC (Westinghouse Savannah River Company), *Phase II RFI/RI Plan for M-Area West Unit,* WSRC-RP-90-995, Rev. 2, Westinghouse Savannah River Company, Aiken, SC. (1993).

WSRC (Westinghouse Savannah River Company), *RFI/RI Report for M-Area West Unit (631-21G) (U),* WSRC-RP-94946, Rev. 1, Westinghouse Savannah River Company, Aiken, SC. (1995; includes baseline risk assessment).

WSRC (Westinghouse Savannah River Company). *Proposed Plan for the M-Area West Unit (631-21G) (U),* WSRC-RP-95469, Rev. 1, Westinghouse Savannah River Company, Aiken, SC.

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 06/18/1996
Operable Unit: 32
ROD ID: EPA/ROD/R04-96/268

Media: soil, groundwater

Contaminant: Arsenic

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The Savannah River, Burma Road Rubble Pit Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. It is a secured government facility with no permanent residents. SRS is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina.

SRS is owned by the U.S. Department of Energy (DOE). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided nuclear materials for the space program and for medical, industrial, and research efforts. Chemical and radioactive wastes are by-products of nuclear material production processes.

The Burma Road Rubble Pit (BRRP) is located approximately one-half mile southwest of F-Area Separations Facility and one-tenth mile southwest of C Road. The BRRP is between Upper Three Runs Creek (approximately 4,000 feet to the northwest) and Four Mile

Creek (approximately one mile to the southwest). A westward trending tributary to the Upper Three Runs Creek is located approximately 2,000 feet to the north. The BRRP ground surface elevation is approximately 290 feet mean sea level. Surface runoff is northwestward toward the tributary.

The BRRP consists of two unlined earthen pits dug into surficial soil and filled with various waste materials. The BRRP area consists of two rectangular pits, each about 400 feet long, up to about 50 feet wide, and 10 feet deep. A small circular area of disturbed soil was detected adjacent to these pits and is considered to have been used as a source of backfill for the pits.

The BRRP was used from 1973 to 1983 for the disposal of dry inert rubble such as wood, trash, wire, bottles, plastic, rubble, foam, concrete, etc. The area is currently delineated by orange marker balls at the perimeter of the waste unit.

Investigations indicate that source soils pose minimal risk to human health or the environment. The only soil contamination found at the BRRP source unit was arsenic.

Since the arsenic concentration does not appear to be from the BRRP Operable Unit, the source of arsenic will be evaluated on a site-wide scale during the implementation of the Soil Background Study.

Groundwater contamination found beneath the BRRP is due to migration from upgradient sources such as the F-Area Inactive Process Sewer Lines and thus will not be addressed in this remedial action.

Remedy: The results of investigations indicate that the BRRP unit soils pose minimal risk to human health and the environment. Therefore, no action is needed for the BRRP unit soils. Only non-hazardous, inert material was placed at the BRRP source unit. A notation, identifying the presence of buried, inert debris, on the deed to the facility property will be placed in the Aiken County Records. This notation will include a survey plat, prepared and verified by a professional land surveyor. This is a final action for the BRRP unit soils.

Groundwater contamination beneath the BRRP is due to migration from upgradient sources and thus will not be addressed in this remedial action. Following an investigation on upgradient groundwater contaminant sources, a determination will be made as to what corrective action might be appropriate for the groundwater beneath the BRRP.

Text: Full-text ROD document follows on next page.

Text:

United States Department of Energy

Savannah River Site

Record of Decision
Remedial Alternative Selection
for the
Burma Road Rubble Pit (231-4F) (U)

WSRC-RP-96-101
Revision 1
April 1996

Westinghouse Savannall River Company
Savannah River Site
Aiken, South Carolina 29808

<IMG SRC 0496268>

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY UNDER CONTRACT DE-AC09SR18035

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DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

BURMA ROAD RUBBLE PIT UNIT (231-4F)

WSRC-RP-96-101
Revision 1
April 1996

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U.S. Department of Energy Under Contract DE-AC09-89SR18035
Savannah River Operations Office
Aiken, South Carolina

DECISION SUMMARY
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DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

Burma Road Rubble Pit unit (SRS Building Number 231-4F)
Savannah River Site
Aiken, South Carolina

The Burma Road Rubble Pit (BRRP) unit (231-4F) is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) solid waste management unit/Comprehensive Environmental Response, Compensation and Liability Act (CERLCA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site.

Statement of Basis and Purpose

This decision document presents the selected remedial action for the BRRP unit soils located at the SRS in Aiken, South Carolina. The selected action was developed in accordance with CERCLA, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this specific RCRA/CERCLA unit.

Description of the Selected Remedy

The results of the RCRA Facility Investigation/Remedial Investigation indicate that the BRRP unit soils pose minimal risk to human health and the environment. Therefore, no action is needed for the BRRP unit soils. Only non-hazardous, inert material (e.g., wood, trash, wire, bottles, plastic, rubble, foam, concrete, etc.) was placed at the BRRP source unit. A notation, identifying the presence of buried, inert debris, on the deed to the facility property will be placed in the Aiken County Records. This notation will include a survey plat, prepared and certified by a professional land surveyor, of the area. This is a final RCRA/CERCLA action for the BRRP unit soils.

Groundwater contamination beneath the BRRP is due to migration from upgradient sources and thus will not be addressed in this remedial action. Following an investigation on upgradient groundwater contaminant sources, a determination will be made as to what corrective action might be appropriate for the groundwater beneath the BRRP.

Declaration Statement

Based on the results of the remedial investigation, no action is necessary at the BRRP unit soils to ensure the protection of human health and the environment. Since the BRRP unit soils pose minimal risk to human health and the environment, and no action is needed, the CERCLA Section 121 requirements are not applicable. This action protective of human health and the environment and is meant to be a permanent solution final action, for the BRRP unit soils. Section 300.430(f)(4)(ii) of the NCP requires that a Five-Year Review of the Record of Decision be performed if hazardous substances, pollutants, or contaminants remain at the unit. The three Parties have determined that a Five-Year Review of the ROD for the BRRP unit soils will not be performed. The remedial action selected for this unit (No Action) results in no hazardous substances, pollutants, or contaminants remaining in the soils of the BRRP source unit.

<IMG SRC 0496268A>

Date

T.F. Heenan
Assistant Manager for Environmental Restoration and Solid Waste

U.S. Dept. of Energy, Savannah River Operations Office

Date

John H. Hankinson, Jr.
Regional Administrator
U.S. Environmental Protection Agency

Date

R. Lewis Shaw
Deputy Commissioner
Environmental Quality Control
South Carolina Department of Health and Environmental Control

I. Site and Operable Unit Name, Location, and Description

The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina (Figure 1). SRS is a secured U.S. Government facility with no permanent residents. SRS is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina.

SRS is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided nuclear materials for the space program and for medical, industrial, and research efforts. Chemical and radioactive wastes are by-products of nuclear material production processes.

The Federal Facility Agreement (FFA) lists the Burma Road Rubble Pit (BRRP) source unit (231-4F; Figure 2) as a Resource Conservation and Recovery Act (RCRA)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit that required further evaluation. An investigation/assessment process that integratesand combines the RCRA Facility Investigation (RFI) process with the CERCLA Remedial Investigation (RI)to

approximately 290 feet mean sea level. Surface runoff is northwestward toward the tributary. The soil type that exists at the BRRP consists of Udorthents.

The BRRP consists of two unlined earthen pits dug into surficial soil and filled with various waste materials. The BRRP was originally reported to be 485 feet long, 125 to 150 feet wide, and at least 10 feet deep. A GPR survey, conducted in September 1988, indicates that the BRRP area consists of two generally rectangular pits (GPR Zone 1 and GPR Zone 2, Figure 3), each about 400 feet long, up to 50 feet wide, and 10 feet deep. A small circular area (GPR Zone 3, Figure 3) of disturbed soil was detected adjacent to these pits and is considered to have been used as a source of backfill for the pits.

II. Operable Unit History and Compliance History

Operable Unit History

The BRRP was used from 1973 to 1983 for the disposal of dry inert rubble such as wood, trash, wire, bottles, plastic, rubble, foam, concrete, etc. No record' of hazardous substance disposal at the BRRP has been found. In 1983, disposal at the BRRP ceased and it was backfilled with soil. The area is currently delineated by orange marker balls at the perimeter of the waste unit.

Compliance History

determine the actual or potential impact to human health and the environment was performed.

The BRRP, 231-4F, is located approximately one-half mile southwest of F-Area Separations Facility and one-tenth mile southwest of C Road. The BRRP is between Upper Three Runs Creek (approximately 4000 feet to the northwest) and Four Mile Creek (approxitnately one mile to the southwest). A westward trending tributary to the Upper Three Runs Creek is located approximately 2,000 feet to the north. The BRRP ground surface elevation is

At SRS, waste materials are managed which are regulated under the RCRA. Certain SRS activities have required Federal operating or post-closure permits under RCRA. SRS received a RCRA hazardous waste permit from the South Carolina Department of Health and Environmental Control (SCDHEC) on Septrmber 30, 1987. Part V of the permit mandates that SRS establish and implement an RFI Program to fulfill the requirements specified in Section 3004(u) of the Federal permit.

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<IMG SRC 0496268D>

Hazardous substances, as defined by CERCLA, are also present in the environment at SRS. On December 21, 1989, the SRS was placed on the National listed Priorities List (NPL). A site placed on the NPL comes under the jurisdiction of CERCLA. In accordance with Section 120 of CERCLA, DOE has negotiated an FFA (FFA, 1993) with the U.S. Environmental Protection Agency (EPA) and SCDHEC to coordinate remedial activities at SRS into one comprehensive strategy which fulfills issue." these dual regulatory requirements.

public The BRRP RFI/RI investigation was conducted from November 1993 to February of 1994. The results of the RFI/RI indicate

corrective action migat be appropriate for the groundwater beneath the BRRP.

Public participation requirements are

in Sections 113 and 117 of CERCLA. These requirements include establishment of an Administrative Record File that documents the selection of remedial alternatives and allows for review and comment by the public regarding those alternatives. The Administrative Record File must be established "at or near the facility at

The SRS Public Involvement Plan (PIP) (DOE, 1994) is designed to facilitate

involvement in the decision-making process for permitting, closure, and the selection

remedial alternatives.

that the BRRP source unit soils pose minimal risk to human health or the environment. The only soil contamination found at the BRRP source unit was arsenic at a concentration of 1.74 mg/kg. This soil concentration led to a risk value of 1.9 x 10-6 for the future residential adult (i.e., there is a 1.9 in one million chance of developing cancer from the ingestion of arsenic) and a risk value of 2.8 x 10-6 for the future residential child (i.e., there is a 2.8 in one million chance of developing cancer from the ingestion of arsenic). Based on these risk values, no action is warranted at the BRRP source unit soils. No other alternatives were considered. This is a proposed final CERCLA action for the listed
BRRP source unit soils only.

an
Since the arsenic concentration does not appear to be from the BRRP Operable Unit, the source of the arsenic will be evaluated on a site-wide scale during the implementation of the Soil Background Study (or potentially the Site-wide Soil Integrator Operable Unit Workplan).

Groundwater contamination found beneath the BRRP is due to migration from upgradient sources such as the F-Area Inactive Process Sewer Lines and thus will not be addressed in this remedial action. Following all investigation on upgradient groundwater contaminant sources, a determination will bc made as to what

A Proposed Plan (PP) was submitted that fulfills the requirements of CERCLA Section 117(a) by providing the public an opportunity to participate in the selection of a remedial action. The PP presented the preferred alternative and the rationale for selecting the alternative. DOE, in consultation with EPA and SCDHEC selected the final action for the BRRP source unit soils following the public comment period.

III. Highlights of Community Participation

Public participation requirements are

in Sections 113 and 117 of CERCLA. These requirements include the establishment of

Administrative Record File that documents the investigation nd selection of the remedy for addressing the BRRP. The SRS PIP (DOE, 1994) is designed to facilitate public involvement n the decision-making processes for permitting, closure, and the selection of remedia alternatives. The SRS PIP addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act (NEPA. Section 117(a)of CERCLA, as amended, requires the preparation of a proposed plan as part of the site remedial process. The Proposed Plan for the Burma Road Rubble Pit (231-4F) (WSRC, 1995b), which is part of the Administrative Reccrd File, highlights key

aspects of the investigation and identifies Responsiveness
the preferred action for addressing the BRRP soils only.

The Administrative Record File, which contains the information pertaining to the selection of the response action, was made available at the EPA office and at the following locations:

received are addressed in the

Summary (Appendix A).

IV. Scope and Role of Operable Unit Within the Site Strategy

The overall strategy for addressing the BRRP source unit was to: (1) characterize the waste unit delineating the nature and

U.S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Library
University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

Similar information is available through the repositories listed below:

Reese Library
Augusta College
2500 Walton Way
Augusta, Georgia 30910
(706) 737-1744

Asa H. Gordon Library
Savannah State College
Tompkins Road
Savannah, Georgia 31404
(912) 356-2183

The public was notified of the comment period for the proposed plan through mailings of the SRS Environmental Bulletin, a newsletter sent to approximately 1400 citizens in South Carolina and Georgia, and through notices in local newspapers including the Aiken Standard, the Augusta Chronicle, the Allendale Citizen Leader, and the Barnwell People-Sentinel.

The public comment period for the Proposed Plan began on January 10, I996

extent of contamination and identifying the media of concern (perform the RFI/RI); (2) perform a baseline risk assessment to evaluate media of concern, chemicals of concern, exposure pathways, and characterize potential risks; and (3) evaluate and perform a final action to remediate, as needed, the identified media(s) of concern.

The investigation and risk assessment have been completed for the BRRP source unit. Since the results of the investigation indicate that the BRRP source unit soils pose minimal risk to human health or the environment, no action was recommended by the Proposed Plan for the Burma Road Rubble Pit (231-4F) (WSRC, 1995b). Only non-hazardous, inert material (e.g., wood, trash, wire, bottles, plastic, rubble, foam, concrete, etc.) was placed at the BRRP source unit. A notification, identifying the presence of buried, inert debris, will be placed in the Aiken County Records which will include a survey plat, prepared and certified by a professional land surveyor, of the area.

Although there is groundwater contamination beneath the BRRP, the groundwater contamination is due to migration from upgradient sources such as the F-Area Inactive Process Sewer Lines (Figure 2) and thus will not be addressed by this remedial action. The depth to the water table beneath the BRRP is 61 to 83 feet.

Figure 4 illustrates the regional groundwater flow direction in the vicinity of the BRRP, The map indicates west-northwestward flow of the shallow aquifer system groundwater in the BRRP area. Groundwater data from two nearby areas, the F-Area Seepage Basins and the F-Area Separations Facility which

and ended on February 8, 1996. Comments

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includes the Inactive Process Sewer Lines, suggest that these areas may have impacted the BRRP. The F-Area Separations Facility is located approximately 2,000 feet northeast of the BRRP. The F-Area Seepage Basins are located approximately 1,100 feet to the southeast of the BRRP.

was
Following an investigation on upgradient groundwater contaminant sources, a determination will be made as to what corrective action might be appropriate.

The BRRP is a source control operable unit (OU) located within the Upper Three Runs at
Watershed. Several source control and groundwater OUs, including the F- and H-Area Groundwater OU, within this watershed will be evaluated to determine impacts, if any, to associated streams and wetlands. It rod-
has been determined that the BRRP source container
control OU does not contribute contamination to the area groundwater or surrounding soils. The proposed action for the BRRP source unit soils is a final action.

V. Summary of Operable Unit Characteristics

and
The BRRP was used from 1973 to 1983 for the disposal of dry inert rubble such as metal, concrete, lumber, poles, light fixtures, and glass. No record of hazardous substances disposal at the BRRP has been found. In 1983, disposal at the BRRP ceased and it was gas
backfilled with soil. The area is currently delineated by orange marker balls at the Burma Road Rubble Pit (231-4F), (WSRC, 1995a).

Surface and subsurface soil samples were collected from seventeen locations within the BRRP in areas of suspected contamination (e.g., the soil borings were located in areas when a soil gas anomaly

detected or adj Lcent to potential underground object, and/or areas of high metal concentrations as indicated by anomalies in the GPR, electromagnetic (EM), or magnetometer surveys). These sampling depths provide a representation of soil conditions above the fill material and

the bottom layer below the fill material.

During the sampling, none of the soil borings encountered any containers (e.g., drums), liquid, sludge, or experienced a

drop that would indicate a drubs or

had been punctured. Only inert materials (e.g., wood, trash, wire, bottles, plastic, rubble, foam, concrete, etc.) were encountered during the soil sampling.

Four background subsurface soil samples and two background surface soil samples were collected to gather data for statistical

comparative analysis against samples collected in the areas suspected of containing hazardous material. The background soil samples were located in areas that were away from GPR Zones 1, 2, 3 (Figure 3) and were outside of the soil

anomalies. The background surface soil samples were located upgradient and at a

perimeter of the waste unit.

RFI/RI Characterization

The BRRP RFI/RI investigation was conducted from November 1993 to February 1994. Samples were collected to characterize the chemical concentrations in soil, groundwater, sediments, and surface water at the BRRP.

Sampling and investigation activities are summarized below. Detailed information regarding sampling/investigation activities can be found in the Final RFI/RI Report for

sufficient distance from the BRRP source unit so as to preclude any impact from the unit.

Background surface water samples were unavailable because there is no upgradient body of surface water within a reasonable distance of the waste unit from which to obtain unit-specific background samples.

All samples were analvzed in accordance with EPA-approved protocols. The detailed analytical results are contained in the Quality Control Summary Report for the Burma Read Rubble Pit RFI/RI Unit

Assessment (WSRC, 1994). Validation and verification of the analytical data were performed as part of the RFI/RI data review process; therefore, the data were considered concentrations,
acceptable for this evaluation.

Nine new groundwater monitoring wells were constituents
installed at varying depths in 3 three-well clusters. Of the 14 wells that exist at BRRP the
(new and existing), sixwells are considered to be upgradient wells. However, the entire BRRP is downgradient of the SRS F-Area Separations Facility and the entire BRRP through
well network may be impacted by groundwater migration from F-Area.

The BRRP RFI/RI investigation process concluded that source characterization has shown that historical documents are correct in stating that only inert material was disposed of at the BRRP; therefore, the the
BRRP is not expected to be a future source of contamination.

exposure
VI. Summary of Operable Unit Risks

The process of designating the constituents of potential concern (COPCs) was based on consideration of backgoround

frequency of detection, the relative toxic potential of the chemicals, and chemical nutrient status. COPCs are the

that are potentially site-related and whose data are of sufficient quality for use in

risk assessment. COPCs included volatile organic compounds, semi-volatile organic compounds, metals and other inorganic analytes, and radionuclides identified

approved site characterization activities.

An exposure assessment was performed to provide an indication of the potential exposures which could occur based on the chemical concentrations detected during sampling activities. The only existing (current) exposure scenario identified for

BRRP was for environmental researchers who may work or traverse the BRRP on an intermittent/limited basis. Future

scenarios identified for the BRRP included future environmental researchers as well as

The BRRP operable unit investigation addressed the rubble (potential source term), surrounding soils, and the groundwater under the facility. This section summarizes the be
baseline risk assessment information associated with the BRRP operable unit. It should be noted, however, that the remedial action proposed by this plan is for the BRRP soils only. The groundwater contamination will be addressed following an investigation result
on upgradient contaminant sources.

Human Health Risk Assessment

As part of the investigation/assessment process for the BRRP source unit, a risk assessment was performed using the data the
generated during the assessment phase. Detailed information regarding the development of contaminants of potential concern, the fate and transport of contaminants, and the risk assessment can be found in the Final RFI/RI Report for Burma Road Rubble Pit (231-4F), (WSRC, at
1995a).

conservative future esidential adult and child and an occupational worker.

Per EPA guidance, the carcinogenic (cancer) risks and non-carcinogenic hazards should

calculated to determine the appropriate remedial action for a waste unit.

Cancer risks are estimated as the incremental probabiity of an individual developing cancer over a lifetime as a

of pathway-specific exposure to carcinogenic contaminants. The risk to an individual resulting from exposure to non-radioactive chemical carcinogens is expressed as the increased probability of cancer occurring over the course of a 70 year lifetime. Cancer risks are related to

EPA target range of one in ten thousand (1.0x10-4) to one in one million (1.0x10-6) for incremental cancer risk at NPL sites. This means that one in ten thousand to one in one million people may develop cancer over a lifetime as result of exposure to cancer-causing contaminants. Risk levels

or above 1.0 x 0-4 are considered

significant. In order to account for simultaneous exposure to multiple carcinogens through a given pathway, the face,
risk calculated for each individual carcinogen in that medium were summed to obtain an estimate of the total cancer risk for the pathway.

Non-carcinogenic effects are evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a reference anticipated
dose (RID) derived for a similar exposure period. To evaluate the non-carcinogenic effects of exposure to soil contaminants, the week
hazard quotient (HQ), which is the ratio of

vicinity for a four hear work period. The person would wear clothing which covers all bodily areas with the exception of the

hands, and forearms.

Future Land Use Scenarios
Residential Scenario
The future residential adult receptor was assumed to reside on he BRRP for a long-term duration of 30 years and/or a short-term duration of 5 years. It was

that the adult residential person would engage in gardening/yard maintenance activities for a total of eight hours per

year-round (four two- our periods per week,

the exposure dose to the RfD, is calculated for each contaminant. The non-carcinogenic HQ assumes that below a given level of exposure (e.g., the RfD), even sensitive populations are unlikely to experience adverse health effects. If the exposure level exceeds the threshold there may be concern for potential non-carcinogenic health effects.

HQs are summed for each exposure pathway in
to create a pathway specific hazard index (HI) for eachexposure scenario. The more the HI exceeds unity (1.0), the greater the concern that adverse health effects will occur.

The reasonable maximum exposure concentration value was used as the exposure point concentration.

In order to determine the carcinogenic (cancer) and non-carcinogenic hazards the following general exposure assumptions were used in the baseline risk assessment:

Current Land Use Scenario
Soil
Environmental Researcher
The adult environmental researcher receptor was assumed to enter onto the BRRP unit on an intermittent basis. The adult was assumed to work in the BRRP area for 72 days per year (approximately one quarter of the year). Exposures were evaluated for a short- assumed
term and long-term scenario (over a half-year and a 25 year interval, respectively). It was also assumed that the person would short-
remain at the BRRP unit or in the BRRP

It

350 days/year, assuming approximately two weeks spent away from the residence per year). During such activities, the person would wear clothing which covers all bodily areas with the exception of the face, arms, hands, and lower legs.

The future residential child receptor was assumed to reside on the BRRP between the ages of two through even years. The child was assumed to live in a house constructed

close proximity to the BRRP. The child would engage in outdoor activities 350 days/year (assuming approximately two weeks spent away from the residence per year). The average rate for time spent outdoors would encompass periods when exposures may be more or less frequent, as well as times when adverse weather would prohibit outdoor activity. It was assumed that the young child would remain outdoors for a four hour perior

Occupational Worker
The primary receptor examined under the future commercial use scenario was an on-site adult worker aged 18 years or older.

exposure could occur during normal day-to-day activities for an on-site worker.

Environmental Researcher
The adult environmental researcher receptor was assumed to enter onto the BRRP unit on an intermittent basis. The adult was

to work in the BRRP area for 72 days per year (approximately one quarter of the year). Exposures were evaluated for a

term and long-term scenario (over a half-year and a 25 year interval, respectively).

was also assumed that the person would remain at the BRRP unit or in the BRRP vicinity for a four hour work period. The person would wear clothing which covers all

dermal contact with soil (based on exposure to the face, arms, hands, and lower legs),
inhalation of chemicals in ambient

bodily areas with the exception of the face, hands, and forearms.

Current Land Use - Noncarcinogenic Hazard Indices

Table 1 provides a summary of the noncarcinogenic hazard indices and 1.9 applicable constituents of concern (COCs) million associated with the current land use scenario for the BRRP unit soils.

The total noncarcinogenic (noncancer) hazard index did not exceed unity for the (i.e., environmental researcher receptor evaluated in the current land use scenario. This indicates that potential adverse health with effects are not likely to occur for the current environmental researcher.

Current Land Use - Carcinogenic Risks

scenario
Table 2 provides a summary of the carcinogenic risks and applicable COCs associated with the current land use scenario for the BRRP unit soils.

Under the current land use scenario, the total carcinogenic (cancer) risk (for chemicals and radionuclides) did not exceed a level of 1.0 x 10-6 for the environmental researcher which indicates that carcinogenic risk from the unit soils is not significant.

Future Land Use - Noncarcinogenic Hazard Indices

Table 3 provides a summary of the noncarcinogenic hazard indices and applicable COCs associated with the future land use scenario for the BRRP unit soils.

The HIs were all less than one, indicating that adverse noncarcinogenic effects are unlikely for the following pathways:

incidental ingestion of soil,
air, and
ingestion of homegrown produce.

Future Land Use - Caarcinogenic Risks

For the future residential adult, the only estimated risk from the unit soils was the ingestion of arsenic with a risk value of

x 10-6, (i.e., there is a 1.9 in one

chance of developing cancer from the ingestion of arsenic). And, for the future residential child, the only estimated risk from the unit soils was the ingestion of arsenic with a risk value of 2.8 x 10-6

there is a 2.8 in one million chance of developing cancer from the ingestion of arsenic). The arsenic level associated

both risks was 1.74 mg/kg.

Table 4 provides a summary of the carcinogenic risks and applicable COCs associated with the future land use

for the BRRP unit sois.

Ecological Risk Assessment

An ecological risk assessment was conducted to assess the potential impacts to biota caused by exposure to chemicals and radionuclides at the BRRP.

A site ecological reconnaissance was conducted in August 1994. No wetlands or threatened and endangered (T&E) species were observed in the vicinity of the BRRP, and use of the site by T&E species was not expected. The potential media of contaminant exposure were surface soil, sediment, and surface water at or near the BRRP.

Based on the ecological risk assessment, ecological impacts from the BRRP source unit are unlikely.

Table 1 - Current Land Use - Noncarcinogenic Hazard Index

RECEPTOR	EXPOSURE TO CHEMICALS (HAZARD INDEX)				
	Soil - Ingestion	Soil - Dermal	Soil - Inhalation	Total (Soils Only)	COCs
Environmental Researcher - ST & LT	0.041	0.024	0.0000034	0.065	NA

Table 2 - Current Land Use - Carcinogenic Risks

RECEPTOR	EXPOSURE TO CHEMICALS				
	Soil - Ingestion	Soil - Dermal	Soil - Inhalation	Total (Soils Only)	COCs
Environmental Researcher- ST	3.2 x 10-9	3.4 x 10-10	2.6 x 10-11	3.6 x 10-9	NA
Environmental Researcher- LT	1.6 x 10-7	1.7 x 10-8	1.3 x 10-9	1.8 x 10-7	NA

RECEPTOR	EXPOSURE TO RADIONUCLIDES				
	Soil - Ingestion	Soil - Dermal	Soil - Inhalation	Total (Soils Only)	COCs
Environmental Researcher- ST	5.3 x 10-12	1.9 x 10-8	1.6 x 10-15	1.9 x 10-8	NA
Environmental Researcher- LT	1.5 x 10-10	7.1 x 10-8	1.2 x 10-14	7.1 x 10-7	NA

Table 3 - Future Land Use - Noncarcinogenic Hazard Index

RECEPTOR	EXPOSURE TO CHEMICALS (HAZARD INDEX)				
	Soil - Ingestion	Soil - Dermal	Soil - Inhalation	Produce - Ingestion	Total (Soils Only)
Environmental Researcher - ST & LT	0.041	0.024	0.0000034	NA	0.065
Residential Adult- ST & LT	0.026	0.029	0.0000027	0.00013	0.055
Residential Child - ST	0.23	0.11	0.000013	0.00030	0.34
Occupational Worker- ST & LT	0.14	0.083	0.000024	NA	0.22

COCs - Constituents of Concern ST - Short Term
LT - Long Term NA - Not Applicable

Table 4 - Future Land Use -Carcinogenic Risks

RECEPTOR	EXPOSURE TO CHEMICALS					
	Soil - Ingestion	Soil - Dermal	Soil - Inhalation	Produce - Ingestion	Total (Soils Only)	COCs
Environmental Researcher - ST	3.2 x 10-9	3.4 x 10-10	2.6 x 10-11	NA	3.6 x 10-9	NA
Environmental Researcher - LT	1.6 x 10-7	1.7 x 10-8	1.3 x 10-9	NA	1.8 x 10-7	NA
Residential Adult - ST	3.1 x 10-7	1.6 x 10-8	7.5 x 10-9	2.0 x 10-8	3.5 x 10-7	NA
Residential Adult - LT	1.9 x 10-6	9.8 x 10-8	4.5 x 10-8	1.2 x 10-7	2.2 x 10-6	Arsenic
Residential Child - ST	2.8 x 10-6	6.4 x 10-8	3.6x 10-8	4.4 x 10-8	2.9 x 10-6	Arsenic
Occupational Worker - ST	1.1 x 10-7	1.2 x 10-8	1.8 x 10-9	NA	2 x 10-7	NA
Occupational Worker - LT	5.6 x 10-7	5.8 x 10-8	9.0 x 10-9	NA	1.2 x 10-7	NA

RECEPTOR	EXPOSURE TO RADIONUCIDES					
	Soil - Ingestion	Soil - Dermal	Soil - Inhalation	Produce - Ingestion	Total (Soils Only)	COCs
Environmental Researcher - ST	5.3 x 10-12	1.9 x 10-8	1.6 x 10-15	NA	1.9 x 10-8	NA
Environmental Researcher - LT	1.5 x 10-10	7.1 x 10-8	1.2 x 10-14	NA	7.1 x 10-8	NA
Residential Adult - ST	4.0 x 10-10	2.6 x 10-7	2.1 x 10-13	2.8 x 10-14	2.6 x 10-7	NA
Residential Adult - LT	1.6 x 10-9	3.6 x 10-7	3.7 x 10-13	1.1 x 10-13	3.6 x 10-7	NA
Residential Child - ST	8.3 x 10-10	2.6 x 10-7	2.4 x 10-13	1.5 x 10-14	2.6 x 10-7	NA
Occupational Worker - ST	1.4 x 10-10	7.8 x 10-8	5.0 x 10-14	NA	7.8 x 10-8	NA
Occupational Worker - LT	9.0 x 10-10	1.1 x 10-7	8.5 x 10-14	NA	1.1 x 10-7	NA

Shaded items represent exceedances. COCs - Constituents of Concern
ST - Short Term LT - Long Term NA - Not Applicable

VII. Description of the No Action Alternative

According to the EPA guidance document Guidance on Preparing Superfund Decision Documents (EPA, 1989), if there is no current or potential threat to human health or the environment and no action is warranted, the CERCLA 121 requirements are not triggered. This means that there is no need to evaluate other alternatives or the no action alternative against the nine criteria specified under CERCLA.

Under the No Action alternative, no treatment will be performed, no new institutional controls or engineering controls will be implemented, and no cost is associated with implementing the alternative. According to CERLCA regulations, Section 121, if no action is the preferred action, then no applicable or relevant and appropriate requirements are associated with the alternative.

Since the BRRP source unit poses minimal known risk to human health or the environment and the no action alternative is warranted, it does satisfy the CERCLA criteria. The no action alternative is intended to be the final action for the BRRP source unit soils only. This solution is meant to be permanent and effective in both the long and short term. The no action decision is the least cost option with no capital, operating, or monitoring costs, and is protective of human health and the environment.

The groundwater contamination beneath the BRRP is due to migration from upgradient sources such as the F-Area Inactive Process Sewer Lines and thus will not be addressed by this re,nedial alternative. Following an investigation on upgradient groundwater contaminant sources, a determination will be made as to what corrective action might be appropriate for the groundwater beneath the

VIII. Explanation of Significant Changes

No significant changes were made to the Record of Decision based on the, public comment period for the proposed plan. Two public comments were received. However, they did not have an impact on the no action preferred alternative decision. One of the comments required clarification information to be added to Section VI, Summary of Operable Unit Risks (see Appendix A).

BRRP.

IX. References

DOE (U.S. Department of Energy), 1994. Public Involvement, A Plan for the Savannah River Site. Savannah River Operations Office, Aiken, South Carolina.

EPA (U.S. Environmental Protection Agency), 1989. Guidance on Preparing Superfund Decision Documents. Office of Solid Waste and Emergency Response - OSWER Directive 9355.3-02.

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FFA, 1993. Federal Facility Agreement for the Savannah River Site, Administrative Docket No. 89-05-FF, (Effective Date: August 16, 1993).

WSRC (Westinghouse Savannah River Company), 1993. Phase II RFI/RI Work Plan for the Burma Road Rubble Pit (231-4F) (u), WSRC-RP-90-1104, Rev. 2, Westinghouse Savannah River Company, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1994. Quality Control Summary Report for the Burma Road Rubble Pit RFI/RI Unit Assessment (U), ESH-EMS-94-0425, Westinghouse Savannah River Company, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1995a. Final RFI/RI Report for Burma Road Rubble Pit (231-4F) (U), WSRC-RP-94-1217, Rev. 1, Westinghouse Savannah River Company, Aiken, South Carolina (includes the Baseline Risk Assessment).

Westinghouse Savannah River Company, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1995b. Proposed Plan for the Burma Road Rubble Pit (231-4F) (U), WSRC-RP-95-1531, Rev 1,

APPENDIX A

RESPONSIVENESS SUMMARY

Record of Decision for the Burma Road Rubble Pit (231-4F) WSRC-RP-96-101
Savannah River Site Rev. 1, April 1996

Responsiveness Summary

The public comment period for the Burma Road Rubble Pit Proposed Plan began on January 10, 1996 and ended on February 8, 1996. There were no requests for public meeting about the proposed action. Two comments were received. Specific comments and responses are found below.

Public Comment #1

Phone Call

January 11, 1996

Burma Road Comment (U)

On January 11, 1996, Lee Poe, citizen, offered the following comment, for consideration and response, regarding the Proposed Plan for the Burma Road Rubble Pit 231-4F).

"How much money has SRS spent, to date, on the characterization and remedial process for the Burma Road Rubble Pits?"

Response to Public Comment #1

The costs for the BRRP characterization/assessment are estimated to be $1,780,791. A breakdown of the costs by the investigation and assessment phases follow.

The associated cost for the investigation phase are estimated to be $1,576,325. The activities associated with this phase consist of the following:

(1) Work Plan development and regulatory approval,
(2) Field characterization including data validation,
(3) RFI/RI/BRA Report development and regulatory approval, and
(4) Program management associated with these tasks,

The cost for the assessment phase is estimated to be $204,466. The activities associated

with this phase consist of the following:

(1) Initiation of a feasibility study,
(2) Proposed Plan development and approval,
(3) Record of Decision development and approval and,
(4) Program management associated with these tasks.

It should be noted that the feasibility study was initiated before SRS had received approval from the regulators to proceed with the no action proposed plan.

Although these costs may seem high for a no action unit, it should be noted that the BRRP was not initially a candidate for no action. SRS had to provide sufficient data in the RFI/RI Report and the Baseline Risk Assessment (BRA) in order to show the regulators that this should be a no action waste unit. Information regarding the types of waste that were encountered during characterization had to be placed in the RFI/RI Report. Based on the

RFI/RI Report, the BRA determined that the only contamination in the waste unit soils was arsenic which was used before the SRS existed. The groundwater contamination that exists beneath the BRRP is the result of upgradient migration and a corrective action for the groundwater will be determined after an investigation on the upgradient migration sources. After all the information was presented to the regulators, a decision was made to proceed with the no action for the BRRP surface unit only.

Public Comment #2

Phone Call

January 29, 1996

Public Comment on Burma Road Proposed Plan (U)

The following comment was offered by Lee Poe, citizen, on the Burma Road Proposed Plan.

"The risk discussion portion of this Proposed Plan is unclear and written in a manner that assumes the reader has a thorough understanding of the CERCLA process and risk methodology. Future Proposed Plans should more clearly explain the assumptions used in the risk assessment, as well as the real risk associated with the waste unit in terms that are easily understood by the reader. Risk numbers should be accompanied with units and an explanation of what these numbers mean, to make the documents less confusing and complex."

Response to Public Comment #2

Section VI, Summary of Operable Unit Risks has been revised to list the assumptions used for the Current Land Use and Future Land Use Baseline Risk Assessment. This section has also been revised to more clearly state what the risk numbers mean. The evisions to the text are shown below:

p. 10 - 1st column
" . . . This means that one in ten thousand to one in one million people may develop cancer over

a lifetime as a result of exposure to cancer-causing contaminants . . . . "

p. 10 - 2nd column through p. 11 - top of 2nd column
"In order to determine the carcinogenic (cancer) and non-carcinogenic hazards the following general exposure assumptions were used in the baseline risk assessment:

Current Land Use Scenario
Environmental Researcher
The adult environmental researcher receptor was assumed to enter onto the BRRP unit on an intermittent basis. The adult was assumed to work in the BRRP area for 72 days per year (approximately one quarter of the year). Exposures were evaluated for a short-term and long-term scenario (over a half-year and a 25 year interval, respectively). It was also assumed that the person would remain at the BRRP unit or in the BRRP vicinity for a four hour work period.

The person would wear clothing which covers all bodily areas with the exception of the face, hands, and forearms.

Future Land Use Scenarios
Residential Scenario
The future residential adult receptor was assumed to reside on the BRRP for a long-term duration of 30 years and/or a short-term duration of 5 years. It was anticipated that the adult residential person would engage in gardening/yard maintenance activities for a total of eight hours per week year-round (four two-hour periods per week, 350 days/year, assuming approximately two weeks spent away from the residence per year). During such activities, the person would wear clothing which covers all bodily areas with the exception of the face, arms, hands, and lower legs.

The future residential child receptor was assumed to reside on the BRRP between the ages of two through seven years. The child was assumed to live in a house constructed in close proximity to the BRRP. The child would engage in outdoor activities 350 days/year (assuming approximately two weeks spent away from the residence per year). Thel average rate for time spent outdoors would encompass periods when exposures may be more or less frequent, as well as times when adverse weather would prohibit outdoor activity. It was assumed that the young child would remain outdoors for a four hour period.

Occupational Worker
The primary receptor examined under the future commercial use scenari, was an on-site adult worker aged 18 years or older. Soil exposure could occur during normal day-to-day activities for an on-site worker.

Environmental Researcher
The adult environmental researcher receptor was assumed to enter onto the BRRP unit on an intermittent basis. The adult was assumed to work in the BRRP area for 72 days per year (approximately one quarter of the year). Exposures were evaluated for a short-term and long-term scenario (over a half-year and a 25 year interval, respectively). It was also assumed that the person would remain at the BRRP unit or inthe BRRP vicinity for a for hour work period. The person would wear clothing which covers all bodily areas with the exception of the face,

hands, and forearms."

p. 13 - 1st column
For the future residential adult, the only estimated risk from the unit soils was the ingestion of arsenic with a risk value of 1.9 x 10-6 (i.e., there is a 1.9 in one million chance of developing cancer from the ingestion of arsenic). And, for the future residential child, the only estimated risk from the unit soils was the ingestion of arsenic with a risk value of 2.8 x 10-6 (i.e., there is a 2.8 in one million chance of developing cancer from the ingestion of arsenic).

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 03/27/1997
Operable Unit: 14
ROD ID: EPA/541/R-97/022

Media: Groundwater,Soil

Contaminant: Tritium, plutonium, cesium-137, strontium-90, iodine-129, uranium-238, radium-226, potassium-40

Abstract: Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. SRS is a secured U.S. Government facility with no permanent residents. SRS is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina.SRS is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. Chemical and radioactive wastes are by-products of nuclear material production processes.Between 1951 and 1973, SRS used Pits 231-F and 231-1F to burn a variety of wastes, which were considered non-hazardous at the time. Some of these waste materials (degreasers and solvents) are now considered to be hazardous based on ingestion or possible dermal contact. Waste was usually burned on a monthly basis. The chemical composition and volumes of the disposed waste are unknown, but waste materials burned included paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents. No known or suspected radioactive materials were allowed in the burning pits. These radioactive wastes were managed in the Radioactive Waste Burial Ground about 1 1/2 miles east. Pit 231-2F was used exclusively as a rubble pit. Large volumes of

uncontaminated construction debris disposed in the pits may have included relatively small non-homogeneously distributed amounts of low level contamination by cesium-137, strontium-90, and iodine-129. Traces of these radionuclides may also have entered the burning/rubble pits as fallout. Uranium-238, radium-226, and potassium-40 are all naturally occurring radionuclides; radium is always associated with uranium. The typical soils in this region contain about twice as much uranium and potassium as the average soil in the United States.Burning of waste in the SRS pits was discontinued by October 1973. A layer of soil was then placed over the residue in the pits and they were subsequently used as rubble pits. Materials allowed in the rubble pits included concrete, bricks, tile, asphalt, plastic, metal, empty drums, wood products, and rubber. When the pits were filled to capacity in 1978, a layer of clay soil was placed over the contents and the surface was compacted and mounded. Vegetation has been established to reduce erosion.

Remedy: The preferred alternative for the F-Area Burning/Rubble Pits (FBRP) source operable unit is institutional controls, which will preclude residential use of this land. Implementation of the institutional controls alternative requires both near-term and long-term actions, which will be protective of human health and the environment. For the near-term, signs will be posted at the source unit which indicate that this area was used for the disposal of waste material and contains buried waste. In addition, existing SRS access controls will be used to maintain the use of this site for industrial use only. Groundwater contamination a the FBRP will be addressed within the Technical Memorandum and Summary for the FBRP. Based upon the conclusions of this document, one of three options described below will be selected and implemented.1) If no upgradient is indicated, the contribution of the FBRP source unit is confirmed and a remedy for the FBRP groundwater will be pursued.2) If a previously unrecognized upgradient source is identified, a new groundwater operable unit will be created which will undergo an assessment.3) If an existing upgradient groundwater operable unit is determined to be the source of the contamination, the boundaries of the existing operable unit will be modified to include the groundwater contamination in the FBRP area.In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government would create a deed for the new property owner. The deed shall include notification disclosing former waste management and disposal activities taken on the site. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of construction debris and other materials, including hazardous substances.

Text: Full-text ROD document follows on next page.

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Record Of Decision for the F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) (U)
WSRC-RP-96-868
Savannah River Site
Revision 1
February 1997

Printed in the United States of America

Prepared for
U. S. Department of Energy
and
Westinghouse Savannah River Company
Aiken, South Carolina

Record Of Decision for the F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) (U)
WSRC-RP-96-868
Savannah River Site
Revision 1
February 1997
Declaration

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RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION
FOR THE F-AREA BURNING/RUBBLE PITS (231-F, 231-1F, AND 231-2F) (U)

WSRC-RP-96-868
Revision 1
February 1997

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U. S. Department of Energy Under Contract DE-AC09-96SR 18500
Savannah River Operations Office
Aiken, South Carolina

February 1997
Declaration

DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F)
Savannah River Site
Aiken, South Carolina

The F-Area Burning/Rubble Pits (FBRP)(231-F, 231-1F, and 231-2F) source unit is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Unit/Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site.

Statement of Basis and Purpose

This decision document presents the selected remedial alternative for the FBRP located at the SRS in Aiken, South Carolina. The selected alternative was developed in accordance with CERCLA, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this specific RCRA/CERCLA unit.

Description of the Selected Remedy

The preferred alternative for the FBRP source operable unit is Institutional Controls which will preclude residential use of this land. Implementation of the Institutional Controls alternative requires both near-term and long-term actions which will be protective of human health and the environment. For the near-term, signs will be posted at the source unit which indicate that this area was used for the disposal of waste material and contains buried waste. In addition, existing SRS access controls will be used to maintain the use of this site for industrial use only. Groundwater contamination at the FBRP will be addressed within the Technical Memorandum and Summary for the FBRP. Based upon the conclusions of this document, one of three options described below will be selected and implemented. If options 1 or 2 are selected, the new groundwater operable unit will be placed into Appendix C of the Federal Facility Agreement. The Technical Memorandum and Summary for the FBRP will contain the proposed implementation schedule for this groundwater operable unit.

1) If no upgradient source is indicated, the contribution of the FBRP source unit is confirmed and a ROD for

the FBRP groundwater will be pursued.

2) If a previously unrecognized upgradient source is identified, a new groundwater operable unit will be created which will undergo Remedial Investigation/Feasibility Study assessment.

3) If an existing upgradient groundwater operable unit is determined to be the source of the contamination, the boundaries of the existing operable unit will be modified to include the groundwater contamination in the FBRP area.

In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government would create a deed for the new property owner which would include information in compliance with Section 120(h) of CERCLA. The deed shall include notification disclosing former waste management and disposal activities taken on the site. The deed notification shall, in perpetuity, notify any potential purchaser that the property

has been used for the management and disposal of construction debris and other materials, including hazardous substances.

The deed shall also include deed restrictions precluding residential use of the property, However, the need for these restrictions could be reevaluated at the time of ownership transfer in the event that contamination no longer poses an unacceptable risk under residential use.

In addition, if the site is ever transferred to non-federal ownership, a survey plat of the area would be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

The FBRP Corrective Measures Implementation/Remedial Action Report (CMI/RAR) post-ROD document will identify the actions to be taken for the institutional control remedy. The CMI/RAR will be submitted to the regulatory agencies four months after issuance of the ROD. The regulatory review period, SRS revision period, and final regulatory review and approval period for the CMI/RAR will be 90 days, 60 days, and 30 days respectively.

The SCDHEC has modified the SRS RCRA permit to incorporate the selected remedy.

Statutory Determinations

Based on the FBRP RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report and the Baseline Risk Assessment (BRA), the FBRP poses no significant risk to the environment and minimal risk to human health. Because risk levels exceed 1 x 10 -6, a decision was made to implement the Institutional Controls alternative in an effort to be fully protective of human health and the environment.

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The random distribution and low levels of contaminants in the soils make treatment impractical. Institutional controls wil result in hazardous substances, pollutants, or contaminants remaining in the source unit. Because treatment of the principal threats of the site was found to be impracticable, this remedy does not satisfy the statutory preference for treatment as a principal element.

Section 300,430 (f)(4)(ii) of the NCP requires that a Five Year Review of the ROD be performed if hazardous substances, pollutants, or contaminants remain in the source unit. The three Parties have determined that a Five Year Review of the ROD for the FBRP would be performed to ensure continued protection of human health and the environment.

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DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION
FOR THE F-AREA BURNING/RUBBLE PITS (231-F, 231-1F, AND 231-2F) (U)

WSRC-RP-96-868
Revision 1
February 1997

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U. S. Department of Energy Under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

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I. SITE AND OPERABLE UNIT NAME, LOCATION, AND DESCRIPTION

SRS occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina (Figure 1). SRS is a secured U.S. Government facility with no permanent residents. SRS is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina.

SRS is owned by the U.S. DOE. Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. Chemical and radioactive wastes are by-products of nuclear material production processes. Hazardous substances, as defined by CERCLA, are currently present in the environment at SRS.

The Federal Facility Agreement lists the FBRP, as a RCRA/CERCLA unit requiring further evaluation using an investigation/assessment process that integrates and combines the RFI process with the CERCLA RI to determine the actual or potential impact to human health and the environment.

Figure 1 shows the location of the FBRP in relation to other facilities at SRS, Figure 2 shows the location of the FBRP within the F-Area, and Figure 3 shows the layout of the FBRP with sample locations and monitoring wells.

The FBRP comprise a RCRA/CERCLA source unit located within the SRS, approximately 3000 feet west of F-Ares, and 1100 feet north of SRS Road C. Upper Three Runs is located approximately 2,300 feet northwest of the pits. The local topography of the area is flat upland and the pits are at an elevation of 290 feet above mean sea level and 170 feet above Upper Three Runs. The water table is 70 to 100 feet below ground surface in the area of the FBRP. Surface drainage is to the northwest toward an ephemeral tributary of Upper Three Runs about 7.5 miles upstream of its confluence with the Savannah River.

The two contiguous burning/rubble pits, which cover a total area of 1.05 acre, are designated as

231-F and 231-1F; a twenty foot wide berm of undisturbed soil separates these two pits. The rubble pit (231-2F) covers about 0.13 acre. Approximate dimensions of the pits are:

- º 231-F: 275 feet x 62 feet x 10 feet
- º 231-1F: 325 feet x 89 feet x 10 feet
- º 231-2F: 165 feet x 33 feet x 4-9 feet.

The pits have been backfilled with soil; the pit cover is mounded above the surrounding terrain, which is essentially level, to enhance drainage. Vegetation has been established on the pits to reduce erosion.

II. OPERABLE UNIT HISTORY AND COMPLIANCE HISTORY

Operable Unit History

Between 1951 and 1973, SRS used Pits 231-F and 231-1F to burn a variety of wastes which were considered non-hazardous at that time. Some of these waste materials (degreasers and solvents) are now considered to be hazardous based on ingestion or possible dermal contact. Waste was usually burned on a monthly basis. The chemical composition and volumes of the disposed waste are unknown, but waste materials burned included paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents. No known or suspected radioactive materials were allowed in the burning pits. These radioactive wastes were managed in the Radioactive Waste Burial Ground about 1.5 miles east. Pit 231-2F was used exclusively as a rubble pit. Large volumes of uncontaminated construction debris disposed in the pits may have included relatively small, nonhomogeneously distributed amounts of low level contamination by cesium-137, strontium-90, and iodine- 129. Traces of these radionuclides may also have entered the burning/rubble pits as fallout. Uranium-238, radium-226, and potassium-40 are all naturally occurring radionuclides; radium is always associated with uranium. The typical soils in this region contain

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about twice as much uranium and potassium as the average soil in the United States.

Burning of waste in the SRS pits was discontinued by October 1973. A layer of soil was then placed over the residue in the pits and they were subsequently used as rubble pits. Materials allowed in the rubble pits included concrete, bricks, tile, asphalt, plastic, metal, empty drums, wood products, and rubber. When the pits were filled to capacity in 1978, a layer of clayey soil was placed over the contents and the surface was compacted and mounded. Vegetation has been established to reduce erosion.

Compliance History

At SRS, waste materials are managed which are regulated under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities have required Federal operating or post-closure permits under RCRA. SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control on September 5, 1995. Part V of the permit mandates that SRS establish and implement an RFI Program to fulfill the requirements specified in Section 3004(u) of the Federal permit.

Hazardous substances, as defined by CERCLA, are also present in the environment at the SRS. On December 21, 1989, SRS was included on the National Priorities List. This inclusion created a need to integrate the established RFI Program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA, DOE has negotiated a Federal Facility Agreement (FFA, 1993) with U. S. Environmental Protection Agency (EPA) and

SCDHEC to coordinate remedial activities at SRS into one comprehensive strategy which fulfills these dual regulatory requirements,

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Both RCRA and CERCLA require that the public be given an opportunity to review and comment on the draft permit modification and proposed remedial alternative. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternatives for addressing the FBRP soils and groundwater. The Administrative Record File must be established at or near the facility at issue. The SRS Public Involvement Plan (DOE, 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS Public Involvement Plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act. SCHWMR R.61-79.124 and Section 117(a) of CERCLA, as amended, require the advertisement of the draft permit modification and notice of any proposed remedial action and provide the public an opportunity to participate in the selection of the remedial action. The Statement of Basis/Proposed Plan for the F-Area Burning/Rubble Pits (231 -F, 231-1F, and 231-2F) (WSRC, 1996e), which is part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the FBRP.

The FFA Administrative Record File, which contains the information pertaining to the selection of the response action, is available at the EPA office and at the following locations:

U. S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department

University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

Reese Library
Augusta State University
2500 Walton Way
Augusta, Georgia 30910
(706) 737-1744

Asa H. Gordon Library
Savannah State University
Tompkins Road
Savannah, Georgia 31404
(912) 356-2183

The public was notified of the public comment period through mailings of the SRS Environmental Bulletin, a newsletter sent to approximately 3500 citizens in South Carolina and Georgia, through notices in the Aiken Standard, the Allendale Citizen Leader, the Augusta Chronicle, the Barnwell People-Sentinel, and the State newspapers. The public comment period was also announced on local radio stations.

The 45-day public comment period began on September 17, 1996 and ended on October 31, 1996. A public comment meeting was held on October 15, 1996. A Responsiveness Summary was prepared to address comments received during the public comment period. The Responsiveness Summary is provided in Appendix A of this Record of Decision.

IV. SCOPE AND ROLE OF OPERABLE UNIT WITHIN THE SITE STRATEGY

The overall strategy for addressing the FRBP was to: (1) characterize the source unit delineating the nature and extent of contamination and identifying the media of concern (perform the RFI/RI); (2) perform a baseline risk assessment to evaluate media of concern, constituents of concern (COCs),

exposure pathways, and characterize potential risks; and (3) evaluate and perform a final action to remediate, as needed, the identified media of concern.

The FBRP operable unit consists of source materials, soils, and groundwater. It is located within the Upper Three Runs Watershed. Source control and groundwater operable units within this watershed will be evaluated to determine impacts, if any, to associated streams and wetlands. SRS will manage all source control units to prevent impact to the Upper Three Runs Watershed. Groundwater contamination has been documented during the FBRP groundwater monitoring program in both upgradient and downgradient wells. The Technical Memorandum and Summary for the FBRP is being finalized and will determine how groundwater contamination in this area will be addressed. This contamination will, therefore, not be dealt with concurrently with the FBRP source operable unit. The proposed action for the FBRP source unit is intended as a final action. Upon disposition of all source control and groundwater operable units within this watershed, a final, comprehensive ROD for the watershed will be pursued.

V. SUMMARY OF OPERABLE UNIT CHARACTERISTICS

The Data Summary Report (WSRC, 1994), RFI/RI Report (WSRC, 1996a), BRA (WSRC, 1996b), and Corrective Measures Study/Feasibility Study (WSRC, 1996c) contain detailed analytical data for all of the environmental media samples taken in the characterization of the FBRP. These documents are available in the Administrative Record (See Section III).

Soils

Analytical data indicate that little or no significant contamination of the soil outside of the FBRP has occurred. During the preparation of the RFI/RI Report, it was noted that constituents of potential concern (including arsenic, benzo(a)pyrene, cadmium, cesium-137, chromium, heptachlorodibenzo-p-dioxin, lead, manganese, PCB-1254, and radium) were confined to the debris interval of the soil within the pits. This distribution and the contaminant transport modeling results indicate limited mobility of these contaminants in the soil. Despite being a

groundwater risk driver, carbon tetrachloride was not detected in the soil of the FBRP source unit.

The approximate pit boundaries and sample locations are shown on Figure 3.

Arsenic was found in most of the samples from the debris interval in Pits 231-F and 231-1F, but was only found in one sample in Pit 231-2F. The highest value reported was 15.2 mg/kg (parts per million) in the 2-4 foot interval of boring 16 in Pit 231-F. Cadmium was only found in nine samples from Pits 213-F and 231-1F, with a maximum value of 22.2 mg/kg in the 6-8 foot sample from boring 13 in Pit 231-1F. This sample also yielded the highest reported values for chromium (16,000 mg/kg), copper (917 mg/kg), manganese (1030 mg/kg), and nickel (7140 mg/kg), suggesting a concentration of metals from a single source.

The maximum value for benzo(a)pyrene was 2.37 mg/kg, found in the 4-6 foot interval of boring 14 in Pit 231-1F. Benzo(a)pyrene was only identified in a single sample from Pit 231-2F. Heptachlorodibenzo-p-dioxin was found in two samples in Pit 231-2F and 16 samples in Pits 231-F and 231-1F. The maximum value, 0.009 mg/kg, was reported from the 6-8 foot interval in boring 13, Pit 231-1F. PCB-1254 was found in four samples in Pit 231-2F, including the highest value, 9.14 mg/kg, an estimated value, in the 6-8 foot interval in boring 17. This value is less than the industrial cleanup goal of 10 mg/g. The 18 detects in Pits 231-F and 231-1F were all less than the residential cleanup goal of 1 mg/kg PCB-1254.

Cesium-137 was found in 11 samples in Pit 231-2F and 27 samples from Pits 231-F and 231-1F. The highest value was 32.4 pCi/g in the 8-10 foot sample from boring 12, Pit 231-1F. The maximum value for total alpha emitting radium was 4 pCi/g in the 6-8 foot interval in boring 13, Pit 231-1F.

VI. SUMMARY OF OPERABLE UNIT

RISKS

Human Health Risk Assessment

As part of the investigation/assessment process for the FBRP, a BRA was performed using data generated during the assessment phase. Detailed information regarding the development of constituents of potential concern, the fate and transport of contaminants, and the risk assessment can be found in the RFI/RI and BRA reports. The process of designating the constituents of concern was based on consideration of background concentrations, frequency of detection, the relative toxic potential of the constituents, and human nutrient requirements. Constituents of potential concern are the constituents that are potentially site-related and are reported at a sufficient data quality level for use in the risk assessment.

An exposure assessment was performed to provide an indication of the potential exposures which could occur based on the chemical concentrations detected during sampling activities. The only current exposure scenario identified for the FBRP was for on-site visitors. Conservative future exposure scenarios identified for the FBRP included future industrial workers and future resident adults and children. The reasonable maximum exposure concentration value was used as the exposure point concentration.

Carcinogenic risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of pathway-specific exposure to cancer-causing contaminants. The risk to an individual resulting from exposure to non-radioactive chemical carcinogens is expressed as the increased probability of cancer occurring over the course of a 70 year lifetime. Cancer risks are related to the target risk range of one excess human cancer in a population of ten thousand (1×10^{-4}) to one in one million (1×10^{-6}) for incremental cancer risk at National Priorities List sites

Non-carcinogenic effects are also evaluated to identify a level at which there may be concern for potential health effects other than cancer-causing. The hazard quotient, which is the ratio of the exposure dose to the reference dose, is calculated for each contaminant. Hazard quotients are summed for each exposure pathway to determine the specific hazard index for each exposure

scenario. If the hazard index exceeds unity (1.0),

there is concern that adverse health effects might occur.

The following sections discuss the carcinogenic risks and noncarcinogenic hazards for current visitors, hypothetical future workers, and hypothetical future residents. These risks are summarized in Table 1 (Burning Rubble Pits 231-F and 231-1F) and Table 2 (Rubble Pit 231-2F).

Current Land Use - Noncarcinogenic Hazards

The BRA shows that potential adverse noncarcinogenic health effects are not likely to occur, because none of the hazard indices exceeds a value of one.

Current Land Use - Carcinogenic Risks

Under the current land use scenario, human health risks were characterized for the current on-unit visitor. The highest estimated nonradiological cancer risk was 2×10^{-7} for dust inhalation from pit 231-2F. Media evaluated include soil inside the FBRP source unit, soil outside the FBRP source unit, associated airborne soil particulates, and surface water and sediment in an adjacent seasonal wetland.

The highest estimated radiological risk for each pathway was: 3×10^{-7} for direct radiation in all of the pits; 2×10^{-10} for ingestion of soil in the 231-2F pit; and 3×10^{-12} for inhalation of particulates from soil inside the FBRP.

Future Industrial Land Use - Noncarcinogenic Hazards

The hazard indices were less than one for all constituents by all exposure pathways.

Future Industrial Land Use - Carcinogenic Risks

The risks for chemical carcinogens were all within or below the target risk range. The maximum risk from soil ingestion was 5 x 10 -6 driven by arsenic, heptachlorodibenzo-p-dioxin, and benzo(a)pyrene in Pits 231-F and 231-1F and 4 x 10 -6 driven by PCB-1254 in Pit 231-2F.

Carcinogenic risk for radiological exposure was within the target risk range for all pathways. The highest risk under this pathway was 3 x 10 -6 for exposure to soil from the 231-F and 231-1F pits. This risk was driven by cesium-137 and potassium-40. Potassium-40 is a naturally occurring radionuclide.

Future Residential Land Use - Noncarcinogenic Hazards

The hazard indices for noncarcinogenic hazards under a future resident scenario were less than one for all pathways except ingestion of soil from Pit 231-2F. The hazard index for ingestion of soil was 2.0, predominantly driven by PCB-1254 in Pit 231-2F.

Future Residential Land Use - Carcinogenic Risks

The nonradiological ingestion and dermal exposure pathways for the future on-unit resident had estimated carcinogenic risks within the target risk range. The highest risks were 2 x 10 -5 for the soil ingestion pathway in Pits 231-F and 231-1F, driven by arsenic, benzo(a)pyrene, and heptachlorodibenzo-p-dioxin; 2 x 10 -5 for the soil ingestion pathway in Pit 231-2F, driven by PCB-1254.

Carcinogenic risk for radiological exposure was within or below the target risk range for all pathways. The highest risk under the direct radiation pathway was 3 x 10 -5 for ingestion of fruit grown in pits 231-F/1F. This risk was driven by cesium-137 and potassium-40.

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Ecological Risk Assessment

Based on characterization of the environmental setting and identification of potential receptor organisms, a conceptual site model was developed to determine the complete exposure pathways through which receptors could be exposed to constituents of potential concern.

Interpretation of the ecological significance of the unit-related contamination at the FBRP source unit concluded that there was no likelihood of unit related constituents causing significant impacts to the community of species in the vicinity of the unit.

Site-Specific Considerations

Site-specific considerations, based on the conclusions of the BRA and RFI/RI, which suggest limited or no potential for significant risk include:

1) The FBRP contain a large volume of buried nonhazardous waste material and cover soil.

2) The levels of contamination recognized during Phase II characterization are generally very low; there is a preponderance of "non-detects". The contaminants are very stable chemically and exhibit limited mobility in the soil.

3) The groundwater monitoring program indicates that there has not been significant impact from the waste materials in the pits.

4) The FBRP are in a remote area which has been recommended as an industrial zone by the Citizens Advisory Board and the Savannah River Site Future Use Project Report (DOE, 1996), precluding future residential use.

Remedial Action Objectives

Remedial action objectives specify unit-specific contaminants, media of concern, potential

exposure pathways, and remediation goals. The remedial action objectives are based on the nature and extent of contamination, threatened resources, and the potential for human and environmental exposure. Initially, preliminary remediation goals are developed based upon ARARs, or other information from the RFI/RI Report and the BRA. These goals should be modified, as necessary, as more information concerning the unit and potential remedial technologies becomes available. Final remediation goals will be determined when the remedy is selected and shall establish acceptable exposure levels that are protective of human health and the environment.

Constituents of potential concern are site- and media-specific, man-made and naturally occurring inorganic and organic chemicals, pesticides, and radionuclides detected at a unit under investigation. Constituents of concern are isolated from the list of constituents of potential concern by calculating carcinogenic risks and noncarcinogenic hazard indices. A constituent of concern contributes significantly to a pathway having a carcinogenic risk greater than 1×10^{-4} and a hazard index greater than 1.0. Risk levels at or above the upper-bound of the target risk range 1×10^{-4} are considered significant and these sites are expected to undergo remediation. Risk levels between 1×10^{-6} and 1×10^{-4} require consideration for remediation.

ARARs are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal, state, or local environmental law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Three types of ARARs; action-, chemical-, and location-specific; have been developed to simplify identification and compliance with environmental requirements. Action-specific requirements set controls on the design, performance and other aspects of implementation of specific remedial activities. Chemical-specific requirements are media specific, health-based concentration limits developed for site-specific levels of contaminants in specific media. Location-specific ARARs must consider federal, state, and local requirements that reflect the physiographical and environmental characteristics of the unit or the immediate area.

There were no action-specific or location-specific ARARs relevant to establishing remedial action objectives for the FBRP source unit. There also were no chemical-specific ARARs identified, however a to-be-considered guidance level for PCBs was identified. The Toxic Substances Control Act establishes an action level of 10 mg/kg for PCBs in soil. The maximum level of PCBs found in the 0 to 2 foot interval in any of the pits was 2.87 mg/kg in 231-2F. This value is below the to-be-considered guidance.

None of the risks associated with the soil in the FBRP source unit has been found to be greater than 1 x 10 -4. The only hazard index that exceeded 1.0 was for PCB-1254 from the 0-2 foot soil interval in Pit 231-2F for future residents. The hazard index for this exposure scenario was 2.0. The only guidance that was exceeded for soil concentrations was for PCB-1254 which had a maximum value of 2.87 mg/kg in the 0 to 2 foot interval. The to-be-considered guidance for PCBs specifies recommended soil action levels of 1.0 mg/kg for residential use and 10-25 mg/kg for industrial use (EPA, 1990). The maximum PCB-1254 concentration in Pit 231-2F is well below the range for industrial land use.

Table 3 lists the Remedial Goal Options for intermediate risk contaminants (1 x 10 -4 to 1 x 10 -6) for soil by receptor for all of the pits. Figure 4 is a graphical summary of the conceptual site risk model for soil for all of the pits for both future residents and future on-site workers.

VII. DESCRIPTION OF THE CONSIDERED ALTERNATIVES

Description of the Considered Alternatives for the FBRP Source Control Operable Unit

The RFI/RI and BRA indicate that the FBRP source unit poses minimal risk to the environment and minimal risk to human health when industrial exposure scenarios are assumed. Although the risks are generally within the target risk range,

this Corrective Measures Study/Feasibility Study was conducted to consider possible actions which could reduce the risks to 1 x 10 -6 or less.

The Corrective Measures Study/Feasibility Study included detailed analyses for five alternatives which are described below.

Alternative 1. No Remedial Action

Under this alternative, no remedial action would be taken at the FBRP. EPA policy and regulations require consideration of a no remedial action alternative to serve as a basis against which other alternatives can be compared. Because no remedial action would be taken and the FBRP would remain in their present condition, there are no costs associated with this alternative and there would be no reduction or mitigation of risk.

Alternative 2. Institutional Control

Under this alternative, institutional controls would be implemented at the FBRP. Implementation of this alternative will require both near- and long-term actions. For the near-term, signs will be posted indicating that this area was used to manage hazardous materials. In addition, existing SRS access controls will be used to maintain the use of this site for industrial use only.

In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government would, in compliance with Section 120(h) of CERCLA, create a deed for the new property owner. The deed would include notification disclosing former waste management and disposal activities as well as remedial actions taken on the site. The deed notification would, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of non-hazardous, inert construction debris, and that wastes containing hazardous substances, such as degreasers and solvents, were also managed and burned on the site.

The deed would also include deed restrictions precluding residential use of the property. However, the need for these deed restrictions could be reevaluated at the time of transfer in the event that contamination no longer poses an unacceptable risk under residential use.

Table 3 Remedial Goal Options for Intermediate Risk Contaminants of Concern for Soil by Receptor for the F-Area Burning/Rubble Pits (231-F/1F) and Rubble Pit (231-2F)

		Target Cancer Risk			Target Hazard Quotient	Reasonable Maximum
Medium	Chemical	1 x 10 -4	1 x 10 -5	1 x 10 -6	3	1
0.1	EPC					
BRPs 231-F/1F, Future Resident						
Soil (mg/kg)	Arsenic	80.152	8.015	0.8015	-	-
-	5.29					
	HpCDD	0.079	0.0079	0.00079	-	-
-	0.00411					
	B[a]P	16.225	1.623	0.162	-	-
-	0.649					
Soil (PCi/g)	Cs-137	27.918	2.792	0.279	-	-
-	1.77					
(Radionuclides)	K-40	103.390	10.339	1.034	-	-
-	4.27					
BRPs 231-F/lF, Future Worker						
Soil (mg/kg)	Arsenic	370.769	37.077	3.708	-	-
-	5.29					
	HpCDD	0.374	0.0374	0.00374	-	-
-	0.00411					
Soil (pCi/g)	Cs-137	104.118	10.412	1.041	-	-
-	1.77					
(Radionuclides)	K-40	384.685	38.469	3.847	-	-
-	4.27					
RP 231-2F, Future Resident						
Soil (mg/kg)	PCB-1254	1.44E+01	1.44E+00	1.44E-01	4.72	1.57
0.157	0.178					
Soil (pCi/g)	Cs-137	27.998	2.790	0.279	-	-
-	1.77					
(Radionuclides)	K-40	103.268	10.327	1.033	-	-
-	4.27					
	Sr-90	51.282	5.128	0.513	-	-
-	2.96					
RP 231-2F, Future Worker						

Soil (mg/kg)	PCB-1254	6.51E+01	6.51E+00	6.51E-01	123	40.9	4.09	0.178
Soil (pCi/g)	Cs-137	104.118	10.412	1.041	-	-	-	1.77
(Radionuclides)	K-40	384.685	38.469	3.947	-	-	-	4.27

Note: HpCDD is Heptachlorodibenzo-p-dioxin
B[a]P is Benzo[a]pyrene
PCB-1254 is a contaminant of concern for 231-2F soil only.
Potential future resident/worker exposure to soil contaminants includes ingestion, dermal contact, and inhalation of particulates.
EPC is Exposure Point Concentration. Reasonable maximum EPC is the lower of the 95% UCL of the transformed data or the maximum.

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In addition, if the site is ever transferred to non federal ownership, a survey plat of the area would be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

There are no construction costs associated with this alternative. The cost for surveying the land, installing signs, and filing with the Aiken County Records is estimated to be $2,000. Five year reviews of remedy would be required; the estimated present value for these reviews over the next 30 years is $8,000. The total present value cost for Alternative 2 would be $10,000.

The remaining risk via soil ingestion to future on site workers would be 5 x 10 -6 and the hazard index would be 0.02 for Pits 231-F and -1F. The risk and hazard index from Pit 231-2F would be 4 x 10 -6 and 0.09 respectively.

Alternative 3. Native Soil Cover (4')

Under this alternative, a four foot thick cover of native soil would be installed over the present surface of each of the pits to reduce the likelihood that future excavation for construction of a typical basement would expose waste or contaminated soil. If the property is ever transferred to private ownership, in compliance with CERCLA 120(h), the U.S. Government would create a deed with notifications and restrictions similar to those identified in Alternative 2. A deed restriction prohibiting excavation below four feet would also be filed in Aiken County Records. The deed restrictions on excavation below four feet would be necessary to prevent potential exposure of future workers or residents to buried waste which may contain low concentrations of hazardous constituents.

The cost for developing a, CERCLA Remedial Design/Remedial Action Work Plan would be $50,000. The construction costs associated with this alternative are estimated at $347,000 for the installation of a four foot thick native soil cover. The cost for surveying the land, installing signs, and filing with the Aiken County Records is estimated to be $2,000. Present value costs of maintenance over 30 years is $8000. Five year reviews of remedy could be required; the estimated present value for these reviews over the next 30 years is $8,000. Total present value costs for this alternative are estimated at $415,000.

Remaining risks from the pits would be insignificant. The hazard indices from all pits would be less than 1.0.

Alternative 4. Thermal Desorption/Incineration

Under this alternative, the upper four feet of contaminated soil and waste in the pits would be excavated for treatment to eliminate the PCB-1254 and other organic contaminants by thermal desorption/incineration. The soil would be fed through a high temperature rotary kiln to extract the volatile organic contaminants from the soil. The extracted gases would then be destroyed in the incinerator. The treated soil would be returned to the site and vegetation would be established to prevent erosion. If the property is ever transferred to private ownership, in compliance with CERCLA 120(h), the U.S. Government would create a deed with notifications and restrictions similar to those identified in Alternative 2. Deed restrictions on excavation below four feet would be

necessary to prevent potential exposure of future workers or residents to buried waste which may contain low levels of hazardous constituents.

A National Emission Standards for Hazardous Air Pollutants permit would be required because of the potential for atmospheric releases during remediation; the cost of obtaining this permit would be $150,000. The estimated cost for developing a CERCLA Remedial Design/Remedial Action Work Plan would be $150,000. The cost for excavation and backfilling would be $412,000. The cost for thermal desorption/incineration is $6,166,000. The deed notifications and restrictions would cost $2,000. The total cost for this alternative would be $6,880,000.

This alternative is protective of human health and would permanently reduce risk to less than 1×10^{-6} for ingestion of soil in Pit 231-2F. The remaining risk to future residents would be 6×10^{-6} (from

arsenic) for nonradiological exposure and 1×10^{-5} for radiological exposure for direct radiation in Pits 231-F and 231-1F and 8×10^{-6} for pit 231-2F. The risk for ingestion of fruit is 3×10^{-6} for BRPs 231-F and -1F and 2×10^{-6} for RP 231-2F. The risks from ingestion of leafy vegetables is 6×10^{-6} for the BRPs and 5×10^{-6} for the RP. The risk from ingestion of tuberous vegetables is 4×10^{-6} for the BRPs and 3×10^{-6} for the RP.

Alternative 5. Offsite Soil Disposal

Under this alternative, the upper four feet of soil in the pits would be excavated and transported to a licensed offsite disposal facility. The excavation would be filled to grade with clean native soil and cover vegetation would be established. If the property is ever transferred to private ownership, in compliance with CERCLA 120(h), the U.S. Government would create a deed with notifications and restrictions similar to those identified in Alternative 2. Deed restrictions on excavation

below four feet would also be necessary to prevent potential exposure of future workers or residents to buried waste which may contain low levels of hazardous constituents.

The cost for developing a CERCLA Remedial Design/Remedial Action Work Plan would be $150,000. The cost for excavation and backfilling would be $411,000. The cost for transportation is estimated to be $761,000. The cost for disposal is $3,350,000. The deed notifications and restrictions would cost $2,000. The total cost for this alternative would be $4,674,000.

This alternative is protective of human health and would permanently reduce risk to less than 1×10^{-6} for soil related risks in all of the pits.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF THE ALTERNATIVES

Description of Nine Evaluation Criteria

Each of the remedial alternatives was evaluated using the nine criteria established by the National Oil and Hazardous Substances Contingency Plan (NCP). The criteria were derived from the statutory requirements of CERCLA Section 121. The NCP [40 CFR § 300.430 (e) (9)] sets forth nine evaluation criteria that provide the basis for evaluating alternatives and selecting a remedy. The criteria are:

- overall protection of human health and the environment,
- compliance with ARARs,
- long-term effectiveness and permanence,
- reduction of toxicity, mobility, or volume through treatment,
- short-term effectiveness,
- implementability,
- cost,
- state acceptance, and
- community acceptance.

In selecting the preferred alternative, the above mentioned criteria were used to evaluate the alternatives developed in the F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Corrective Measures Study/Feasibility Study (U) (WSRC, 1996e). The nine criteria are used to evaluate all the alternatives, based on human health and environmental protection, cost, and

feasibility issues. Brief descriptions of a nine criteria are given in the following section.

Overall Protection of Human Health and the Environment - The remedial alternatives are assessed to determine the degree to which each alternative eliminates, reduces, or controls threats to human health and the environment through treatment, engineering methods, or institutional controls.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) - ARARs are Federal and state environmental regulations that establish standards which remedial actions must meet. There are three types of ARARs: (1) chemical-specific, (2) location-specific, and (3) action-specific.

Chemical-specific ARARs are usually health- or risk-based levels or methodologies which, when applied to unit-specific conditions, result in the

establishment of numerical values. Often these numerical values are promulgated in Federal or state regulations.

Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in specific locations. Some examples of specific locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats.

Action-specific ARARs are usually technology- or remedial activity-based requirements or limitations on actions taken with respect to hazardous substances or unit-specific conditions. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy.

The remedial activities are assessed to determine whether they attain ARARs or provide grounds for invoking one of the five waivers for ARARs.

These waivers are:

- the remedial action is an interim measure and will become a part of a total remedial action that will attain the ARAR,
- compliance will result in greater risk to human health and the environment than other alternatives,
- compliance is technically impracticable from an engineering perspective,
- the alternative remedial action will attain an equivalent standard of performance through use of another method or approach,
- the state has not consistently applied the promulgated requirement in similar circumstances or at other remedial action sites in the state.

In addition to ARARs, compliance with other criteria, guidance, and proposed standards that are not legally binding, but may provide useful information or recommended procedures should be reviewed as To-Be-Considered when setting remedial objectives.

Long-Term Effectiveness and Permanence - The remedial alternatives are assessed based on their ability to maintain reliable protection of human health and the environment after implementation.

Reduction of Toxicity, Mobility, or Volume Through Treatment - The remedial alternatives are assessed based on the degree to which they employ treatment that reduces toxicity (the harmful nature of the contaminants), mobility (ability of the contaminants to move through the environment), or volume of contaminants associated with the unit.

Short-Term Effectiveness - The remedial alternatives are assessed considering factors relevant to implementation of the remedial action, including risks to the community during implementation, impacts on workers, potential environmental impacts (e.g., air emissions), and the time until protection is achieved.

Implementability - The remedial alternatives are assessed by considering the difficulty of implementing the alternative including technical feasibility, constructability, reliability of technology, ease of undertaking additional remedial actions (if required), monitoring

considerations, administrative feasibility (regulatory requirements), and availability of services and materials.

Cost - The evaluation of remedial alternatives must include capital and operational and maintenance costs. Present value costs are estimated within +50/-30 percent, per EPA guidance. The cost estimates given with each alternative are prepared from information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope, final project schedule, and other variable factors, As a result, the final project costs may vary from the estimates presented herein.

State Acceptance - In accordance with the Federal Facility Agreement (FFA), the State is required to comment/approve the RFI/RI Report, the Baseline

Risk Assessment, the Corrective Measures Study/Feasibility Study, and the Statement of Basis/Proposed Plan

Community Acceptance - The community acceptance of the preferred alternative is assessed by giving the public an opportunity to comment on the remedy selection process. A public comment period was held and public comments concerning the proposed remedy are addressed in the Responsiveness Summary of this Record of Decision.

Detailed Evaluation

The remedial action alternatives discussed in Section VII have been evaluated using the nine criteria just described. Tables 4 through 8 present the evaluation of the remedial alternatives.

IX. THE SELECTED REMEDY

The preferred action at the FBRP is institutional

controls (Alternative 2).

Implementation of this alternative will require both near- and long-term actions. For the near-term, signs will be posted indicating that this area was used to manage hazardous materials. In addition, existing SRS access controls will be used to maintain use of this site for industrial use only.

In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government will create a deed for the new property owner which will include information in compliance with Section 120(h) of CERCLA. The deed will include notification disclosing former waste management and disposal activities on the site. The deed notification will, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of non-hazardous, inert construction debris, and that wastes containing hazardous substances, such as degreasers and solvents, were also managed and burned on the site.

The deed will also include restrictions precluding residential use of the property. However, the need for these deed restrictions could be reevaluated at the time of transfer in the event that contamination no longer poses an unacceptable risk under residential use.

In addition, if the site is ever transferred to non-federal ownership, a survey plat of the area would be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

The Institutional Controls Alternative is intended to be the final action for the FBRP source unit. The solution is intended to be permanent and effective in both the long and near terms. Alternative 2 is considered to be the least cost option that is still protective of human health and the environment. Alternatives 3, 4, and 5 offer only an incremental reduction in risk and hazard for a substantial increase in cost (up to 688 times).

This proposal is consistent with EPA guidance and the National Contingency Plan for sites that have relatively large volumes of waste with low levels of contamination and is an effective use of risk management principles.

Since the initial groundwater assessment did not

conclusively determine where the groundwater contamination was coming from, further assessment of the groundwater contamination was conducted under the groundwater assessment program addendum to the Work Plan (WSRC, 1996d) to determine whether the FBRP source unit is the source of the contamination. Depending on the results of the groundwater assessment three possible options were recognized for addressing the groundwater contamination:

1) If no upgradient source is indicated, the contribution of the FBRP source unit is confirmed and a ROD for the FBRP groundwater will be pursued.

2) If a previously unrecognized upgradient source is identified, a new groundwater operable unit will be created which will undergo Remedial Investigation/Feasibility Study assessment.

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3) If an existing upgradient groundwater operable unit is determined to be the source of the contamination, the boundaries of the

existing operable unit will be modified to include the groundwater contamination in the FBRP area.

The Technical Memorandum and Summary for the FBRP is being finalized. Based upon the conclusions of this document, one of the three options described above will be selected and implemented. If options 1 or 2 are selected, the new groundwater operable unit will be placed into Appendix C of the Federal Facility Agreement. The Technical Memorandum and Summary for the FBRP will contain the proposed implementation schedule for this groundwater operable unit.

The SCDHEC has modified the SRS RCRA permit to incorporate the selected remedy.

This proposal is consistent with EPA guidance and is an effective use of risk management principles.

X. STATUTORY DETERMINATIONS

Based on the FBRP RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report and the Baseline Risk Assessment (BRA), the FBRP poses no significant risk to the environment and minimal risk to human health. Because risk levels exceed 1 x 10 -6, a decision was made to implement the Institutional Controls alternative in order to be fully protective of human health and the environment.

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The random distribution and low levels of contaminants in the soils make treatment impractical. Institutional controls will result in hazardous substances, pollutants, or contaminants remaining in the source unit. Because treatment of the principal threats of the site was found to be impracticable, this remedy does not satisfy the statutory preference for treatment as a principal element. Section 300.430 (f)(4)(ii) of the NCP requires that a Five Year Review of the ROD be performed if hazardous substances, pollutants, or contaminants remain in the source unit. The three Parties have determined that a Five Year Review of the ROD for the FBRP would be performed to ensure continued protection of human health and the environment.

XI. EXPLANATION OF SIGNIFICANT CHANGES

There are no significant changes from the preferred alternative stated in the Statement of Basis/Proposed Plan.

The 45-day public comment period began on September 17, 1996 and ended on October 31, 1996. A public comment meeting was held on October 15, 1996. Comments that were received during the 45-day public comment period are addressed in Appendix A of the Record Of Decision and are available with the final RCRA permit.

XII. RESPONSIVENESS SUMMARY

A Responsiveness Summary of the comments received during the public comment period is included in Appendix A.

XIII. POST-ROD DOCUMENT SCHEDULE

The post-ROD document schedule is listed below and is illustrated in Figure 5:

1) Corrective Measures Implementation/Remedial Action Report (CMI/RAR) (rev. 0) for Institutional Controls will be submitted 4 months after issuance of the ROD.

2) EPA and SCDHEC review of the CMI/RAR (rev. 0), (90 days).

3) SRS revision of CMI/RAR (rev. 0) after receipt of regulatory comments, (60 days).

4) EPA and SCDHEC final review of CMI/RAR (rev. 1), (30 days).

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XIV. REFERENCES

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WSRC, 1996b. Baseline Risk Assessment for the F-Area Burning/Rubble Pits (U). WSRC-TR 94-108, Rev. 1.2, Westinghouse Savannah River Company, Aiken, South Carolina (March 1996).

WSRC, 1996c. F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) Corrective Measures Study/Feasibility Study (U). WSRC-RP-95-660, Rev. 1.1, Westinghouse Savannah River Company, Aiken, South Carolina (June 1996).

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Carolina (May 1996).

WSRC, 1996e. Statement of Basis/Proposed Plan for the F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F)(U). WSRC-RP-95-831, Rev. 1.2, Westinghouse Savannah River Company, Aiken, South Carolina (August 1966).

APPENDIX A - RESPONSIVENESS SUMMARY

Responsiveness Summary

The 45-day public comment period for the Statement of Basis/Proposed Plan for the F-Area Burning/Rubble Pits (231-F, 231-1F, and 231-2F) began on September 17, 1996 and ended on October 31, 1996. A public meeting was held on October 15. 1996. During the public meeting, there were two questions received during the Public Meeting and Comment Session on the Limited Action Proposed Plans/Permit Modifications presentations; and there was one public comment received during the Formal Public Comment Session. All of the comments are listed as recorded in the Savannah River Site Information Exchange transcript based on the October 15, 1996 Public Meeting.

Specific comments and responses are found below. The comments are italicized and the responses are bolded

Public Comments

The following two comments were received during the Limited Action Proposed Plans/Permit Modifications
presentations.

1) PUBLIC CITIZEN: What risk is there for animals or I guess future environmental, like if you were going to
turn this into a park?

Response to Comment 1):

The Baseline Risk Assessment investigated the ecological affects that any contaminants at the FBRP
could have. This document determined that there is "essentially no likelihood that ecologically
significant impacts to the community of species in the vicinity of the unit will occur". Therefore, the
animal and plant species found in this area should not be affected by any contaminants found at the F-
Area Burning/Rubble Pits. The Savannah River Site is currently considered to be a national
environmental research park and as such, the site is/will be used for environmental research.

This site is located in dose proximity to the F-Area which has a number of facilities which contain high
levels of radioactive waste. It is unlikely that this particular area would be made available to the
public as a recreational park in the near future. For this reason, it is recommended that the FBRP be
retained as part of an industrial area.

2) PUBLIC CITIZEN: Are you using like private landfills and private -- or I guess other communities that
have developed? I mean it looks like a landfill to me. And it looks like there are landfills all over the
country and there's a whole lot of landfills that have turned into like parks and stuff. Is that an opportunity
here to turn it into a park or to use private models and maybe who have done this a lot? I guess the EPA
guy was talking about streamlining. Are you guys using private streamlining ideas?

Response to Comment 2):

The FBRP was operated very much like a small-scale landfill. Waste was deposited on a regular basis
and, initially, was burned monthly. After burning ceased, the waste was deposited and finally covered
by a layer of soil when the site was closed.

The Savannah River Site is currently considered to be a national environmental research park and as such, the site is/will be used for environmental research. The F-Area Burning/Rubble Pits have been shown to pose an insignificant threat to any plants or animals in the area.

This site is located in close proximity to the F-Area which has a number of facilities which contain high levels of radioactive waste. It is unlikely that this particular area would be made available to the public as a recreational park in the near future. For this reason, it is recommended that the FBRP be retained as part of an industrial area.

The following comment was received during the Formal Public Comment Session.

3) Mike Rourak: My name is Mike Rourak and my question is directed directly to Mr. Brian Hennessey's earlier discussion [unintelligible] Silverton Road property, for example. In the Future Use Manual that was sent out to some of us about the disposal of close to a million acres of property for DOE, in your deed restrictions there're things that we cannot do. And we're going to need a little bit before we can respond back to Washington. Those of us who received the manual, we almost are going to need to know what those deed restrictions are because if we cannot have a subdivision then there's no need to bid the price accordingly or say that's what we want to use it for. If we cannot graze cattle there like we do in Tennessee at [unintelligible] or something or grow crops because we cannot put a well in for contamination, then we are left with only looking at it for the pine trees.

So being federal, you own this property. Even with deed restrictions you've got to give us either a Phase I, II, or III audit. In this case, it's the seller who has to provide this liability, not necessarily the buyer's neglect of liability to due diligence. So it would really help if we knew what deed restrictions would be there to a more extent and also what we can use the land for. If I want to use it for applying 50 - -- under the Code of Federal Regulations 503, if I want to use it for bio solid disposal, can I do so? Because it's adjacent to your other property. So the deed restrictions that you brought up were of

immense concern
about responding back to the future use and the disposal of roughly 849, 000 acres nationwide for - to be
put back into - I understand from Washington, they would like to put it back mainly into public use to get
the taxes off of it. Maybe not so much for the government, but for the local entities who lose the tax base.
Thank you.

Response to Comment 3):

The SRS Future Use Project Report was distributed to inform citizens of the planned future uses of
SRS. The recommendations that were presented in the report may change over time and will be
discussed with the stakeholders. Deed restrictions for federal property are not determined until the
land is transferred to non-federal control. At the time of property transfer, the need for deed
restrictions will be evaluated. Due to natural attentuation, decay, etc., the conditions at specific areas
may not warrant any deed restrictions. All legal requirements will be met at the time of property
transfer.

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 03/27/1997
Operable Unit: 15
ROD ID: EPA/541/R-97/027

Media: Groundwater,Soil

Contaminant: Chemical wastes, radioactive wastes, tritium, plutonium, oil, degreasers, spent organic solvents, radioactive materials,

Abstract: The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of western South Carolina. SRS is a secured U.S. Government facility with no permanent residents. SRS is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina.SRS is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense and the space program. Chemical and radioactive wastes are byproducts of nuclear material production processes. The D-Area Burning/Rubble Pits (DBRP) are located in the western part of the SRS in Barnwell County, approximately 2,600 feet west of D Area and 1 3/5 miles west of State Highway 125. The two contiguous waste pits are designated as 431-D and 431-1D and cover a total area of a little over 1/2 acre. Approximate dimensions of 431-D are 257 feet by 46 feet by 10 feet, and the dimensions of 431-1D are 229 feet by 36 feet by 10 feet. The two pits are separated by a 15-foot wide berm of undisturbed soil. The total planar area of the DBRP is assumed to be 257 feet by 97 feet. The pits have been backfilled with soil, and vegetation has been established on the resulting surface. The pit cover is raised above the surrounding terrain, which is essentially level, to enhance

drainage.Between 1951 and 1973, burning pits were used at SRS to burn a variety of hazardous and non-hazardous waste. The chemical composition and volumes of the disposed waste are unknown. Combustible materials, which were burned monthly, included paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents. No known or suspected radioactive materials were allowed in the burning pits.Burning of waste in the SRS pits was discontinued by October 1973. A layer of soil was then placed over the residue in the pits and they were subsequently used as rubble pits. Materials allowed in the rubble pits generally included concrete, bricks, tile, asphalt, plastic, metal, empty drums, wood products, and rubber. When the pits were filled to capacity in 1983 or were no longer needed, a 1 to 3 foot layer of clay soil was placed over the contents and the surface was compacted and mounded above the surrounding terrain, which is essentially level, to enhance drainage. Vegetation was established to reduce erosion.At SRS, waste materials are managed and regulated under the Resource Conservation and Recovery Act (RCRA), a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities have required Federal operating or post-closure permits under RCRA. SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control (SCDHEC) on September 5, 1995.

Remedy: The preferred alternative for the DBRP source operable unit soils is institutional controls, which will restrict this land to future industrial use. Additional groundwater monitoring will also be conducted. Implementation of the institutional controls alternative will require both near-and long-term actions, which will be protective of human health and the environment. For the near-term, signs will be posted at the waste unit which indicate that this area was used for the disposal of waste material and contains buried waste. In addition, existing SRS access controls will be used to maintain the use of this site for industrial use only. In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government will create a deed for the new property owner. The deed would include notification disclosing former waste management and disposal activities as well as remedial actions taken on the site, and any continuing groundwater monitoring commitments. The deed notification would, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of construction debris and other materials, including hazardous substances.

Text: Full-text ROD document follows on next page.

<IMG SRC 970270>

United States Department of Energy

Savannah River Site

Record of Decision
Remedial Alternative Selection for the
D-Area Burning/Rubble Pits (431-D and 431-1D)(U)

WSRC-RP-96-867
Revision 1
February 1997

<IMG SRC 97027A>

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808
Prepared for the U.S. Department of Energy under Contract No. DE-AC09-96SR18500

<IMG SRC 97027B>

<IMG SRC 97027C>

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

D-Area Burning/Rubble Pits (431-D and 431-1D)

WSRC-RP-96-867
Revision 1
February 1997

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U.S. Department of Energy Under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

D-Area Burning/Rubble Pits (431-D and 431-1D)

WSRC-RP-96-867
Revision 1
February 1997

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U.S. Department of Energy Under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

Record of Decision for the D-Area Burning/Rubble Pits (431-D and 431-1D)
WSRC-RP-96-867
Savannah River Site
Revision 1
February 1997

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Record of Decision
Remedial Alternative Selection for the
D-Area Burning/Rubble Pits (431-D and 431-1D)(U)

Appendix A
Responsiveness Summary

The 45-day public comment period for the Statement of Basis/Proposed Plan for the D-Area Burning/Rubble Pits (431-D and 431-1D)(U) began an September 17, 1996 and ended on October 31, 1996. A public meeting was held on October 15, 1996. Specific comments and responses are found below. The comments are italicized and the responses are bolded.

Public Meeting Comments

The following comments were received during the Limited Action Proposed Plans/Permit Modifications presentations. These comments were taken from the October 15, 1996 Public Meeting as recorded in the Savannah River Site Information Exchange transcript.

Comment 1: Public Citizen: What risk is there for animals or I guess future environmental, like if you were going to turn this into a park?

Response to Comment 1: As a part of the baseline risk assessment process for the DBRP, an ecological risk assessment was conducted to assess the potential impacts to biota caused by exposure to chemical and radiological constituents at the DBRP. A site ecological reconnaissance survey was conducted in April 1994. No stressed vegetation was observed on or around the DBRP. No threatened and endangered specles were observed in the vicinity of the DBRP or the adjacent ephemeral stream.

Based on the ecological risk assessment, there is little or no risk of adverse ecological effects from the DBRP. Therefore, if the unit is turned into a park in the future, the animal and plant species would not be affected.

Comment 2: Public Citizen: "Are you using like private landfills and private - or I guess what other communities have developed? I mean it looks like a landfill to me. And it looks like there are landfills all over the country and there's a whole lot of landfills that have been turned into like parks and stuff. Is that an opportunity here to turn it into a park or to use private models and maybe look at who has done this a lot? I guess the EPA guy was talking about streamlining. Are you guys using private streamlining ideas?"

Response to Comment 2: There is a proposal for the entire Savannah River Site (SRS) to become a national research park at some time in the future. Even now, the SRS is a national environmental research park and as such, the site is/will be used for environmental research. For the institutional control units, the only thing that our remedial decision has done is to state that on this waste unit there will not be any residential use.

Due to its location, approximately 0.7 mile from the Savannah River and the absence of remarkable scenery, the DBRP would be unlikely to become a recreational site. The risk levels for the soils alone barely exceed the threshold for residential use; the presence of buried waste should not interfere with the use of the DBRP as a park. However, there is groundwater contamination at the DBRP that could preclude use of the local shallow groundwater as a source of drinking water. Groundwater risk modeling indicates that there are constituents present which could exceed primary drinking water standards in the future.

It should also be noted that the use of the DBRP as an environmental research or recreational park would be evaluated at the time of property transfer if ownership of the land is ever transferred from the Federal government. DBRP is one of the first burning/rubble pits at SRS to be evaluated and will contribute to a streamlined process for characterization, technology evaluation, and determinig likely response actions at subsequent burning/rubble pits.

The following comment was received during the Formal Public Comment Session.

Comment 3: Mike Rourak: My name is Mike Rourak and my question is directed to Mr. Brian Hennessey's earlier discussion (unintelligible) Silverton Road property, for example. In the Future Use Manual that was sent out to some of us about the disposal of close to a million acres of property for DOE, in your deed restrictions there's things that we cannot do. And we're going to need a little bit before we can respond back to Washington. Those of us who received the manual, we almost are going to need to know what those deed restrictions are because if we cannot have a subdivision then there's no need to bid the price accordingly or say that's what we want to use it for. If we cannot graze cattle here like we do in Tennessee at (unintelligible) or something or grow crops because we cannot put a well in for contamination, then we are left with only looking at it for the pine trees.

So being federal, you own this property, Even with deed restrictions you've got to give us either a Phase I, II, or III audit. In this case, it's the seller who has to provide this liability, not necessarily the buyer's neglect of liability to due diligence. So it would really help if we knew what deed restrictions would be there to a more extent and also what we can use the land for. If I want to use it for applying 50 - - under the Code of Federal Regulations 503, if I want to use it for bio solid disposal, can I do so? Because it's adjacent to your other property. So the deed restrictions that you brought up were of immense concern about responding back to the future use and the disposal of roughly

849,000 acres nationwide for - to be put back into - I understand from Washington, they would like to put it back mainly into public use to get the off of it. Maybe not so for the government, but for the local entities who lose the tax base.

Thank you.

Response to Comment 3: The SRS Future Use Project Report was distributed to inform citizens of the planned future uses of the SRS. The recommendations that were presented in the report any change over time and will be discussed with the stakeholders. Deed restrictions for federal property are not determined until the land is transferred to non-federal control. At the time of property transfer, the need for deed restrictions win be evaluated. Due to natural attenuation, decay, etc, the conditions at specific areas may not warrant any deed restrictions. All legal requirements will be met at the time of property transfer.

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Appendix

A. Responsiveness Summary.....A-1

DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

D-Area Burning/Rubble Pits (431-D and 431-1D)
Savannah River Site
Aiken, South Carolina

The D-Area Burning/Rubble Pits (DBRP) (431-D and 431-1D) Waste Unit is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Unit/Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS).

Statement of Basis and Purpose

This decision document presents the selected remedial alternative for the DBRP located at the SRS in Aiken, South Carolina. The selected alternative was developed in accordance with CERCLA, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this specific RCRA/CERCLA unit.

Description of the Selected Remedy

The preferred alternative for the DBRP source operable unit soils is Institutional Controls which will restrict this land to future industrial use. Additional groundwater monitoring, as discussed in Section IX of the ROD, will also be conducted. Based on the groundwater monitoring history, the probable condition is that no significant groundwater contamination has originated from the DBRP. Thus, no remedial action and a period of continued monitoring for confirmation is the only appropriate action for the

groundwater
at the DBRP. In the event that the probable condition of the local groundwater is no longer appropriate,
DOE will evaluate the need for remedlal action. Implementation of the Institutional Controls alternative
will require both near- and long-term actions which will be protective of human health and the environment.
For the near-term, signs will be posted at the waste unit which indicate that this area was used for the
disposal of waste material and contains buried waste. In addition, existing SRS access controls will be used
to maintain the use of this site for industrial use only.

In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government will
create a deed for the new property owner which would contain information in compliance with Section
120(h) of CERCLA. The deed would include notification disclosing former waste management and disposal
activities as well as remedial action, taken on the site, and any continuing groundwater monitoring
commitments. The deed notification would, in perpetuity, notify any potential purchaser that the property
has been used for the management and disposal of construction debris and other materials, including
hazardous substances.

The deed would also include deed restrictions precluding residential use of the property. However, the need
for these restrictions may be reevaluated in the event that contamination no longer poses an unacceptable
risk under residential use. In addition, if the site is ever transferred to non-federal ownership, a survey plat
of the area will be prepared, certified by a professional land surveyor, and recorded with the appropiate
Barnwell County recording agency.

The post-ROD document, the Corrective Measures Implementation/Remedial Action Report
(CMI/RAR), will be submitted to the Regulators four months after the issuance of the ROD. The
(CMI/RAR) will contain a detailed monitoring strategy which will outline the submittal schedule and
contents of the periodic monitoring reports to include: an analysis of the data, a conclusion, and a

recommendation. The regulatory review period, SRS revision period, and final regulatory review and approval period will be 90 days, 60 days, and 30 days, respectively.

The South Carolina Department of Health and Environmental Control has modified the SRS RCRA permit to incorporate the selected remedy.

Statutory Determination

Based on the DBRP RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report and the BRA, the DBRP source operable unit poses no significant risk to the environment and minimal risk to human health. Therefore, a determination has been made that Institutional Controls are sufficiently protective of human health and the environment for the remaining contamination in the DBRP soils and groundwater. The selected remedy is protective of human health and the environment, complies with Federal and State of South Carolina requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The random distribution and low levels of contamination preclude a remedy in which treatment is a practical alternative. Because treatment of the principal threats of the site was found to be impracticable, this remedy does not satisfy the statutory preference for treatment as a principal element.

Institutional Controls will result in hazardous substances, pollutants, or contaminants remaining in the waste unit. Section 300.430 (f)(4)(ii) of the NCP requires that a Five Year Review of the Record of Decision be performed if hazardous substances, pollutants, or contaminants remain in the waste unit. The three Parties have determined that a Five Year Review of the Record of Decision for the DBRP will be performed to ensure continued protection of human health and the environment.

<IMG SRC 97027D>

I. Site and Operable Unit Name,

Location, and Description

The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of western South Carolina. SRS is a secured U.S. Government facility with no permanent residents. SRS is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina.

SRS is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense and the space program. Chemical and radioactive wastes are by-products of nuclear material production processes.

The Federal Facility Agreement (FFA) lists the D-Area Burning/Rubble Pits (DBRP), 431-D and 431-1D, as a Resource Conservation and Recovery Act/Comprehensive Environmental Response, Compensation and Liability Act (RCRA/CERCLA) unit requiring further evaluation using an investigation/assessment process that integrates and combines the RCRA Facility Investigation (RFI) process with the CERCLA Remedial Investigation (RI) to determine the actual or Potential impact to human health and the environment.

The DBRP are located in the western part of the SRS in Barnwell County, approximately 2600 feet west of D Area and 1.6 miles west of State Highway 125 (Figure 1). The topography of the area is flat and the surface of the DBRP is at an elevation of 130 feet above mean sea level and 45 feet above the Savannah River (Figure 2). The water table is approximately 10 feet below ground surface in the area of the DBRP (Figure 3). Surface drainage is to the west-southwest toward a nearby ephemeral tributary of the Savannah River.

The two contiguous waste pits are designated as 431-D and 431-1D and cover a total area of 0.54 acre. Approximate dimensions of 431-D are 257 feet by 46 feet by 10 feet, and the dimensions of 43l-1D are 229 feet by 36 feet by 10 feet. The two pits are separated by a 15-foot wide berm of

undisturbed soil. The total planar area of the DBRP is assumed to be 257 feet by 97 feet (24,929 ft^2). The pits have been backfilled with soil and vegetation has been established on the resulting surface. The pit cover is raised above the surrounding terrain, which is essentially level, to enhance drainage.

II. Operable Unit History and Compliance History

Operable Unit History

Between 1951 and 1973, burning pits were used at SRS to burn a variety of hazardous and non-hazardous waste. The chemical composition and volumes of the disposed waste are unknown Combustible materials, which were burned monthly, included paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents. No known or suspected radioactive materials were allowed in the burning pits.

Burning of waste in the SRS pits was discontinued by October 1973. A layer of soil was then placed over the residue in the pits and they were subsequently used as rubble pits. Materials allowed in the rubble pits generally included concrete, bricks, tile, asphalt, plastic, metal, empty drums, wood products, and rubber. When the pits were filled to capacity in 1983 or were no longer needed a 1 to 3 foot layer of clayey soil was placed over the contents and the surface was compacted and mounded above the surrounding terrain, which is essentially level, to enhance drainage. Vegetation was established to reduce erosion.

Compliance History

At SRS, waste material are managed which are regulated under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities have required Federal operating or post-closure permits under RCRA. SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control (SCDHEC) on September 5, 1995.

<IMG SRC 97027E>

<IMG SRC 97027F>

<IMG SRC 97027G>

Part V of the permit mandates that SRS establish and implement an RFI Program to fulfill the requirements specified in Section 3004(u) of the Federal permit.

On December 21, 1989, SRS was included on the National Priorities List (NPL). This inclusion created a need to integrate the established RFI Program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA, DOE has negotiated a Federal Facility Agreement (FFA, 1993) with U.S. Environmental Protection Agency (EPA) and SCDHEC to coordinate remedial activities at SRS into one comprehensive strategy which fulfills these dual regulatory requirements.

III. Highlights of Community Participation

Both RCRA and CERCLA require that the public be given an opportunity to review and comment on the draft permit modification and proposed remedial alternative. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulation (SCHWMR) R61-79.124 and Sections 113 and 117 of CERCLA. These requirements include establishmen of an Administrative Record File that documents the investigation and selection of the remedial alternatives for addressing the DBRP soils and groundwater. The Administrative Record File must be established at or near the facility at issue. The SRS Public Involvement Plan

(DOE, 1994) is designed to facilitate public involvement in the decision-making process for permitting closure, and the selection of remedial alternatives. The SRS Public Involvement Plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act, 1969 (NEPA). SCHWMR R61-79.124 and Section 117(a) of CERCLA, as amended require the advertisement at the draft permit modification and notice of any proposed remedial action and provide the public an opportunity to participate in the selection of the remedial action. The Statement of Basis/Proposed Plan for the D-Area Burning/Rubble Pits (WSRC 1996c), which is part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the DBRP.

The FFA Administrative Record File, which contains the information pertaining to the

selection of the response action, is available at the EPA office and at the following lodations:

U.S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

Reese Library
Augusta State University
2500 Walton Way
Augusta, Georgia 30910
(706) 737-1744

Asa H. Gordon Library
Savannah State University
Tompkins Road
Savannah, Georgia 31404
(912) 356-2183

The public was notified of the public comment period through mailings of the SRS Environmental Bulletin, a newsletter sent to approximately 3500 citizens in South Carolina and Georgia, through

notices in the Aiken Standard the Allendale Citizen Leader, the Augusta Chronicle, the Barnwell People-Sentinel, and The State newspapers. The public comment period was also announced on local radio stations.

The 45-day public comment period began on September 17, 1996 and ended on October 31, 1996. A public comment meeting was held on October 15, 1996. A Responsiveness Summary was prepared to address comments received during the public Comment period. The Responsiveness Summary is available with the final RCRA permit and is also provided in Appendix A of this Record of Decision (ROD).

IV. Scope and Role of Operable Unit Within the Site Strategy

The overall strategy for addressing the DBRP was to:

1) characterize the waste unit delineating the nature and extent of contamination and identifying the media of concern (WSRC, 1994 and WSRC, 1995b);
2) perform a baseline risk assessment to evaluate media of concern, constituents of concern (COCs), exposure pathways, and characterize potential risks (WSRC, 1995a);
3) evaluate applicable technologies and isolate a preferred technology to remediate the waste site as needed (WSRC, 1996b and WSRC, 1996c); and
4) perform a final action to remediate the identified media of concern to the remedial action objectives.

The DBRP is an operable unit located within the Savannah River Floodplain Swamp Watershed. Several source control and groundwater operable units within this watershed will be evaluated to determine impacts, if any, to associated streams and wetlands. SRS will manage all source control and groundwater operable units, to minimize

impact to the watershed. Based on characterization and risk assessment information, the DBRP does not significantly impact the watershed. Upon disposition of all source control and groundwater operable units within this watershed, a final, comprehensive evaluation of the watershed will be conducted to determine whether any additional actions are necessary. The groundwater at the DBRP was investigated during the RFI/RI conducted in 1993. The Baseline Assessment (BRA) (WSRC, 1995a) found no risks exceeding 1.0×10^{-6} for ingestion of the DBRP soil by future industrial workers, but calculated a risk of 3.0×10^{-4} for ingestion of groundwater by future industrial workers. Additional groundwater monitoring of the groundwater for modeled risk and hazard drivers at the DBRP will be conducted and reported in the five-year ROD reviews.

V. Summary of Operable Unit Characteristics

The SRS burning/rubble pits were excavated in 1951, during the construction of most of the major facilities at the Savannah River Plant. The DBRP received waste materials produced

during construction of D-Area facilities. The chemical composition and volumes of the disposed waste are unknown. During the operation of the burning/rubble pits, combustible materials (including paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents) were burned monthly, as was the practice at that time, for volume reduction. This practice would have eliminated many of the combustible organic materials while creating combustion by-products. No known or suspected radioactive materials were disposed in the burning pits.

Open burning of waste material was discontinued at SRS in 1973. At that time, the waste residue was covered with soil and the pits were used as rubble pits. Materials allowed in the rubble pits included concrete, bricks, tile, asphalt, plastic metal, empty drums, wood products, and rubber. When the pits were filled to capacity about 1993, a 1 to 3 foot layer of clayey soil was placed over the contents and the surface was compacted, mounded, and seeded.

Media Assessment

The Data Summary Report (WSRC, 1994), BRA (WSRC, 1995a), RFI/RI Report (WSRC, 1995b), and Corrective Measures Study/Focused Feasibility Study) (WSRC, 1996b) contain detailed analytical data for all of the environmental media samples taken in the characterization of the DBRP. These documents are available in the Administrative Record (See Section III).

Soils

Analytical data indicate that little or no contamination of the soil outside of the DBRP has occurred. Figure 3 shows the sample locations for the Phase I characterized in 1989 and the Phase II characterization in 1993. The 1989 program included, two locations in each pit, one in the berm between the pits, and one directly down gradient of the pits. The 1993 progam consisted of four soil borings in each pit and four borings around the pits.

In the BRA, the analytical data from the 1993 soil samples were divided into two groups:

- surface soils, 0.0 to 2.0 feet (primary direct contact exposure interval for soils) and

- subsurface soils, 0.0 to 4.0 feed (potential exposure interval for future scenarios where excavation may occur).

The BRA identified the following constituents of concern:

arsenic,
benzo(a)pyrene,
chromium,
manganese,
octachlorodibenzo-p-dioxin,
PCB-1260, and
total alpha emitting radium.

Dieldrin was identified as a modeled-DBRP-soils-to-groundwater ingestion risk driver to future residents, 81% of 8x10 -4 in Revision 0 of the BRA. Dieldrin was only detected two times

out of 45 soil samples collected in the DBRP. The maximum value reported was J0.0165 mg/Kg in the 4 to 6 foot interval of boring 11, the "J" qualifier indicates that the analyte was recognized below detection limits and the value was estimated. The risk contribution of dieldrin was reevaluated in the BRA, Revision 1 and dieldrin was eliminated as a risk driver based on its high uncertainty of detection and low number of occurrences.

Two times the mean background value for a constituent was used in screening that constituent for consideration as a constituent of potential concern. The mean background value for arsenic at the DBRP is 2.3 mg/kg. In the 0-2 foot interval of the DBRP, arsenic only exceeds 2 times mean background (4.6 mg/kg, parts per million) at one location, boring 7 (7.6 mg/kg). The levels of arsenic detected are consistent with the levels found throughout SRS. Arsenic may be naturally occurring, added to the soils as a pesticide, or a constituent of waste materials disposed in the DBRP. Arsenic in the soil at SRS is believed to be primarily the residue of pre-SRS agricultural pesticide application. The occurrence of arsenic will be evaluated on a site-wide scale in the forthcoming SRS background soils study report.

In the near-surface soil at the DBRP, chromium only exceeded 2 times mean background (80.8 mg/kg) in boring 12 (339 mg/kg). The chromium present in the DBRP is believed to be predominantly CrIII (chromium in the +3 valence state) which is much less mobile and

toxic than the CrVI (chromium+6) assumed in the BRA evaluation. CrVI is thermodynamically unstable in soils in the region including SRS and is rapidly reduced to CrIII. Manganese only exceeded 2 times mean background (242 mg/kg) in the near-surface interval in boring 11 (260 mg/kg).

Benzo(a)pyrene (BaP) did not exceed detection limits in the 0-2 foot interval at the DBRP. Octachlorodibenzo-p-dioxin (OCDD), which comprised only 9% of the risk via soil ingestion for future on-site workers, was detected at low concentrations in all of the shallow soil samples. Dioxins are common products of incomplete combustion. Polychlorinated Biphenyl-1260 (PCB-1260) was identified in only one location,

soil boring 12; the maximum concentration of PCB-1260, 3.39 mg/kg, was found in the 0.5-2.0 foot interval. Total alpha emitting radium was only detected in the 0-2 foot interval (1.2 pCi/g) in boring 7; 2 times mean background was 2.49 pCi/g.

Based on the fad that all the soil analytes passed either the simple site-specific or detailed site-specific method of screening, there is little or no chance for the residual waste at the DBRP to be a source of future contamination. The remaining soil contaninants pose little, if any threat for future contamination.

Groundwater

Groundwater monitoring data indicate that no significant release of hazardous substances to groundwater from the DBRP has occured. However, risk evaluation indicates a groundwater ingestion risk of 3.0x 10 -4 for future workers and 1.0 x 10 -3 for future residents due to arsenic (discussed later in this section). There are 5 monitoring wells in the DBP (D-Area Burning Pit) well series: DBP-1, -2, -3 (installed in September 1983), DBP-4 installed in June 1994), and DBP-5 (installed in June 1993). Figure 3 shows the locations of the monitoring wells comprising the DBP network and the potentiometric water table map.

Comparison of constituent concentrations, from 1984 through 1992 in the four downgradient DBP wells with concentrations in the upgradient well, DBP-3, indicates little or no constituent concentration increase in groundwater after flowing beneath the DBRP. The only constituents which show any apparent increase

are iron, manganese, lead, sulfate, and possibly gross alpha and total radium. Iron, manganese,

and sulfate are covered by the Secondary Drinking Water Standards which deal with the aesthetic properties of public drinking water. The RCRA groundwater protection standard for lead is 0.05 mg/L. The highest value of lead reported for the period of interest was 0.013 mg/L.

The measured groundwater risk drivers under the future resident scenario are: arsenic (dermal, 3 x 10 -6 and ingestion, 1 x 10 -3); dichloromethane (inhalation, 2 x 10 -8); Ra-226 and Ra-228 (ingestion, 2 x 10 -5); and tritium (inhalation, 3 x 10 -9). The modeled-DBRP-soils to groundwater risk drivers are octachlorodibenzo-p-dioxin (OCDD) and heptachlorodibenzo-p-dioxin (HpCDD)(dermal, 1 x 10 -4); polyaromatic hydrocarbons (PAH) and 1,1,2-trichloroethane (1,1,2-TCA) (ingestion, 2 x 10 -4); 1,2-dichloroethane (1,2 DCA), 1,1,2-TCA, and chloroform (inhalation, 3 x 10 -5); and tritium (ingestion, 2 x 10 -5 and inhalation, 3 x 10 -5). The measured groundwater hazard drivers are: manganese (dermal, 1.0); arsenic and manganese (ingestion, 50.0); and toluene (inhalation, 0.005). The modeled-DBRP-soil-to-groundwater hazard drivers are: OCDD and HpCDD (dermal, 5.0); acetone and naphthalene (ingestion, 20.0); and carbon disulfide (inhalation, 0.3). Many of these exposure scenarios are well below the 1 x 10 -6 risk and 1.0 hazard levels.

Arsenic was the sole nonradioactive contributor to risk under the measured groundwater ingestion pathway in the BRA. The risk to the future on-unit worker was 3.0 x 10 -4; to the future on-unit resident the risk was 1.0 x 10 -3. The maximum contaminent level for arsenic in drinking water is 0.05 mg/L. Arsenic was only detected twice in the DBP monitoring network; the higher value in the December 1993 sample from well DBP-5 was reported as 0.044 mg/L. The following quarter when the well was resampled, arsenic was reported below detection limits of 0.002 mg/L. Therefore the risks attributed to this single arsenic value are believed to be exaggerated.

Manganese is covered by the secondary maximum contaminant level of 0.05 mg/L. This contaminant level addresses the aesthetic properties of public drinking water rather than

dealing with health-based concerns. The maximum value of manganese reported in the DBP well series was 1.44 mg/L from well DBP 2 in the fourth quarter of 1993.

Dichloromethane (methylene chloride), a common laboratory artifact, was only reported in three soil samples in a total of 55 samples collected from the DBRP with a maximum of V0.06 mg/Kg (boring 7 at a depth of 4.0-6.0 feet). The "V" qualifier indicates that the analyte was also detected in the associated method blank, indicating laboratory contamination. The risk attributed to dichloromethane via the groundwater inhalation pathway by future residents was 2 x 10 -8, well below 1 x 10 -6. Dichloromethane was detected in the groundwater in excess of the 0.005 mg/L maximum contaminant level four times since January 1993, two of these exceedances were in upgradient well DBP 3. Dichloromethane was evaluated and determined to be a laboratory artifact. Likewise, acetone has been detected in up- and downgradient wells and is a common laboratory artifact.

Gross alpha and total radium were the only radioactive constituents, in the Unit Assessment samples (covering three quarters in 1993) for which primary maximum contaminant levels may have been exceeded. The maximum contaminant level (MCL) for gross alpha is 15 pCi/L, this level may have been exceeded in the December 1993 sample from well DBP-2 (15 pCi/L ± 0.21 pCi/L). This gross alpha anomaly occurred only once in a single well that had previously contained no detectable gross alpha and may be due to field or laboratory contamination.

The MCL (regulatory standard) for total radium is 5 pCi/L; an increase to 20 pCi/L is being considered under proposed regulations (56FR33050). Total radium in the groundwater has only exceeded 5 pCi/L once since monitoring began at ther DBRP. This exceedance occurred in the sample collected from well DBP-2 in December 1993 (the same sample which yielded the gross alpha anomaly); Ra-226 was 4.8 pCi/L and Ra-228 was 3.5 pCi/L. The relationship of the gross alpha and Ra-226/228 anomalies in the same sample

suggests that these anomalies could be due to problems with laboratory or field sampling techniques.

During evaluation performed for the BRA, the assumption was made that all the radium present was Ra-226, the only radium for which slope factors have been determined and the most toxic radium species. This assumption contributed to an exaggeration of the risk attributed to radium. The ingestion of radium in the groundwater pathway risks was evaluated at 6.0 x 10 -6 for future workers and 2.0 x 10 -5 for future residents.

Tritium was recognized as a risk driver in the modeled-DBRP-soil-to-groundwater exposure pathway as discussed in the preceeding paragraphs. Tritium only exceeded the two times mean background screening level (5.26 pCi/g) in the DBRP soils seven times in 49 soil samples, the maximum value reported was 13.5 pCi/g from the 2 to 4 foot interval in boring 8. The maximum, contaminant level for tritium is 20,000 pCi/L, the highest value of tritium reported from the groundwater was only 3400 pCi/L, 17% of the MCL. The maximum modeled-soil-to-groundwater concentration was 11,500 pCi/L.

The PAHs, HpCDD, OCDD, 1,1,2-TCA, 1,2-DCA, carbon disulfide and chloroform, have not been detected in groundwater. These constituents have very low solubilities in aqueous system and tend to be strongly adsorbed to clays and humates in the soil; they are not readily transferred from soil to groundwater. The modeling in the BRA is conservative in that it assumes that the contaminant is present at its maximum detected concentration throughout the waste body and that the contaminant does not suffer degradation or depletion, thus the modeled-DBRP-soil-to-groundwater risks are exaggerated.

Under current land use (and recommended institutional controls) the on-site visitor is supplied with drinking water from the SRS drinking water supply system. Under SRS institutional control, the local groundwater at the DBRP is not used for drinking or hygienic purposes.

VI. Summary of Operable Unit Risks

Human Health Risk Assesment

As part of the investigation/assessment process for the DBRP waste unit, a BRA was performed using data generated during the assessment phase. Detailed information regarding the development of constituents of potential concern (COPCs), the fate and transport of contaminants, and the risk assessment can be found in the BRA (WSRC, 1995a) and the RFI/RI Report for the D-Area Burning/Rubble Pits (431-D and 431-1D)(U), (WSRC, 1995b).

COPCs are site- and media-specific, man-made and naturally occurring, inorganic and organic chemicals pesticides, and radionuclides detected at a unit under investigation. These constituents are potentially site-related and data treating their distribution and concentration, are of sufficient quality for use in the risk assessment. The process of designating the COPCs was based on consideration of background concentrations, frequency of detection, the relative toxic potential of the chemicals, and chemical nutrient status.

Constituents of concern (COCs) are isolated from the list of COPCs by calculating carcinogenic (cancer-causing) risks and noncarcinogenic hazard indices. A COC contributes significantly to a pathway that contributes to either a cumulative site carcinogenic risk greater than 1.0×10^{-6} or a hazard index greater than 1.0.

An exposure assessment was performed to provide an indication of the potential exposures which could occur based on the chemical concentrations detected during sampling activities. The only current exposure scenario identified for the DBRP was for on-site workers, who may perform environmental research or maintenance activities (such as mowing and

inspections) on the DBRP on a limited and intermittent basis. Conservative future exposure scenarios identified for the DBRP included future environmental researchers and maintenance workers and future resident adults and children. The reasonable maximum exposure concentration value was used as the exposure point concentration.

Per EPA guidance, the carcinogenic risks and noncarcinogenic hazards must be calculated to determine the appropriate remedial action for a waste unit. Carcinogenic risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of pathway-specific exposure to cancer-causing contaminants. These risks are expressed as the increased likelihood that an exposed individual will develop cancer during his lifetime (70 years) because of a 30-year (chronic) exposure to the contaminants at a given waste site.

Cancer risks are related to the EPA target risk range of one in ten thousand (1.0 x 10 -4) to one in one million (1.0 x 10 -6) for incremental cancer risk at National Priorities List sites.

Remedy selection, addressing significant risks and/or principal threat source material, was completed in a comprehensive Corrective Measures Study/Feasibility Study (CMS/FS). Alternatives that are permanent and/or employ treatment as a principal element of the remedy are necessary for inclusion in the CMS/FS.

Non-carcinogenic effects are also evaluated to identify a level at which there may be concern for potential health effects other than cancer. The hazard quotient which is the ratio of the exposure dose to the reference dose, is calculated for each contaminent. Hazard quotients are summed for each exposure pathway to determine the specific hazard index (BD for each exposure scenario. If the hazard index exceeds unity

(1.0), there is concern that adverse health effects might occur.

Exposure risks and hazard for the three land use scenarios are presented in Tables 1 through 3. The future residential scenario indcludes homegrown produce as an exposure point, which is not considered under the current on-unit visitor or future industrial worker scenarios.

Current Land Use-Noncarcinogenic Hazards

Under the current land use scenario, human health risks and noncarcinogenic hazards were characterized for the current on-unit visitor. An on-unit visitor is described as an employee of SRS who works at the DBRP for short periods on an infrequent basis, (i.e., a few hours per month performing environmental sampling or maintenance activities). Current on-unit vistors are supplied with drinking water from the SRS drinking water supply system; the local groundwater is not used for drinking or hygiene.

The BRA (WSRC, 1995a) shows that potential, adverse noncarcinogenic health effects are not likely to occur, because none of the hazard indices exceeds a value of one. Table 1 contains a summary of noncarcinogenic hazards under the current land use scenario.

Current Land Use - Carcinogenic Risks

Under the current land use scenario, human health risks were characterized for the current on-unit visitor. Table 1 contains a summary of carcinogenic risks. All of the estimated nonradiological cancer risks were less than 1.0 x 10 -6, indicating that carcinogenic risk from the unit is not significant. Media evaluated include soil inside the DBRP, soil outside the DBRP, associated airborne soil particulates, and surface water and sediment in the stream/wetland.

All of the estimated radiological risks were less than 1.0 x 10 -6. Radiological risks were estimated for three exposure pathways: ingestion of soil inside the DBRP, inhalation of particulates from soil inside the DBRP, and ingestion of sediment.

Future Land Use - Noncarcinogenic Hazards

The HIs were less than one, indicating adverse

noncarcinogenic effects are unlikely for the following pathways:

- direct exposure of on-unit workers to soils inside and outside the DBRP (Table 2)
- direct exposure of adult and child residents to soils inside and outside the DBRP (Table 3)
- direct exposure of child-only residents to soils inside and outside the DBRP
- exposure of a child to surface water and sediment

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<IMG SRC 97027J>

<IMG SRC 97027K>

The groundwater ingestion and inhalation pathway yielded a HI of 50 from arsenic and manganese to future resident adults and children. This hazard is reduced to 6 for future on-unit workers.

Future Land Use - Carcinogenic Risks

Several exposure pathways for the future on-unit resident had estimated nonradiological carcinogenic risks exceeding the lower bound of the target risk range, 1.0 x 10 -6 (Tables 2 and 3). No contamination was found in concentrations that yielded risks greater than the upper bound of the risk range of 1.0 x 10 -4 except for arsenic by groundwater ingestion. Under the groundwater ingestion pathway, the risk due to arsenic to the future on-unit worker was 3.0 x

10^{-4}; to the future on-unit resident the risk was 1.0×10^{-3}. These risks were based on a single measured arsenic value in the groundwater which was less than the MCL for drinking water.

For the future on-unit worker, cancer risks for ingestion of soil from inside the DBRPs were equal to the EPA point of departure of 1.0×10^{-6} for the 0-2.0 foot and 0-4.0 foot depth intervals. Estimated risks for dermal contact with soil and inhalation of soil particulates at both depths inside the DBRP were equal to 1.0×10^{-6}.

Ecological Risk Assessment

Based on characterization of the environmental setting and identification of potential receptor organisms, a conceptual site model was developed to determine the complete exposure pathways through which receptors could be exposed to COPCs.

Interpretation of the ecological significance of the unit-related contamination at the DBRP indicated that there was essentially no likelihood of unit-related chemicals causing significant impacts to the community of species in the vicinity of the unit.

Site-Specific Considerations

Site-specific considerations, based on the conclusions of the BRA and RFI/RI, which suggest limited or no potential, for significant risk include:

1) The DBRP contain a large volume of buried non-hazardous waste material and cover soil.
2) The levels of contamination recognized during Phase II characterization are generally very low; there is a preponderance of non-detects. The contaminants are very stable chemically and exhibit limited mobility in the soil.
3) The groundwater monitoring program indicates that there has not been signficant impact from the waste material in the pits.
4) The DBRP are in a remote area which has been recommended as a future industrial zone by the Citizens Advisory Board (CAB) and in the Savannah River Site Future Use Project Report (DOE, 1996).

Remedial Action Objectives

Remedial action objectives specify unit-specific contaminants, media of concern, potential exposure pathways, and remediation goals. The remedial action objectives are based on the nature and extent of contamination, threatened resources, and the potential for human and environmental exposure. Initially, preliminary remediation goals are developed based upon Applicable or Relevant and Appropriate Requirements (ARARs), or other information from the RFI/RI Report and the BRA. These goals should be modified, as necessary, as more information concerning the unit and potential remedial technologies becomes available. Final remediation goals will be determined when the remedy is selected and shall establish acceptable exposure levels that are protective of human health and the environment.

Risk levels at or above the upper-bound of the target risk range 1.0 X 10 -4 are considered significant and are expected to undergo remediation.

Location-specific ARARs must consider Federal, State, and local requirements that reflect the physiographical and environmental characteristics of the unit or the immediate area. Remedial actions may be restricted or precluded depending on the location or characteristics of the unit and the resulting requirements.

None of the risks associated with the soil in the DBRP was found to be greater than 1.0 x 10 -4. PCB-1260 from the 0-2 foot soil interval in Pit 431-D was the predominant risk driver for future residents, contributing 79% of the 1.0 x 10 -5 risk.

The hazard index for this exposure scenario was 0.7. The only guidance that was exceeded for soil concentrations was for PCB-1260 which had a maximum value of 3.39 mg/kg in the 0-2 foot

interval of boring 12 in Pit 431-D. The to-be-considered guidance for PCBs is recommended soil action levels of 1.0 mg/kg for residential use and 10-25 mg/kg for industrial use (EPA, 1990). The PCB-1260 concentration in Pit 431-D is well below the range for industrial land use.

VII. Description of the Considered Alternatives for the DBRP Source Control Operable Unit

The RFI/RI and BRA indicate the DBRP pose minimal risk to the environment. The risk to future on-unit workers is only 1.0×10^{-6}. Ingestion of soil in the top two foot layer by future residents poses a risk of 1.0×10^{-5}, primarily from PCB-1260. The Corrective Measures Study/Focused Feasibility Study (CMS/FFS) was developed to consider possible actions which could reduce the risks to 1.0×10^{-6} or less.

A broad suite of treatment alternatives has already been considered in the F-Area Burning/Rubble Pits (231-F, 231-1F and 231-2F) Corrective Measures Study/Feasibility Study (U) (WSRC, 1996a). Both sets of burning/rubble pits received similar wastes which were managed under similar conditions and practices; similar constituents of concern have been recognized for both facilities. On July 20, 1995, SRS, SCDHEC, and EPA held a scoping meeting for the DBRP CMS/FS. The agenda of this meeting included discussion of the site specific considerations and uncertanties, the limited risks associated with the DBRP, and the CAB proposed industrial land use zones. The conclusion of the scoping meeting was that focusing on a limited suite of alternatives in the feasibility study for the DBRP would be appropriate. Therefore, SRS conducted the CMS/FFS (WSRC, 1996b) for the DBRP, reducing the number of treatment options to be considered to the five alternatives discussed in the following paragraphs.

Five alternatives were evaluated for remedial action at the DBRP source control operable unit. Each alternative is described below:

Alternative 1 No Action

Under this alternative, no action would be taken at the DBRP. EPA policy and regulations

require consideration of a no action alternative to serve as a basis against which other alternatives can be compared. Because no further action would be taken and the DBRP would remain in their present condition, there are no costs associated with this alternative and there would be no reduction of risk. Potential risks of 1.0 x 10 -5 due to soil ingestion and 1.0 x 10 -3 from ingestion and inhalation of groundwater would remain for possible future residents. However, the groundwater risk is believed to be overestimated based on the groundwater monitoring history and contaminent concentrations in the DBRP soil as discussed in Section V.

Alternative 2 Institutional Controls

Under this alternative, institutional controls would be implemented at the DBRP. Implementation of this alternative will require both near- and long-term actions. For the near-term, signs will be posted indicating that this area was used to manage hazardous materials. In addition, existing SRS access controls will be used to maintain the use of this site for industrial use only.

In the long-term, if the property is ever transferred to non-fedederal ownership, the U.S. Government would create a deed for the new property owner in compliance with Section 120(h) of CERCLA. The deed would include notification disclosing former DBRP waste management and disposal activities, results from groundwater monitoring, and remedial actions taken on the site. The deed notification would, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of non-hazardous, inert construction debris, and that wastes containing hazardous substances, such as degreasers and

solvents, were also managed and burned on the site.

The deed would also include deed restrictions precluding residential use of the property. However, the need for these deed restrictions could be reevaluated at the time of transfer in the event that contamination no longer poses an unacceptable risk under residential use.

In addition, if the site is ever transferred to non-federal ownership, a survey plat of the area will be prepared, certified by a professional land surveyor and recorded with the appropriate county recording agency.

There are no construction costs associated with this alternative. The cost for surveying the land and filing with the Barnwell County Records is estimated to be $2,000. If five year reviews of remedy are required, the estimated present value for these reviews over the next 30 years is $8,000. The total present value costs for Alternative 2 are $10,000. Additional groundwater monitoring and reporting costs would total about $12,000 annually; these costs may not continue indefinately and are not included in the total cost used for comparison.

With essentially no further action except for the modest cost of deed notifications and restrictions upon transfer of the land and five year reviews, under Alternative 2 Institutional Controls, risks attributable to future workers at the DBRP would be 1.0×10^{-6}.

Alternative 3 Native Soil Cover (4')

A four foot thick cover of natural soil would be installed over the present surface of the DBRP to reduce the liklihood that future excavation for construction of a typical basement would expose waste or contaminated soil. If the property is ever transferred to private ownership, in compliance with CERCLA 120(h), the U.S. Government would create a deed with notifications and restrictions similar to those identified in Alternative 2. Future deed restrictions on excavation below four feet would be necessary to prevent potential exposure of future workers or residents to buried waste which may contain low concentrations of hazardous constituents.

The preparation of a Remedial Design/Remedial Action Work Plan would cost $30,000. The construction costs associated with this alternative are estimated at $160,000 for the installation of a four foot thick native soil cover. The cost for surveying the land and filing with the Barnwell County Records is estimated to be $2,000. Maintenance costs for 30 years are estimated at $15,000. If five year reviews would be required; the estimated present value for these reviews over the next 30 years is $8,000. Total present value costs for this alternative are estimated at $235,000.

With deed restrictions upon the transfer of the land to non-federal ownership per Section 120(h) of CERCLA, the risk to future workers and possible future residents would be reduced to less than 1.0×10^{-6}. The need for the deed restrictions would be reevaluated prior to transfer.

Alternative 4 Thermal Desorption/ Incineration

Under this alternative, the upper two feet of contaminated soil would be excavated for treatment to eliminate the PCB-1260, BaP, and OCDD. The soil would be fed through a high temperature rotary kiln to extract the volatile organic contaminants from the soil. The extracted gases would then be destroyed in the incinerator. The treated soil would be returned to the site and vegetation would be estiblished to prevent erosion. If the property is ever transferred to private ownership, in compliance with CERCLA 120(h), the U.S. Government would create a deed with notifications and restrictions similar to those identified in Alternative 2. Future deed restrictions (upon transfer of the land to non-federal ownership) on excavation below two feet would be necessary to prevent potential exposure of future workers or residents to buried waste which may contain low levels of hazardous constituents. The need for these deed restrictions could be reevaluated at the time of transfer in the event that contamination no longer poses an unacceptable risk under residential use.

Preparation of the Remedial Design/Remedial Action Work Plan to implement this alternative would cost $150,000. A National Emission

Standards for Hazardous Air Pollutants permit would be required at a cost of $150,000 because of the potential for atmospheric releases during remediation. The treatment cost for this alternative would be $1,500,000 and the deed restriction on excavation below two feet would cost $2,000 for a total cost of $1,502,000.

This alternative is protective of human health and would permanently reduce risk to less than 1.0 x 10 -6 for ingestion of soil from PCB-1260 for future on-site workers and future residents.

Alternative 5 Offsite Soil Disposal

Under this alternative, the upper two feet of contaminated soil would be excavated and transported to a licensed offsite disposal facility. The excavation would be filled to grade with clean native soil and cover vegetation would be established. If the property is ever transferred to private ownership, the U.S. Government would create a deed with notifications and restrictions similar to those identified in Alternative 2 in compliance with CERCLA 120(h). The potential risk for exposure of future workers and possible residents to low concentrations of hazardous constituents in the remaining waste would necessitate the filing of a deed restriction on excavation below two feet upon the transfer of the land to non-federal ownership. The need for these deed restrictions could be reevaluated at the time of transfer in the event that contamination no longer poses an unacceptable risk under residential use.

The preparation of a Remedial Design Remedial Action Work Plan would cost $150,000. The cost for excavation, transportation, disposal fees, and backfilling would be $932,000. The total cost for this would be $1,084,000, including $2,000 for recording the deed notifications and restrictions.

The risk to future workers and possible future residents would be reduced to less than 1.0 x 10 -6 from ingestion of PCB-1260 contaminanted soil.

VIII. Summary of Comparitive Analyses of the Alternatives

Description of Nine Evaluation Criteria

Each of the remedial alternatives was evaluated using the nine criteria established by the National Oil and Hazardous Substances Contingency Plan (NCP). The criteria were derived from the statutory requirements of CERCLA Section 121. The NCP [40 CFR § 300.430 (e)(9)] sets forth nine evaluation criteria that provide the basis for evaluating alternatives and selecting a remedy. The criteria are:

- overall protection of human health and the environment,
- compliance with ARARs,
- long-term effectiveness and permanence,
- reduction of toxicity, mobility, or volume through treatment,
- short-term effectiveness,
- implementability,
- cost,
- state acceptance, and
- community acceptance.

In selecting the preferred alternative, the above mentioned criteria were used to evaluate the alternatives developed in the D-Area Burning/Rubble Pits (431-D and 431-1D) Corrective Measures Study/Focused Feasibility Study (U) (WSRC, 1996b). Seven of the criteria are used to evaluate all the alternatives, based on human health and environmental protection, cost, and feasibility issues. The preferred alternative is further evaluated based on the final two criteria: state acceptance and community acceptance. Brief descriptions of all nine criteria are given below.

Overall Protection of Human Health and the Environment - The remedial alternatives are assessed to determine the degree to which each alternative eliminates, reduces, or controls threats to human health and the environment through treatment, engineering methods, or institutional controls.

Compliance with Applicable or Relivant and

Appropriate Requirements - ARARs are Federal and state environmental regulations that establish standards which remedial actions must meet. There are three types of ARARs: (1) chemical-

specific, (2) location-specific, and (3) action-specific.

Chemical-specific ARARs are usually health- or risk-based levels or methodologies which, when applied to unit-specific conditions, result in the establishment of numerical values. Often these numerical values are promulgated in Federal or state regulations.

Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in specific locations. Some examples of specific locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats.

Action-specific ARARs are usually technology- or remedial activity-based requirements or limitations on actions taken with respect to hazardous substances or unit-specific conditions. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy.

The remedial activities are assessed to determine whether they attain ARARs or provide grounds for involing one of the five waivers for ARARs. These waivers are:

- the remedial action is an interim measure and will become a part of a total remedial action that will attain the ARAR,
- compliance will result in greater risk to human health and the environment than other alternatives,
- compliance is technically impracticable from an engineering perspective,

- the alternative remedial action will attain an equivalent standard of performance through use of another method or approach,
- the state has not consistently applied the promulgated requirement in similar or at other remedial action sites in the state.

In addition to ARARS, compliance with other criteria, guidance, and proposed standards that are not legally binding, but may provide useful information or recommended procedures should be reviewed as To-Be-Considered when setting remedial objectives.

Long-Term Effectiveness and Permanence - The remedial alternatives are assessed based on their ability to maintain reliable protection of human health and the environment after implementation.

Reduction of Toxicity, Mobility, or Volume Through Treatment - The remedial alternatives are assessed based on the degree to which they employ treatment that reduces toxicity (the harmful nature of the contaminants), mobility (ability of the contaminants to move through the environment), or volume of contaminants associated with the unit.

Short-Term Effectiveness - The remedial alternatives am assessed considering factors relevant to implementation of the remedial action, including risks to the continunity during implementation, impacts on workers, potential environmental impacts (e.g., air emmissions), and the time until protection is achieved.

Implementability - The remedial alternatives are assessed by considering the difficulty of implementing the alternative including technical feasibility, constructability reliability of technology, ease of undertaking additional remedial actions (if required), monitoring considerations , administrative feasibility (regulatory requirements), and availability of services and materials.

Cost - The evaluation of remedial alternatives must include capital and operational and maintenance costs. Present value costs are estimated within +50/-30 percent, per EPA guidance. The cost estimates given with each alternative are prepared from information

available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity competitive market conditions, final project scope, final project schedule, and other variable factors. As a result, the final project costs may vary from the estimates presented herein.

State Acceptance - In accordance with the FFA, the State is required to comment on/approve the RFI/RI Report, the Baseline Risk Assessment, the Corrective Measures Study/Feasibility Study, and the Statement of Basis/Proposed Plan.

Community Acceptance - The community acceptance of the preferred alternative is assessed

by giving the public an opportunity to comment on the remedy selection Process. A public comment period was held and public comments concerning the proposed remedy are addressed in the Responsiveness Summary of this Record of Decision.

Detailed Evaluation

The remedial action alternatives discussed in Section VII have been evaluated using the nine criteria just described. Tables 4 through 8 present the evaluation of the soil remedial alternatives.

IX. The Selected Remedy

Based on the BRA, the DBRP unit soil poses a risk of 1.0 x 10 -6 for future workers in an industrial land use scenario via ingestion of the soil in the top 2 foot layer. Analysis of the risk evaluation indicated that calculated risks to future workers and residents under the inhalation and ingestion of groundwater pathway were exaggerated because of conservative assumptions in the modeling. The probable condition is that the DBRP source unit

is not contributing to groundwater contamination. As a result, no remedial action for the groundwater with a period of continued monitoring for confirmation is the only appropriate action.

Institutional Controls (Alternative 2) for the DBRP Source Unit and no remedial action for the groundwater with a period of confirmatory groundwater monitoring is the preferred action at the DBRP because:

1) the groundwater history at the DBRP (summarized in Section V) indicates low frequency of occurrences at low concentrations of gross alpha and total radium,
2) the DBRP soils do not represent a credible threat to the quality of groundwater in the future.

A plan for continued annual groundwater monitoring, during the second quarter of each calendar year, for the five wells at the DBRP will be included in the post-ROD document, the Corrective Measures Implementation/Remedial Action Report (CMI/RAR). The groundwater samples will be analyzed for following proposed list of constituents many of which have not been detected in the groundwater at the DBRP since monitoring began in 1983.

arsenic
benzene
benzo(a)anthracene
benzo(a)pyrene
benzo(b)fluoranthene
benzo(k)fluoranthene
chromium
chrysene
1,2-dichloroethane
dichloromethane
endrine
manganese
octachlorodibenzo-p-dioxin
PCB-1260
total radium
1,1,2-trichloroethane
tritium

The CMI/RAR will contain a detailed monitoring strategy which will outline the submittal schedule and contents of the monitoring reports, which will include an analysis of the data, a conclusion, and a

recommendation. The recommendation section of the CMI/RAR will provide for appropriate changes to the monitoring program with SCDHEC and EPA concurrence.

Table 4. Summary of the Evaluation of Alternative 1 No Acton Under the Nine CERCLA Criteria

Alternative 1 No Action

Overall Protection of Compliance with Long-term Reduction of Short-term Implementability Cost State Acceptance Community
Human Health and ARARS Effectiveness Toxicity, Mobility or Effectiveness Acceptance
the Environment Volume

• Protectiveness • Compliance • Magnitude of • Treatment process • Protection of • Ability to • Capital costs • Features of the • Features of the
residual risk used and materials community during construct and
alternative the state alternative the
treated
remedial actions operate the supports community supports

technology
No actions taken PCB-1260 exceeds Risks within EPA No treatment used. Not applicable. No Not applicable. No None.
None. None.
Will not reduce risks the TBE guidance risk range 1x10 -4 to remediation action taken.
from those reported 1.0 mg/kg for 1x10 -4, HI<1. performed.
in the BRA. residential use.

• Compliance with • Adequacy and • Amount of • Protection of • Reliability of the • Operating and • Features of the • Features of the
action-specific reliability of hazardous materials workers during technology maintenance costs alternatives about alternative about
ARARs controls destroyed or

treated remedial action
which the state has which the community

reservations has reservations
No action taken. Not Not applicable. None
destroyed or Not applicable. No Not applicable. No None.
Not applicable. Not applicable.
applicable. treated.
remediation technology applied.
performed.
• Compliance with • Degree of
• Environmental • Ease of • Elements of the
• Elements of the
location-specific expected
reduction impacts undertaking
alternative the state alternative the
ARARs in toxicity,
mobility, additional remedial
strongly opposes community strongly
and volume
action, if necessary opposes
The site is in No reduction
in None. Very easy. Not
applicable. The Not applicable. The
compliance with all toxicity,
mobility, or
state has concurred community supports
location-specific volume.
with Institutional Institutional Controls.
TBCs.
Controls.
• Compliance with • Degree to
which • Time until • Ability to monitor
other criteria, treatment is
remedial action effectiveness of the
advisories, and reversible
objectives are remedy
guidance
achieved
No action taken. Not Not
applicable. Not applicable. Easy to monitor.
applicable.
• Type and
quantity • Contaminants • Coordination with
of residuals
and ability in
remaining
after obtaining approvals
treatment
from other agencies
Not
applicable. PCB-1260 not Not applicable. No
Nothing is
changed. reduced. action taken.

• Availability of

necessary equipment

and specialists and

off-site services

Not applicable. No

action taken.

• Availability of

prospective

technologies

Not applicable. No

action taken.

Selected (Yes/No); Yes Rationale: Required by NCP as a baseline for comparison. (TBC=To be considered guidance)

Table 5. Summary of the Evaluation of Alternative 2 Institutional Controls under the Nine CERCLA
Criteria.

Alternative 2 Institutional Controls

Overall Protection of Compliance with Long-term Reduction of Short-term Implementability Cost State Acceptance Community
Human Health and ARARs Effectiveness Toxicity, Mobility, or Effectiveness Acceptance
the Environment Volume

• Protectiveness • Compliance • Magnitude of • Treatment process • Protection of • Ability to • Capital costs • Features of the • Features of the
residual risk used and materials

community during construct and alternative the state alternative the
treated
remedial actions operate the supports community supports
technology
Exceedes TBCs for DBRP complies with Overall risk is 1x No treatment used.
Not applicable. No Not applicable. No Low. Risks below 1x10 -4. Risks below 1x10 -4.
future residents only. industrial TBC 10 -4, HI is 0.03.
remediation action taken.
Precludes residential guidance 10-25 performed.
use of this property. mg/kg
• Compliance with • Adequacy and • Amount of
• Protection of • Reliability of the • Operating and • Features of the • Features of the
action-specific reliability of hazardous
materials workers during technology maintenance costs alternative about
alternative about
ARARs controls destroyed or treated remedial action
which the state has which the community
reservations has reservations
No action taken. Not Deed restrictions None destroyed or
Not applicable. No Not applicable. No Low. State supports Community supports
applicable. will prevent future treated.
remediation. technology applied. Institutional Controls. Institutional Controls.
residential use. performed.
• Compliance with • Degree of
• Environmental • Ease of • Elements of the • Elements of the
location-specific expected reduction
impacts undertaking alternative the state alternative the
ARARs in toxicity,
mobility, additional remedial stongly opposes
community strongly
and volume
action, if necessary opposes
The site is in No reduction in
None. Very easy. State supports Community supports
compliance with all toxicity,
mobility, or Institutional Controls.
Institutional Controls.
location-specific volume.
guidance.
• Compliance with • Degree to which

• Time until remedial action objectives are achieved

Not applicable.

• Ability to monitor other criteria, effectiveness of the advisories, and remedy guidance

No action taken. Not East to monitor. applicable.

treatment is reversible

Not applicable.

quantity and ability in obtaining approvals from other agencies

PCB-1260 not reduced.

• Contaminants

Not applicable. No action taken.

• Coordination with

• Type and of residuals remaining after treatment

All contaninants remain.

• Availability of necessary equipment and specialists and off-site services

Not applicable. No action taken.

• Availability of prospective technologies

Not applicable. No action taken.

Selected (Yes/No): Yes Rationale: Low cost alternative. Compliance with CAB recommendation for future industrial use of the land. ARARs are met. (YBC=To Be Considered)

Table 6. Summary of the Evaluation of Alternative 3 Native Soil Cover (4') under the Nine CERCLA
Criteria.

Alternative 3 Native Soil Cover (4')

Overall Protection of Compliance with Long-term Reduction in
Short-term Implementability Cost State
Acceptance Community
Human Health and ARARs Effectiveness Toxicity,
Mobility, or Effectiveness
Acceptance
the Environment Volume

• Protectiveness • Compliance • Magnitude of • Treatment
process • Protection of • Ability to • Capital costs
• Features of the • Features of the
residual risk used and
materials community during construct and
alternative the state alternative the
treated
remedial actions operate the supports
community supports

technology
Risk below 1x10 -4 Will meet PCB TBC Risk remains, No treatment
used. No risk to community Easy to install cover. Low.
Low cost, soil cover Low cost, soil cover
guidance for however 4' layer
while cover is provides
barrier provides barrier. CAB
residential 1 mg/kg. would allow shallow
installed.
recommended future
excavation.
industrial use.
• Compliance with • Adequacy and • Amount of
• Protection of • Reliability of the • Operating and • Features of
the • Features of the
action-specific reliability of hazardous
materials workers during technology maintenance costs
alternative about alternative about
ARARs controls destroyed or
treated remedial action
which the state has which the community

reservations has reservations
Must meet CAA Reliable unless None destroyed

or Minor risk to workers Cover can be Low. Inspection and
Contaminants remain. Contaminants remain.
requirements for dust deed restrictions on treated.
during installation breached. May be maintenance will be
CAB recommended
control. deep excavation are
due to heavy difficult to prevent required.
future industrial use.
not enforced.
equipment and dust. deep excavation.
• Compliance with • Degree of
• Environmental • Ease of • Elements of
the • Elements of the
location-specific expected
reduction impacts undertaking
alternative the state alternative the
ARARs in toxicity,
mobility, additional remedial
strongly opposes community strongly
and volume
action, if necessary opposes
None applicable. No reduction in
Potential impacts to Easy, additional None.
None.
toxicity or
volume, environmental from remediation may
dust and
leaching to heavy equipment and require removal of
groundwater
reduced. dust. cover.
• Compliance with • Degree to
which • Time until • Ability to monitor
other criteria, treatment is
remedial action effectiveness of the
advisories and reversible
objectives are remedy
guidance
achieved
Must comply with Cover is
completely Cover can be Easy to monitor
OSHA. reversible.
installed in <1 year. effectiveness.
• Type and
quantity • Contaminants • Coordination with
of residuals
and ability in
remaining after
obtaining approvals
treatment
from other agencies
All contaminants
PCB-1260 remains, Relatively easy to
remain.
but cover provides a obtain approval for

barrier to exposure. installing cover.

• Availability of

necessary equipment

and specialists and

off-site services

Easily available.

• Availability of

prospective

technologies

Readily available.
Selected (Yes/No): Yes Rationale: ARARs are met.
Would allow restricted future residential use of property. (TBC= To be considered guidance)

Table 7. Summary of the Evaluation of Alternative 4 Thermal Desorption/Incineration under the Nine
CERCLA Criteria.

Alternative 4 Thermal Desorption/Incineration

Overall Protecton of Compliance with Long-term Reduction of Short-term Implementability Cost
State Acceptance Community
Human Health and ARARs Effectiveness Toxicity, Mobility, or Effectiveness
Acceptance
the Environment Volume

• Protectiveness • Compliance • Magnitude of • Treatment process • Protection of • Ability to • Capital costs • Features of the • Features of the
residual risk used and materials community during construct and
alternative the state alternative the
treated remedial actions operate the supports
community supports

technology
Offers complete Will meet PCB TBC Remaining risk will PCBs will
be Community will be Implementable. High.
Complete Complete
protection of human for residential use 1 be below 1x10 -4. destroyed.
protected from off- remediation.
remediation.
health and the mg/kg.
gas and dust by
environment.
engineering controls.
• Compliance with • Adequacy and • Amount of
• Protection of • Reliability of the • Operating and • Features of the
• Features of the
action-specific reliability of hazardous
materials workers during technology maintenance costs
alternative about alternative about
ARARs controls destroyed
or treated remedial action
which the state has which the community

reservations has reservations
Must meet CAA Reliable unless PCBs will
be Manageable risk to Very reliable. High. Subsequent
None. CAB recommended
requirements for dust deed restrictions on destroyed.
workers due to maintenance will not
future industrial use.
and off-gas control. deep excavation are
equipment, off-gas be required.
High cost for alight
not enforced.
and dust.
risk reduction.
• Compliance with • Degree of
• Environmental • Ease of • Elements of the
• Elements of the
location-specific expected
reduction impacts undertaking
alternative the state alternative the
ARARs in
toxicity, mobility, additional remedial
strongly opposes community strongly
and volume
action, if necessary opposes
None applicable. Virtually
complete. Potential impacts to Easy, no additional
None. None.

environment from remediation should

equipment, gas, and be required.

dust.

• Compliance with

• Degree to

which

• Time until

• Ability to monitor

other criteria,

treatment

is

remedial action

effectiveness of the

advisories, and

reversible

objectives are

remedy

guidance

achieved

Must comply with

Irreversible.

Can be completed in

Easy to monitor

OSHA.

<1 year.

effectiveness.

• Type and

quantity

• Contaminants

• Coordination with

of

residuals

and ability in

remaining

after

obtaining approvals

treatment

from other agencies

None.

PCB-1260 destroyed.

Air permits required.

• Availability of

necessary equipment

and specialists and

off-site services

Somewhat limited.

• Availability of

prospective

technolgies

Somewhat limited.

Selected (Yes/No): Yes

Rationale: ARARs are met. Would allow future residential use of property with restrictions on excavation below 2 feet. (TBC=To be considered)

Table 8. Summary of Evaluation of Alternative 5 Offsite Soil Disposal under the Nine CERCLA Criteria.

Alternative 5 Offsite Soil Disposal

Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-term Effectiveness	Reduction of Toxicity, Mobility, or Volume
• Protectiveness • Features of the alternative the state remedial actions community supports technology	• Compliance • Protection of community during • Features of the alternative the operate the	• Magnitude of residual risk • Ability to construct and	• Treatment process • Capital costs used and treated supports
Offers complete protection of human health and the environment.	Will meet PCB TBC guidance for residential use, 1 mg/kg.	Remaining risk will be below 1x10 -4	PCB contaminated soil will be removed by engineering controls.
• Protection of the materials alternative about treated which the state has reservations	• Compliance with action-specific workers during remedial action • Reliability of the alternative about ARARs which the community has reservations	• Adequacy and reliability of technology controls • Operating and	• Amount of hazardous maintenance costs destroyed or • Features of maintenance will not
Manageable risk to CAB recommended removed future industrial use.	Must meet CAA requirements for dust workers due to control.	Reliable unless deed restrictions on deep excavation are be required.	PCB contaminated soil will be and replaced with
equipment and dust.	Very reliable	High. Subsequent	None.

High cost for slight

not enforced.

clean fill.

risk reduction.

• Compliance with

• Degree of

• Environmental

• Ease of

• Elements of

the

• Elements of the

location-specific

expected

reduction

impacts

undertaking

alternative the state

alternative the

ARARs

in toxicity,

mobility,

additional remedial

strongly opposes

community strongly

and volume.

action, if necessary

opposes

None applicable.

Virtually

complete,

Potential impacts to

Easy, no additional

None.

None.

PCB is removed.

environment from

remediation should

equipment and dust.

be required.

• Compliance with

• Degree to which

• Time until

• Ability to monitor

other criteria,

treatment is

remedial action

effectiveness of the

advisories, and

reversible

objectives are

remedy

guidance

achieved

Must comply with

Irreversible.

Can be completed in

Easy to monitor

OSHA.

six months.

effectiveness.

• Type and

quantity

• Contaminants

• Coordination with

of residuals

and ability in

remaining after

obtaining approvals

treatment

from other agencies

None.

PCB-1260 removed.

DOT regulations.

• Availability of

necessary equipment

and specialists and

off-site services

Readily available.

• Availability of

prospective

technologies

Readily available.
Selected (YES/No): Yes Rationale: ARARs are met. Would allow future residential use of property with restrictions on excavation below 2 feet. (TBC=To be considered)

Implementation of this alternative will require both near- and long-term actions. For the near-term, signs will be posted indicating that this area was used to manage hazardous materials. In addition, existing SRS access controls will be used to maintain the use of this site for industrial use only.

In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government will create a deed for the new property owner in compliance with Section 120(h) of CERCLA. The deed will include notification disclosing former waste management and disposal activities, results from groundwater monitoring, and remedial actions taken on the site. The deed notification will in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of non-hazardous, inert construction debris, and that wastes containing hazardous substances, such as degreasers and solvents, were also managed and burned on the site.

The deed will also include deed restrictions precluding residential use of the property. However, the need for these deed restrictions could be reevaluated at the time of transfer in the event that contamination no longer poses an unacceptable risk under residential use.

In addition, if the site is ever transferred to non-federal ownership, a survey plat of the area will

be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

The Institutional Controls Alternative is intended to be the final action for the DBRP Source Unit. The solution is intended to be permanent and effective in both the long and near terms. This alternative is considered to be the least cost option which is still protective of humun health and the environment.

Tbe SCDHEC has modified the SRS RCRA permit to incorporate the selected remedy.

This proposal is consistent with EPA guidance and is an effective use of risk management principles.

X Statutory Determinations

Based on the DBRP RFI/RI Report and the BRA, the DBRP source operable unit poses no significant risk to the environment and minimal risk to human health. Therefore, a determination has been made that Institutional Controls are sufficiently protective of human health and the environment for the remaining contamination in the DBRP soils and groundwater.

The selected remedy is protective of human health and the environment, complies with Federal and State of South Carolina requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The random distribution and low levels of contamination preclude a remedy in which treatment is a practical alternative. Institutional Controls will result in hazardous substances, pollutants, or contaminants remaining in the waste unit. Because treatment of the principal threats of the site was found to be impracticable, this remedy does not satisfy the statutory preference for treatment as a principal element.

Section 300.430 (f)(4)(ii) of the NCP requires that a five-year review of the ROD be performed if hazardous substances, pollutants, or contaminants remain in the waste unit. The three Parties, DOE, SCDHEC, and EPA, have determined that a Five Year Review of the ROD for the DBRP will be performed to ensure

continued protection of human health and the environment.

XI. Explanation of Significant Changes

The Statement of Basis/Proposed Plan and the draft RCRA permit modification provided for involvement with the community through a document review process and a public comment period. A public meeting was advertised and held on October 15. Comments that were received during the 45-day public comment period (September 17 through October 31, 1996) are addressed in Appendix A of this Record of Decision and are available with the final RCRA permit.

The only changes to the remedy proposed for the DBRP in the Statement of Basis/Proposed Plan (WSRC, 1996c) are: (1) that the probable condition is that no significant groundwater contamination is originating in the DBRP and no remedial action for the groundwater with a period of continued monitoring for confirmation of no leaching to groundwater is the only appropriate action, and (2) it was determined that it was not appropriate to append the continued groundwater monitoring plan to the ROD as proposed in the Statement of Basis/Proposed Plan. The plan for continued groundwater monitoring will be included in the CMI/RAR. In the event that the probable condition is no longer appropriate, DOE will evaluate the need for remedial action.

XII. Responsiveness Summary

There were three comments received during the public comment period. The Responsiveness Summary (see Appendix A) of this Record of Decision addresses these comments.

XIII. Post-ROD Document Schedule

The post-ROD document schedule is listed below and is illustrated in Figure 4:

1. Corrective Measures Implementation/ Remedial Action Report (CMI/RAR) Revision 0 for the DBRP will be submitted for EPA and SCDHEC review four months after issuance of the ROD.

2. EPA and SCDHEC review of the DBRP CMI/RAR Revision 0 will last 90 days.

3. SRS revision of the DBRP CMI/RAR Revision 0 will be completed in 60 days after receipt of all regulatory comments.

4. EPA and SCDHEC final review and approval of the DBRP CMI/RAR Revision 1 will last 30 days.

<IMG SRC 97027L>

XIV. REFERENCES

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SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 03/27/1997
Operable Unit: 04
ROD ID: EPA/541/R-97/024

Media: Groundwater,Soil,Water

Contaminant: Tritium, plutonium, nuclear materials, chemical wastes, radioactive wastes, duPont Freon 11

Abstract: The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina. SRS is a secured U.S. government facility with no permanent residents. SRS is located approximately 25 miles southeast of Augusta, GA and 20 miles south of Aiken, SC. SRS is owned by the Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided nuclear materials for the space program and for medical, industrial, and research efforts. Chemical and radioactive wastes are byproducts of nuclear material production processes. During the period from 1955 to 1960, to defend SRS in the event of an air attack, the U.S. Army established on-site anti-aircraft artillery gun replacements at several locations near the perimeter of SRS. The Gunsite 720 was one of the those emplacements. There is no documentation of record of an hazardous substance management or disposal at this unit. There is no evidence of any burning or excavation at this waste unit.In the early to mid 1980s, while work was being performed in the area, nine empty, partially buried drums, labeled "duPont Freon 11" were found at the gunsite. The drums were excavated in July 1987, and placed on a pallet at the gunsite. The area around the drums was screened during

excavation and the liquid (rainwater) that collected in the excavated drums was sampled prior to disposal. No evidence of hazardous substances was found. In October 1989, the drums were removed from the unit. A review of SRS plans and maps indicted that an underground fuel storage tank was at the gunsite. An above-ground tank was also noted on the maps; however, there is no physical evidence that the tank still exists at this unit. No contamination, other than household trash (bottles, wrappers, etc.), was noted in the area. Currently, the unit consists of two concrete slabs and an old well.

Remedy: The results of the investigation at the site indicate that the Gunsite 720 Rubble Pit Unit poses no risk to human health or the environment; therefore, no action is needed at the Gunsite 720 Rubble Pit Unit. This is the final action for the Gunsite 720 Rubble Pit Unit. The South Carolina Department of Health and Environmental Control has modified the SRS RCRA permit to incorporate the selected remedy.

Text: Full-text ROD document follows on next page.

<IMG SRC 970240>

<IMG SRC 97024A>

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<IMG SRC 97024C>

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

The Gunsite 720 Rubble Pit (631-16G)
Operable Unit: Final Action

WSRC-RP-96-00832
Revision 1
January 1997

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U.S. Department of Energy under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

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DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

Gunsite 720 Rubble Pit Unit
(SRS Building 631-16G)
Savannah River Site
Aiken, South Carolina

The Gunsite 720 Rubble Pit Unit (631-16G) is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Unit/Comprehensive Environmental Response, Compensation, and Liability Act (CERCIA) Unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS).

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Gunsite 720 Rubble Pit Unit located at the Savannah River Site near Aiken, South Carolina. The selected action was developed in accordance with CERCLA, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The selected remedy satisfies both CERCLA and RCRA 3004 (u) requirements. This decision is based on the Administrative Record File for this specific RCRA/CERCLA Unit.

Description of the Selected Remedy

The results of the Resource Conservation and Recovery Act Facility Investigation/ Comprehensive Environmental Response, Compensation, and Liability Act Remedial Investigation, indicate that the Gunsite 720 Rubble Pit Unit poses no risk to human health or the environment. Therefore, no action is needed at the Gunsite 720 Rubble Pit Unit. This is the final RCRA/CERCLA action for the Gunsite 720 Rubble Pit Unit. The South Carolina Department of Health and Environmental Control has modified the SRS RCRA permit to incorporate the selected remedy.

Declaration Statement

Based on the results of the remedial investigation, no action is necessary at the Gunsite 720 Rubble Pit Unit to ensure the protection of human health and the environment. Since the Gunsite 720 Rubble Pit Unit poses no threat to human health or the environment, and no action is needed, the CERCLA Section 121 requirements are not applicable. This action is protective of human health and the environment and is meant to be a permanent solution, final action, for the Gunsite 720 Rubble Pit Unit. No five-year remedy review is needed or will be performed.

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DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

The Gunsite 720 Rubble Pit (631-16G)
Operible Unit: Final Action

WSRC-RP-96-00832
Revision 1
January 1997

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U.S. Department of Energy under Contract DE-AC09-96SR18500

Savannah River Operations Office
Aiken, South Carolina

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Section I. Site and Operable Unit Name, Location, and Description

Introduction

The Savannah River Site (SRS) occupies

approximately 803 square kilometers (310 square miles) of land adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina. SRS is a secured U.S. government facility with no permanent residents. SRS is located approximately 40 kilometers (25 miles) southeast of Augusta, GA and 32 kilometers (20 miles) south of Aiken, SC. Figure 1 shows the location of the Gunsite 720 Rubble Pit Unit in relation to other facilities at SRS.

SRS is owned by the Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided nuclear materials for the space program and for medical, industrial, and research efforts. Chemical and radioactive wastes are byproducts of nuclear material production processes.

The Federal Facility Agreement (FFA, 1993) for SRS lists the Gunsite 720 Rubble Pit Unit (631-16G) as a RCRA/CERCLA Unit that required further evaluation. An investigation/asssmsment process that integrates and combines the RCRA Facility Investigation (RFI) with the CERCLA Remedial Investigation (RI) to determine the actual or potential impact to human health and the environment was performed.

The Gunsite 720 Rubble Pit Unit is located within SRS and is approximately 305 meters (1000 feet) west of South Carolina Highway 125, 168 meters (550 feet) north of SRS Road A-2, and

2.5 kilometers (1.5 miles) from the nearest SRS boundary (see Figure 1).

The topography of the area is relatively flat with an elevation of about 95.7 meters (150 feet) above mean sea level. The unit consists of an open area covered with natural shrub growth and surrounded by native pine trees. The unit encompasses an area of approximately 2,250 square meters,

(25,000 square feet). Two concrete slabs and an old well are located on the east side of the unit (see Figure 2). Surface drainage in the area is to Upper Three Runs Creek, approximately 1,200 meters (4000 feet) south of the unit. The water table in the area is approximately 10 feet below ground surface.

Section II. Operable Unit History and Compliance History

Operable Unit History

During the period from 1955 to 1960, to defend SRS in the event of an air attack, the U.S. Army established onsite anti-aircraft artillery gun emplacements at several locations near the perimeter of SRS. The Gunsite 720 was one of those emplacements. There is no documentation or record of any hazardous sub0ance management or disposal at this unit. There is no evidence that any recent disposal activity has occurred. Also, them is no evidence of any burning or excavation at this waste unit.

In the early to mid 1980s, while work was being performed in the area, nine (9) empty, partially buried drums, labeled "duPont Freon 11", were found at the gunsite. The drums were excavated in July 1987, and placed on a pallet at the gunsite. The area around the drums was screened during excavation and the liquid (rainwater) that collected in the excavated

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drums was sampled prior to disposal. No evidence of hazardous substances was found. In October 1989, the drums were

removed from the unit. A review of SRS plans and maps indicated that an underground fuel storage tank was at the gunsite. An above-ground tank was also noted on the maps. However, there is no physical evidence that the tanks still exists at this unit. No contamination, other than household trash (bottles, wrappers, etc.), was noted in the area. Currently, the unit consists of two concrete slabs and an old well.

Compliance History

At SRS, certain waste materials are managed in accordance with the requirements of the Resource Conservation and Recovery Act (RCRA). To comply with the requirements of RCRA, certain SRS activities have required treatment, storage, or disposal, closure or post closure RCRA permits.

Non-regulated units, called solid waste management units (SWMU), include any activity where hazardous constituents may remain uncontrolled and may potentially release to the environment. Investigation and potential corrective action for these SWMU(s) are mandated under RCRA 3004(u).

In 1995, SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control (SCDHEC, which includes corrective action requirements. Specifically, Part V of the permit mandates that SRS establish and implement a RCRA Facility Investigation (RFI) program to fulfill the requirements specified in Section 3004(u).

Hazardous substances, as defined by CERCLA, are also present in the environment at SRS. On December 21, 1989, SRS was placed on the National Priorities List (NPL). A site placed on the

NPL comes under the requirements of CERCLA. In accordance with Section 120 of CERCLA, DOE has entered into an FFA with EPA and SCDHEC to coordinate cleanup activities at SRS into one comprehensive strategy that fulfills RCRA

Section 3004(u) and CERCLA assessment, investigation, and response action requirements.

The remedial investigation for the Gunsite 720 Rubble Pit Unit was conducted from March 1988 to early 1993. The results of the RFI/RI Report completed in 1996 (WSRC, 1996a) indicate that the Gunsite 720 Rubble Pit Unit poses no current or future risk to human health or the environment. Therefore, no action is warranted.

According to EPA guidance, if there is no current or potential durat to human health and the environment and no action is warranted, the CERCLA 121 requirements are not triggered. This means that there is no need to evaluate other alternatives.

To fulfill the public participation requirements of CERCLA, RCRA, and the South Carolina Hazardous Waste Management Regulations (SCHWMR), a Statement of Basis/Proposed Plan (WSRC, 1996b) presenting the no action alternative and the rational for selecting the alternative was prepared and submitted for public comment. The public was provided an opportunity to participate in the remedy selection process and was strongly encouraged to submit comments (see Section III). Following the public comment period, all the comments submitted were reviewed and considered. DOE, in consultation with EPA-Region IV and SCDHEC, selected the final action for the Gunsite 720 Rubble Pit Unit. Final selection of the remedial alternative satisfies FFA requirements. SCDHEC has modified the SRS RCRA permit to incorporate the selected remedy.

Section III. Highlights of

Community Participation

Public participation requirements are listed in CERCLA Sections 113 and 117. These requirements include the establishment of an Administrative Record File that documents the selection of remedial alternatives and allows for review and comments by the public regarding those alternatives. The Administrative Record File must be established "at or near the facility at issue". The SRS Public Involvement Plan (DOE, 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. Section 117 (a) of CERCLA requires publication of a notice of any proposed remedial action and provides the public an opportunity to participate in the selection of a remedial action. The Statement of Basis/Proposed Plan for the Gunsite 720 Rubble Pit Unit, which is part of the Administrative Record File, highlights the aspects of the investigation and identifies the preferred action for addressing the Gunsite 720 Rubble Pit Unit.

RCRA provides opportunities for the public to comment on draft permit modifications. Public participation requirements are also listed in SCHWMR R.61-79.124 and require publication of the draft permit modifications. SCHWMR R.61-79.124 requires a brief description and response to all significant comments be made available to the public as a part of the Administrative Record. The preferred alternative proposed in the Statement of Basis/Proposed Plan was also proposed as a draft permit modification under RCRA. Therefore, any comments received on the Statement of Basis/Proposed Plan wore also applicable to the draft RCRA permit modification, proposing the same remedy for the Gunsite 720 Rubblc Pit Unit.

The Administrative Record File, which contains the Statement of Basis/Proposed Plan and all the documents (unabridged) listed in the reference section of this document, is available at the EPA Office

and at the following locations:

U.S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, SC 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, SC 29208
(803) 777-4866

Similar information is available through the repositories listed below:

Reese Library
Augusta State University
2500 Walton Way
Augusta, GA 30910
(706) 737-1744

Asa H. Gordon Library
Savannah State University
Tompkins Road
Savannah, GA 31404
(912) 356-2183

The public was notified of a public comment period by mailing the SRS Environmental Bulletin, a newsletter sent to approximately 3500 citizens in South Carolina and Georgia, and through the Aiken Standard, the Allendale Citizen Leader, the Barnwell People-Sentinel, the State, and the Augusta Chronicle newspapers. The public comment period was also announced on local radio stations. The 45-day public comment period began on September 17, 1996 and ended on October 31, 1996. No public comments were received.

Section IV. Scope and Role of Operable Unit within the Site Strategy

The overall strategy for addressing the Gunsite 720 Rubble Pit Operable Unit was to: (1) determine if there had been a release of hazardous substances; (2) determine the nature and extent of any contamination; (3) perform a baseline risk assessment; and (4) evaluate the need for remedial action to address any potential risks to human health and the environment.

The investigation and risk assessment have been completed for the Gunsite 720 Rubble Pit Unit. Since the results of the investigation indicate that the unit poses no risk to human health or the environment, no action was recommended.

The field investigations and soil sampling conducted during 1990 and 1993 also indicate that there are no hazardous substances at the Gunsite 720 Rubble Pit Unit that would impact the groundwater.

The Gunsite 720 Rubble Pit Unit is an operable unit located within the Upper Three Runs Creek watershed. All the source control and groundwater operable units located within this watershed will be evaluated to determine their impacts, if any, to the associated streams and wetlands.

SRS will manage all source control units to prevent impact to the watershed. Upon disposition of all source control and groundwater operable units within this watershed, a final comprehensive ROD for the Upper Three Runs Creek watershed will be pursued.

Section V. Summary of Operable Unit Characteristics

The Gunsite 720 Rubble Pit Unit was one of the anti-aircraft artillery gun emplacements the U.S. Army established at several locations near the perimeter of SRS. There is no documentation or record of any

hazardous substance management or disposal at this unit. There is no evidence that any recent disposal activity has occurred. Also, there is no evidence of any burning or excavation at this waste unit.

Media Assessment

The RFI/RI Work Plan (WSRC, 1990) and RFI/RI Report (WSRC, 1996a) contain detailed information and analytical data for all the investigations conducted and samples taken in the media assessment of the Gunsite 720 Rubble Pit Unit. These documents are part of the Administrative Record File. The results of the RFI/RI Report are summarized below.

In 1986, a magnetic survey was conducted to locate underground tank(s) beheved to be buried at the unit. However, the results of the magnetometer survey were inconclusive.

In March 1988, four soil gas samples were analyzed for chlorinated hydrocarbons. No chlorinated hydrocarbons (chlorinated solvents) were detected.

In March 1989, a ground penetrating radar survey was also conducted. The survey indicated that there were no buried or underground objects in the area. Trenches were also excavated at the unit to visually characterize buried waste and to locate and identify any underground storage tanks that might be present (see Figure 2). No evidence of burial pits was found. No trenches were backfilled with the excavated materials and leveled.

Soils

During 1990, 12 soil samples were obtained from various locations and depth

intervals within the Gunsite 720 Rubble Pit Unit area and at one background location (see Figure 2). The concentrations detected for al] the hazardous substances were below their respective EPA risk-based concentration levels.

In early 1993, SCDHEC expressed some concerns regarding the existence of the underground storage tanks at the unit and potential releases from the tanks and the drums that were located at the Gunsite 720 Rubble Pit Unit. SRS performed additional ground penetrating radar and magnetometer surveys, and also obtained additional soil samples from the areas where the drums had been found and the underground storage tank was believed to have been located. Samples were collected at various depths ranging from 1.2 meters (4 feet) down to 5.5 meters (18 feet). Figure 2 shows the locations of samples collected in the 1993 survey.

The ground penetrating radar and magnetometer surveys did not indicate the existence of an underground storage tank or any other buried debris. It was concluded that the tank had been removed,

No hazardous substances were detected in the underground storage tank area. In the drum area also, the maximum concentration of all the hazardous substances detected (except for chromium) were lower than the maximum concentrations found in the 1990 sampling. Hence, the only metal detected in 1993 sampling exceeding the 1990 maximum concentration was chromium. However, the concentration was significantly less than EPA risk-based concentrations for chromium (Cr +6 and Cr +3).

Based on comparison of analytical results to risk-based concentrations and two times unit specific concentrations, it was evident

that there had been no environmental impact due to hazardous substance disposal at or release from the Gunsite 720 Rubble Pit Unit.

Groundwater

Since preliminary investigations conducted in 1988 and soil samples collected in 1990 and 1993 concluded that there was no evidence of contamination, no groundwater investigations were conducted.

Surface Water/Sediment

No surface water or sediment sampling was conducted because the nearest surface water feature (the Upper Three Runs Creek) is located approximately 1.2 kilometers (3/4-mile) from the Gunsite 720 Rubble Pit Unit.

Section VI. Summary of Operable Unit Risks

Human Health Risks

As part of the RCRA/CERCIA process for the Gunsite 720 Rubble Pit Unit, a risk assessment was performed using data generated during the assessment phase. Detailed information regarding the developmwnt of constituents of potential concern, fate and transport of contaminants and risk assessment can be found in the RFI/RI Report for the Gunsite 720 Rubble Pit Unit (631-16G) (U), WSRC-RP-95-360, Rev. 1 (WSRC, 1996).

After combining analytical data and eliminating those analytes; not detected in any samples, the data were evaluated on the basis of quality with respect to sample quantitation limits, frequency of detection, relative toxic potential of the constituent, laboratory qualifiers and codes, and blanks. The remaining data (constituents detected)

were compared to two times the unit-specific background and EPA developed Risk-Based Concentrations (RBCs).

RBCs developed by EPA Region III (EPA, 1995) were used to screen the constituents of potential concern for the Gunsite 720 Rubble Pit Unit. This guidance provides reference doses and carcinogenic potency data for nearly 600 chemicals. These toxicity constants have been combined with "standard" exposure scenarios to calculate RBCs (i.e., chemical concentrations corresponding to fixed levels of risk; a hazard quotient of 1, or a lifetime cancer risk of one in one million). The RBCs are very similar to preliminary remediation goals which are concentration goals for individual chemicals for a specific medium and land use combinations at CERCLA Units.

Following the comparison to background and RBCs, it was concluded that the concentrations of all hazardous materials analyzed were below any EPA risk-based concentration action levels. Hence, there are no constituents of potential concern for evaluation in a CERCLA baseline risk assessment (BRA), and there is no determinable risk associated with the Gunsite 720 Rubble Pit Unit.

Current Land Use

Since there is no current activity at the Gunsite 720 Rubble Pit Unit the current land use scenario is not applicable.

Future Land Use

Since there is no constituents of concern and no determinable risk associated with the Gunsite 720 Rubble Pit Unit, the future land use scenario is not applicable.

Ecological Risks

Based on the physical and analytical data pertaining to this unit, there is no evidence

that waste materials were managed or disposed of at the Gunsite 720 Rubble Pit Unit. Therefore, it is reasonable to conclude that this unit presents no significant ecological risk.

Section VII. Description of the No Action Alternative

Based on the unit characterization and risk assessment, the Gunsite 720 Rubble Pit Unit poses no risk to human health and the environment. Therefore, the unit requires no cleanup activities and the no action alternative is recommended for this unit. No additional alternatives were considered for evaluation.

The no action alternative means that no remedial action will be performed at the Gunsite 720 Rubble Pit Unit. There is no waste to treat, no institutional or engineering controls are required, and there are no applicable or relevant and appropriate requirements (ARARs). Because no further action would be taken, the Gunsite 720 Rubble Pit Unit would remain in its present condition. No costs will be involved for this action.

Since the Gunsite 720 Rubble Pit quit poses no risk to human health or the environment and no action is warranted at this unit, the CERCLA Section 121 requirements are not applicable. The no action alternative will be the final action for the Gunsite 720 Rubble Pit Unit and there will be no five-year (ROD) reviews. This solution is meant to be permanent and effective in both the long and short term, and protective of human health and the environment.

Section VIII. References

DOE (U.S. Department of Energy), 1994, Public Involvement, A Plan for the Savannah River Site, Savannah River Operations Office, Aiken, SC.

EPA (U.S. Environmental Protection Agency), 1995, Risk-Based Concentration Table, EPA-III, January-June 1995, dated March 7, 1995.

Federal Facility Agreement (FFA), 1993, Federal Facility Agreement for the Savannah River Site, Administrative Docket No. 89-05-FF, (Effective Date: August 16, 1993),

WSRC, 1990, RCRA Facility Investigation/Remedial Investigation Plan for the Gunsite 720 Rubble Pit Unit, WSRC-RP-90-1049, Westinghouse Savannah River Company, Aiken, SC.

WSRC, 1996a, RCRA Facility Investigation/Remedial Investigation Report for the Gunsite 720 Rubble Pit Unit (631-16G) (U), WSRC-RP-95-360, Rev. 1, Westinghouse Savannah River Company, Aiken, SC.

WSRC, 1996b, Statement of Basis/Proposed Plan for the Gunsite 720 Rubble Pit Unit (631-16G) (U), WSRC RP-96-217, Rev. 1, Westinghouse Savannah River Company, Aiken, SC.

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 03/27/1997
Operable Unit: 05
ROD ID: EPA/541/R-97/023

Media: Soil.

Contaminant: Arsenic, chromium, lead.

Abstract: The Savannah River Site (SRS) is located 25 miles southeast of Augusta, Georgia and occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell Counties in South Carolina. SRS is a secured government facility with no permanent residents. SRS is owned by the Department of Energy (DOE) but is managed and operated by Westinghouse Savannah River Company (WSRC). Operable Unit 5 (OU 5) covers the Gunsite Access Road (631-24G).SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided medical, industrial, and research efforts. Chemical and radioactive wastes are byproducts of nuclear material production processes. During the period from 1955 to 1960, the U.S. Army established on-site anti-aircraft artillery gun emplacements at several locations near the perimeter of the site to defend the SRS in the event of an air attack. In the mid-1980s, sparse vegetation, dead trees, and small amounts of soil were discovered on a portion of the road leading to Gunsite 113. This area, encompassing a portion of the road, became the Gunsite 113 Access Road Unit. The area appears to have been used as a surface disposal area for spoil dirt and/or road construction debris. An investigation was conducted for the Gunsite 113 Access Road from 1988 until early 1993. The results indicated that the site posed no current or future risk to human health and the environment.

Remedy: The results of an investigation at the site revealed that the Gunsite 113 Access Road Unit poses no risk to human health or the environment; therefore, no further action has been selected for the site.

Text: Full-text ROD document follows on next page.

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United States Department of Energy
Savannah River Site

Record of Decision
Remedial Alternative Selection for the Gunsite 113 Access Road (631-24G) Operable Unit: Final Action (U)

WSRC-RP-96-00833
Revision 1
January 1997

Prepared by:
Westinghouse Savannah River Company
Savannah River Site
Aiken, South Carolina 29808

<IMG SRC 97023A>

Prepared for the U.S. Department of Energy Under Contract No. DE-AC09-96SR18500

<IMG SRC 97023B>

CERTIFIED MAIL
RETURN RECEIPT-REQUESTED

4WD-FFB

Mr. Keith Collinsworth, FFA Project Manger
Federal Facility Agreement Section
Division of Site Engineering and Screening

Bureau of Solid & Hazardous Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

SUBJ: Transmittal of Signed Records of Decision for Gunsite 720, Gunsite 113, Grace Road, D-Area Burning/Rubble Pits, F-Area Burning/Rubble Pits, and Silverton Road Waste Unit

Dear Mr. Collinsworth:

Enclosed you will find six (6) Records of decision for the above referenced sites. The Environmental Protection Agency (EPA) has signed these documents. We are transmitting them to you for signature by the State of South Carolina. After signature, please forward the signed documents to the Department of Energy so that they may be included in the administrative record.

If you have any questions, please contact me at (404)562-8551 or Jeffery L. Crane, FFA Project Manger at (404) 562-8546.

<IMG SRC 97023C>

cc: Brian Hennesey, DOE-SRS
Kim Wierzbicki, WSRC
Donna Brumley, DOE-SRS
Hammett DOE-SRS

<IMG SRC 97023D>

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

The Gunsite 113 Access Road (631-24G)
Operable Unit: Final Action

WSRC-RP-96-00833
Revision 1
January 1997

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U.S. Department of Energy under Contract DE-AC09-96SR18500
Savannah River Operations Office

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DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

Gunsite 113 Access Road Unit
(SRS Building 631-24G)
Savannah River Site
Aiken, South Carolina

The Gunsite 113 Access Road Unit (631-24G) is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Unit/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS).

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Gunsite 113 Access Road Unit located at the Savannah River Site near Aiken, South Carolina. The selected action was developed in accordance with CERCLA, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The selected remedy satisfies both CERCLA and RCRA 3004(u) requirements. This decision is based on the Administrative Record File for this specific RCRA/CERCLA Unit.

Description of the Selected Remedy

The results of the Resource Conservation and Recovery Act Facility Investigation/ Comprehensive Environmental Response, Compensation, and Liability Act Remedial Investigation, indicate that the Gunsite 113 Access Road Unit poses no risk to human health or the environment. Therefore, no action is needed at the Gunsite 113 Access Road Unit. This

is
the final RCRA/CERCLA action for the Gunsite 113 Access Road Unit. The South Carolina Department of Health and Environmental Control has modified the SRS RCRA permit to incorporate the selected remedy.

Declaration Statement

Based on the results of the remedial investigation, no action is necessary at the Gunsite 113 Access Road Unit to ensure the protection of human health and the environment. Since the Gunsite 113 Access Road Unit poses no threat to human health or the environment, and no action is needed, the CERCLA Section 121 requirements are not applicable. This action is protective of human health and the environment and is meant to be a permanent solution, final action, for the Gunsite 113 Access Road Unit. No five-year remedy review is needed or will be performed.

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Date R. Lewis Shaw
Deputy Commissioner
Environmental Quality Control
South Carolina Department of Health and Environmental Control

DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

The Gunsite 113 Access Road (631-24G)
Operable Unit: Final Action

WSRC-RP-96-00833
Revision 1
January 1997

Savannah River Site

Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U.S. Department of Energy under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

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Record of Decision
The Gunsite 113 Access Road (631-24G)
Savannah River Site

WSRC-RP-96-00833
Rev. 1
January 1997

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Section I. Site and Operable Unit Name, Location, and Description

Introduction

The Savannah River Site (SRS) occupies approximately 803 square kilometers (310 square miles) of land adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina. SRS is a secured U.S. government facility with no permanent residents. SRS is located approximately 40 kilometers (25 miles) southeast of Augusta, GA and 32 kilometers (20 miles) south of Aiken, SC. Figure 1 shows the location of the Gunsite 113 Access Road Unit in relation to other facilities at SRS.

SRS is owned by the Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC. SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided nuclear materials for space program and for medical, industrial, and research efforts. Chemical and radioactive wastes are

byproducts of nuclear material production processes.

The Federal Facility Agreement (FFA, 1993) for SRS lists the Gunsite 113 Access Road Unit (631-24G) as a RCRA/CERCLA Unit that required further evaluation. An investigation/assessment process that integrates and combines the RCRA Facility Investigation(RFI) with the CERCLA Remedial Investigation (RI) to determine the actual or potential impact to human health and the environment was performed.

The Gunsite 113 Access Road Unit is located in the northeast comer of SRS, adjacent to the access road leading to Gunsite 113, and is approximately 91.5 meters (300 feet) east of where SRS

Road 8 crosses the SRS facility boundary (see Figure 1).

The Gunsite 113 Access Road Unit covers an area of approximately 370 square meters (4,000 square feet) and is a grassy area of weeds and small trees within a mature pine forest. It consists of several small mounds of dirt and asphalt adjacent to die grassy area and several downed pine trees. The mounds of dirt/debris are covered with a thick layer of pine straw, brush, and young trees. The grassy open area, east of the mounds, was identified as the area most likely impacted by possible waste disposal activities. The area contains several dead trees that have fallen down.

The terrain of the Gunsite 113 Access Road Unit is flat with an elevation of about 97.5 meters (320 feet) above mean sea level. There are no major drainage features nearby. The nearest surface water body is a small unnamed creek located approximately 1.3 kilometers (0.8 miles) southeast which feeds into Rosemary Creek, a tributary of Salkehatchie River. The water table is approximately 60 feet below ground surface.

Section II. Operable Unit History and Compliance History

Operable Unit History

During the period from 1955 to 1960, to defend SRS in the event of an air attack, the U.S. Army established onsite anti-aircraft artillery gun emplacements at several locations near the perimeter of SRS. In the mid 1980s, sparse vegetation, dead trees, and small mounds of soil were discovered on a portion of the road leading to Gunsite 113. This arm encompassing a portion of the road, became the Gunsite 113 Access Road Unit.

The area appears to have been used as a surface disposal area for spoil dirt and/or

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road construction debris. There is no documentation or record of any hazardous substance management, disposal, or any other type of waste disposal at this unit. There is no evidence that any recent disposal activities have occurred in this area or that disposal activities were more widespread. Also, there is no evidence of any burning or excavation at this waste unit.

There are no structures of any type located at or near the Gunsite 113 Access Road Unit. The only nearby man-made features are SRS Road 8, which passes within 91.5 meters (300 feet) east of the unit and the unpaved access road to Gunsite 113, which passes by the unit.

Compliance History

At SRS, certain waste materials are managed in accordance with the requirements of the Resource Conservation and Recovery Act (RCRA). To comply with the requirements of RCRA, certain SRS activities have required treatment, storage, or disposal, closure, or post-closure RCRA permits.

Non-regulated units, called solid waste management units (SWMU), include any activity where hazardous constituents may remain uncontrolled and may potentially release to the environment. Investigation and potential corrective action for these SWMU(s) are mandated under RCRA 3004(u).

In 1995, SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control (SCDHEC), which includes corrective action requirements. Specifically, Part V of the permit mandates that SRS establish and implement a RCRA Facility Investigation (RFI) program to fulfill the requirements specified in Section 3004(u) of RCRA.

Hazardous substances, as defined by CERCLA, are also present in the environment at SRS. On December 21, 1989, SRS was placed on the National Priorities List (NPL). A site placed on the NPL comes under the requirements of CERCLA. In accordance with Section 120 of CERCLA, DOE has entered into an FFA with EPA and SCDHEC to coordinate cleanup activities at SRS into one comprehensive strategy that fulfills RCRA Section 3004(u) and CERCLA assessment, investigation, and response action requirements.

The remedial investigation for the Gunsite 113 Access Road Unit was conducted from March 1988 to early 1993. The results of the RFI/RI Report completed in 1996 (WSRC, 1996a) indicate that the Gunsite 113 Access Road Unit poses no current or future risk to human health or the environment. Therefore, no action is warranted.

According to EPA guidance, if there is no current or potential threat to human health and the environment and no action is warranted, the CERCLA 121 requirements am not triggered. This means that there is no need to evaluate other alternatives.

To fulfill the public participation requirements of CERCLA, RCRA, and the South Carolina Hazardous Waste Management Regulations (SCHWMR), a Statement of Basis/Proposed Plan (WSRC, 1996b) presenting the no action alternative and the rational for selecting the alternative was prepared and submitted for public comments. The public was provided an opportunity to participate in the remedy selection process and was strongly encouraged to submit comments (see Section III). Following the public comment period, all the comments submitted were reviewed and considered. DOE, in consultation with EPA-Region IV and

SCDHEC, selected the final action for the Gunsite 113 Access Road Unit. Final selection of the remedial alternative satisfies FFA requirements. SCDHEC has modified the SRS RCRA permit to incorporate the selected remedy.

Section III. Highlights of Community Participation

Public participation requirements are listed in CERCLA Sections 113 and 117. These requirements include the establishment of an Administrative Record File that documents the selection of remedial alternatives and allows for review and comments by the public regarding those alternatives. The Administrative Record File must be established "at or near the

facility at issue". The SRS Public Involvement Plan (DOE, 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. Section 117(a) of CERCLA requires publication of a notice of any proposed remedial action and provides the public an opportunity to participate in the selection of a remedial action. The Statement of Basis/Proposed Plan for the Gunsite 113 Access Road Unit, which is part of the Administrative Record File, highlights the aspects of the investigation and identifies the preferred action for addressing the Gunsite 113 Access Road Unit.

RCRA provides opportunities for the public to comment on draft permit modifications. Public participation requirements are also listed in SCHWMR R.61-79.124 and require publication of the draft permit modifications. SCHWMR R.61-79.124 requires a brief description and response to all significant comments be made available to the public as a part of the Administrative Record. The preferred alternative proposed in the Statement of Basis/Proposed Plan

was also proposed as a draft permit modification under RCRA. Therefore, any comments received on the Statement of Basis/Proposed Plan was also applicable to the draft RCRA permit modification, proposing the same remedy for the Gunsite 113 Access Road Unit.

The Administrative Record File, which contains the Statement of Basis/Proposed Plan and all the documents (unabridged) listed in the reference section of this document, is available at the EPA-Office and at the following locations:

U.S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, SC 29801
(803) 641-3465

Thomas Cooper Library

Government Documents Department
University of South Carolina
Columbia, SC 29208
(803) 777-4866

Similar information is available through the repositories listed below:

Reese Library
Augusta State University
2500 Walton Way
Augusta, GA 309 10
(706) 737-1744

Asa H. Gordon Library
Savannah State University
Tompkins Road
Savannah, GA 31404
(912) 356-2183

The public was notified of a public comment period by mailing the SRS Environmental Bulletin, a newsletter sent to approximately 3500 citizens in South Carolina and Georgia, and through the Aiken Standard, the Allendale Citizen

Leader, the Barnwell People-Sentinel, the State, and the Augusta Chronicle newspapers. The public comment period was also announced on local radio stations. The 45-day public comment period began on September 17, 1996 and ended on October 31, 1996. No public comments were received.

Section IV. Scope and Role of Operable Unit within the Site Strategy

The overall strategy for addressing the Gunsite 113 Access Road Operable Unit was to: (1) determine if there had been a release of hazardous substances; (2) determine the nature and extent of any

contamination; (3) perform a baseline risk assessment; and (4) evaluate the need for remedial action to address any potential risks to human health and the environment.

The investigation and risk assessment have been completed for the Gunsite 113 Access Road Unit. Since the results of the investigation indicate that the unit poses no risk to human health or the environment, no action was recommended.

The field investigations and soil sampling conducted during 1990 and 1993 also indicate that there are no hazardous substances at the Gunsite 113 Access Road Unit that would impact the groundwater.

The Gunsite 113 Access Road Unit is an operable unit located within the Upper Three Runs Creek watershed. All source control and groundwater operable units located within this watershed will be evaluated to determine their impacts, if any, to the associated streams and wetlands.

SRS will manage all source control units to prevent impact to the watershed. Upon disposition of all source control and

groundwater operable units within this watershed, a final comprehensive ROD for the Upper Three Runs Creek watershed will be pursued.

Section V. Summary of Operable Unit Characteristics

Gunsite 113 was one of the anti-aircraft artillery gun emplacements the U.S. Army established at several locations near the perimeter of SRS. The Gunsite 113 Access Road Unit forms a portion of the access road leading to the Gunsite 113. There is no documentation or record of any hazardous substance management or disposal at this unit. There is no evidence that any recent disposal activity has occurred. Also, there is no evidence of any burning or excavation at this waste unit.

Media Assessment

The RFI/RI Work Plan (WSRC, 1990) and RFI/RI Report (WSRC, 1996a) contain detailed information and analytical data for all the investigations conducted and samples taken in the media assessment of the Gunsite 113 Access Road Unit. These documents are part of the Administrative Record File. The results of the RFI/RI Report are summarized below.

Preliminary investigations pertaining to the Gunsite 113 Access Road Unit were conducted in March and April 1988. The investigations consisted of ten soil samples and ten soil gas samples. The soil samples showed trace levels of 1, 2 - dichloroethylene (<11 mg/kg but >3 mg/kg). The soil gas samples contained only low levels of light hydrocarbons (<2500 parts per billion by volume (ppbv) methane). However, these levels were within the range of natural background levels.

In March 1989, a ground penetrating radar survey was conducted. The survey indicated that there was no evidence of any buried or underground objects in the area.

Soils

During 1990, 13 soil samples were collected from four borehole locations. Three boreholes were drilled within the Gunsite 113 Access Road Unit and one outside the unit for background sampling. The soil samples were taken at different depth ranges: 0.9-1.5 meters (3-5 feet); 2.4-3.05 meters (8-10 feet); 3.9-4.6 meters (13-15 feet); and 5.5-6.1 meters (18-20 feet) below the ground surface. The only hazardous substances which were detected and exceeded their respective unit-specific background levels were three metals (arsenic, chromium, and lead). Total cyanide and trace levels of tin, vanadium,

and zinc were also detected but, their concentrations were below EPA risk-based concentration (RBC) levels.

In 1993, SRS performed an additional ground penetrating radar survey for the purpose of making a final determination of any buried waste or any other debris at the Gunsite 113 Access Road Unit. Eleven lines totaling about 305 meters (1,000 feet) were acquired. An additional soil gas survey was also completed in 1993. A total of 30 sample locations were established and samples were collected at each location (see Figure 2).

The ground penetrating radar survey confirmed that no buried objects, trenches, or burial pits exist at the Gunsite 113 Access Road Unit.

The levels of volatile and diesel-range organics observed in the soil gas survey were consistent with the normal background levels associated with the natural decay of plant and animal matter.

In summary, data collected during the field investigations conducted in 1990 and 1993 revealed that only three metals (arsenic, chromium, and lead), exceeded their respective unit-specific background levels.

Groundwater

Since the ground penetrating radar surveys and field investigations conducted in 1988 and 1989 and soil sampling conducted in 1990 showed no sign of any hazardous waste disposal at this unit, groundwater investigations were not conducted.

Surface Water/Sediment

No surface water or sediment sampling was conducted because the nearest surface water feature (a small unnamed creek which feeds into Rosemary Creek) is located approximately 1.3 kilometer (0.8 miles) from the Gunsite 113 Access Road Unit.

Section VI. Summary of Operable Unit Risks

Human Health Risks

As part of the RCRA/CERCLA process for the Gunsite 113 Access Road Unit, a risk assessment was performed using data generated during the assessment phase. Detailed information regarding the development of constituents of potential concern, fate and transport of contaminants and risk assessment can be found in the RF/RI Report for the Gunsite 113 Access Road Unit (631-24G)(U), WSRC-RP-95-359, Rev. 1 (WSRC, 1996).

After combining analytical data and eliminating those analytes not detected in any samples, the data were evaluated on the basis of quality with respect to sample

quantitation limits, frequency of detection, relative toxic potential of the constituent, laboratory qualifiers and codes, and blanks. The remaining data (constituents detected) were compared to two times the unit-specific background and EPA developed Risk-Based Concentrations (RBCs).

RBCs developed by EPA Region III (EPA, 1995) were used to screen the constituents of potential concern for the Gunsite 113 Access Road Unit. This guidance provides reference doses and carcinogenic potency data for nearly 600 chemicals. These toxicity constants have been combined with "standard" exposure scenarios to calculate RBCs (i.e., chemical concentrations corresponding to fixed levels of risk; a hazard quotient of 1, or a lifetime cancer risk of one in one million). The RBCs are very similar to preliminary remediation goals which are concentration goals for individual chemicals for a specific medium and land use combinations at CERCLA Units.

Following the comparison to unit-specific

background levels, it was concluded that three hazardous materials (arsenic, chromium, lead) exceeded their unit-specific background levels. Hence, the maximum concentrations of these three hazardous materials were compared to their respective EPA risk-based concentration action levels to determine if there is any risk to human health and the environment.

The maximum concentration of arsenic detected was 1.8 m/kg which exceeds EPA risk-based concentration level of 0.43 mg/kg for soil ingestion, residential scenario. However, the concentration of the arsenic detected is consistent with the concentration levels found throughout SRS. Arsenic may be naturally occurring or added to the soils as a pesticide prior to

SRS activities. The source of the arsenic will be evaluated on a sitewide basis during the implementation of the sitewide Soil Background Study.

The maximum concentration of chromium detected was 24.3 mg/kg. Compared to the EPA risk-based concentration (RBC) level (390 mg/kg, residential), the concentration of chromium is low. However, the concentration of chromium (24.3 mg/kg) was detected in the soil sample collected from the 2.4-3.05 meters (8-10 feet) depth interval. This concentration exceeds EPAs generic soil screening level (SSL) for migration from soil to groundwater which is 19 mg/kg. Also the EPA site specific SSL for transfer of chromium from soil to groundwater for the 2.4-3.05 meters (8-10 feet) depth interval is 13.5 mg/kg. Hence, the maximum concentration of chromium detected exceeds the EPA's SSLs.

Because the chromium concentration detected exceeded both SSLs, it was decided to evaluate further for any potential unacceptable risk to a future resident that may be associated with chromium's migration from soil to groundwater. To determine the potential risk, a chromium leachability model was studied using site specific standard groundwater model equations. The model estimated that the chromium concentration in the groundwater

would peak at a concentration of 0.18 mg/L in approximately 1,707 years. The calculated concentration is approximately 0.08 mg/L higher than the 0.10 mg/L accepted maximum contaminant level goal (MCLG) for chromium VI, but is equivalent to the chromium VI risk-based concentration (RBC) for tap water (0.18 mg/L) resulting in a hazard index (HI) equal to 1. For chromium III which has an RBC value of 37.0 mg/L, the HI calculated was 4.9 x 10 -3.

These results for chromium are considered to be conservative since chromium was detected in only one sample at the 2.4-3.05 meters (8-10 feet) depth interval and peak concentration in the groundwater would be achieved in nearly 2,000 years. Additionally, soil samples collected in the source borehole at the 0.9-1.5 meters (3-5 feet), 3.9-4.6 meters (13-15 feet), and 5.5-6.1 meters (18-20 feet) depth intervals did not detect chromium.

The maximum concentration of lead was 4.8 mg/kg. The concentration is significantly lower than the EPA risk-based concentration level (400 mg/kg, residential).

The results of the risk analyses indicated that the concentrations of all hazardous substances analyzed, with the exception of arsenic, were near or below naturally occurring background levels and/or below EPA risk-based concentrations. While the concentration of arsenic detected (1.8 mg/kg) exceeded the EPA risk-based concentration (RBC) level of 0.43 mg/kg for soil ingestion, the level detected is consistent with the levels found throughout SRS and the source of arsenic will be evaluated on a sitewide basis during the implementation of the sitewide Soil Background Study. Hence, there are no

constituents of concern (COCs) and there is no impact to human health or the environment from the Gunsite 113 Access Road Unit.

Current Land Use

Since there is no current activity at the Gunsite 113 Access Road Unit, the current land use scenario is not applicable.

Future Land Use

Since there are no contaminants of concern and no determinable risk associated with the Gunsite 113 Access Road Unit, the future land use scenario is not applicable.

Ecological Risks

Based on the physical and analytical data pertaining to this unit, there is no evidence that waste materials were managed or disposed of at the Gunsite 113 Access Road Unit. Therefore, it is reasonable to conclude that this unit presents no significant ecological risk.

Section VII. Description of the No Action Alternative

Based on the unit characterization and risk assessment, the Gunsite 113 Access Road Unit poses no risk to human health and the environment. Therefore, the unit requires no cleanup activities and the no action alternative is recommended for this unit. No additional alternatives were considered for evaluation. However, arsenic will be evaluated on a sitewide basis during the sitewide Soil Background Study.

The no action alternative means that no remedial action will be performed at the Gunsite 113 Access Road Unit. There is no waste to treat, no institutional or engineering controls are required, and there are no applicable or relevant and appropriate requirements (ARARs). Because no further action would be taken, the Gunsite 113 Access Road Unit would remain in its present condition. No costs will be involved for this action.

Since the Gunsite 113 Access Road Unit poses no risk to human health or the environment and no action is warranted at this unit, the CERCLA Section 121 requirements are not applicable. The no action alternative will be the final action for the Gunsite 113 Access Road Unit and there will be no five-year (ROD) review.

This solution is meant to be permanent and effective in both the long and short term,

and protective of human health and the environment.

Section VIII. References

DOE (U.S. Department of Energy), 1994, Public Involvement, A plan for the Savannah River Site, Savannah River Operations Office, Aiken, SC.

EPA (U.S. Environmental Protection Agency), 1995, Risk-Based Concentration Table, EPA-III, January-June 1995, dated March 7, 1995.

Federal Facility Agreement, 1993, Federal Facility Agreement for the Savannah River Site, Administrative Docket No. 89-05-FF, (Effective Date: August 16, 1993).

WSRC, 1990, RCRA Facility Investigational Remedial Investigation Plan for the Gunsite 113 Access Road Unit, WSRC-RP-90-996, Westinghouse Savannah River Company, Aiken, SC.

WSRC, 1996a, RCRA Facility Investigational Remedial Investigation Report for the Gunsite 113 Access Road Unit (631-24G)(U) WSRC-RP-95-359, Rev. 1, Westinghouse Savannah River Company, Aiken, SC.

WSRC, 1996b, Statement of Basis/
Proposed Plan for the Gunsite 113 Access
Road Unit (631-24G)(U), WSRC-RP-96-
218, Rev. 1, Westinghouse Savannah
River Company, Aiken, SC.

APPENDIX A

RESPONSIVENESS SUMMARY

No comments received

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 03/27/1997
Operable Unit: 13
ROD ID: EPA/541/R-97/025

Media: Soil,groundwater.

Contaminant: Arsenic, benzo(k)fluoranthene, potassium-40, dibenz(a,h)anthracene, cesium-137, radium-223, copper, lead, 1,2-dichloroethane, carbon tetrachloride, dichloromethane, tetrachloroethylene, trichloroethylene.

Abstract: The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. SRS is a secured U.S. Government facility with no permanent residents. The site is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company. The Silverton Road Waste Unit (SRWU) is located in the northwestern part of the SRS.SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. Chemical and radioactive wastes are by-products of nuclear material production processes. Hazardous substances are currently present in the environment at SRS. The SRWU portion of SRS was first used before construction of SRS. Municipal, agricultural, and commercial trash, rubbish, garbage, debris, and refuse probably constituted the waste stream until the early 1950s. After procurement by the federal government, the SRWU land continued to be used as an open dump for disposal of metal shavings, 55-gallon drums, cardboard drums, tires, lumber, etc. No records of waste disposal activities were kept. In 1974, the disposal of the waste at the SRWU ceased, and the area was bulldozed, graded, covered with soil, and planted with grasses.The SRS was included in the National Priorities List (NPL)

in 1989. The initial site investigations have been completed.

Remedy: This remedy addresses contamination at the Silverton Road Waste Unit (SRWU) at Savannah River Site. The selected remedy for soil is institutional controls. The remedy for the "M Area" groundwater aquifer is no further action with monitoring.

Text: Full-text ROD document follows on next page.

<IMG SRC 970250>

<IMG SRC 97025A>

United States Department of Energy

Savannah River Site

Record of Decision
Remedial Alternative Selection for the
Silverton Road Waste Unit (731-3A) (U)

WSRC-RP-96-171
Revision 1
February 1997

<IMG SRC 97025B>

<IMG SRC 97025C>

CERTIFIED MAIL APR 01 1997
RETURN RECEIPT REQUESTED

4WD-FFB

Mr. Keith Collinsworth, FFA Project Manger
Federal Facility Agreement Section
Division of Site Engineering and Screening
Bureau of Solid & Hazardous Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

SUBJ: Transmittal of Signed Records of Decison for Gunsite 720, Gunsite 113, Grace Road, D-Area Burning/Rubble Pits, F-Area Burning/Rubble Pits, and Silverton Road Waste Unit

Dear Mr. Collinsworth:

Enclosed you will find six (6) Records of decision for the above referenced sites. The Environmental Protection Agency (EPA) has signed these documents. We are transmitting them to you for signature by the State of South Carolina. After signature, please forward the signed documents to the Department of Energy so that they may be included in the administrative record.

If you have any questions, please contact me at (404)562-8551 or Jeffery L. Crane, FFA Project Manger at (404) 562-8546.

<IMG SRC 97025D>

DOE Remedial Section
Federal Facilities Branch
Waste Management Division

cc: Brian Hennesey, DOE-SRS
Kim Wierzbicki, WSRC
Donna Brumley, DOE-SRS
Hammett, DOE-SRS

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RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

Silverton Road Waste Unit (731-3A)

WSRC-RP-96-171
Revision 1
February 1997

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U. S. Department of Energy Under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

Silverton Road Waste Unit (SRS Building Number 731-3A)
Savannah River Site
Aiken, South Carolina

The Silverton Road Waste Unit (SRWU) (731-3A) is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Unit/Comprehensive Environmental Response, Compensation, and liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS).

Statement of Basis and Purpose

This decision document presents the selected remedial alternative for the SRWU located at the SRS in Aiken, South Carolina. The selected alternative was developed in accordance with CERCLA, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this specific RCRA/CERCLA unit.

Description of the Selected Remedy

The preferred alternative for the SRWU soils is Institutional Controls which will restrict this land to future industrial use and prohibit the excavation of soil which might expose future workers to low concentrations of hazardous constituents. Implementation of the Institutional Controls alternative will require both near- and long-term actions which will be protective of human health and the environment. For the near-term, signs will be posted at the waste unit which indicate that this area was used for the disposal of waste material and contains buried waste. In addition, existing SRS access controls will be used to maintain the use of this site for industrial use only.

In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government would create a deed for the new property owner which would include information needed for compliance with Section 120(h) of CERCLA. The deed shall include notification disclosing former waste management and disposal activities as well as any remedial actions taken on the site, and any continuing groundwater monitoring commitments. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of construction debris and other materials, including hazardous substances.

The deed shall also include restrictions precluding residential use of the property. However, the need for these restrictions may be reevaluated at the time of ownership transfer in the event that contamination no longer poses an unacceptable risk under residential use.

In addition, if the site is ever transferred to non-federal ownership, a survey plat of the area will be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

In the "M Area" groundwater aquifer, low levels of contaminants have been detected which minimally and infrequently exceed maximum contaminant levels (MCLs). The probable condition for the "M Area" groundwater aquifer is no significant groundwater contamination resulting from the SRWU. As a

result, no
remedial action is deemed appropriate for the SRWU "M Area" groundwater aquifer. However, a confirmatory groundwater monitoring program will be established to ensure that this is the appropriate
remedial action for the "M Area" groundwater aquifer. In the event that the probable condition is no longer
appropriate, DOE will evaluate the need for remedial action.

Under the confirmatory groundwater program, an adequate number of monitoring wells will be selected to
monitor the extent of the contaminant plume and the severity of the contamination. Since only one
background well is available for the "M Area" aquifer, new background wells will need to be installed.
The groundwater monitoring is intended to evaluate trends in the groundwater contamination. Groundwater
monitoring was assumed to be conducted on a semi-annual basis for 30 years (for cost estimating purposes
only). However, at the five-year Record of Decision review, the groundwater monitoring data will be
evaluated to determine if any changes in the groundwater remedy are appropriate.

The number and location of the new background well(s), a list of the existing wells to be monitored, the
frequency of monitoring, and the submittal frequency of the groundwater data for regulatory review will be
listed in the SRWU Corrective Measures Implementation/Remedial Action Report (CMI/RAR) post-ROD
document. The CMI/RAR will also identify a groundwater strategy which will include trend analysis and
recommendations based on the interpretation of the data in the post-ROD groundwater monitoring reports.
The CMI/RAR will be submitted to the regulatory agencies four months after issuance of the ROD. The
regulatory review period, SRS revision period, and final regulatory review and approval period for the
CMI/RAR will be 90 days, 60 days, and 30 days, respectively.

The SCDHEC has modified the SRS permit to incorporate the selected remedy.

The groundwater in the lower aquifers are separate operable units and are not within the scope

of this
Record of Decision. The groundwater in the lower aquifers will be evaluated as part of the 1995 RCRA
Permit for the A/M Area Western Sector Corrective Action Program.

Statutory Determinations

Based on the SRWU RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report and the Baseline
Risk Assessment (BRA), the SRWU poses no significant risk to the environment and minimal risk to human
health. Tberefore, a determination has been made that institutional controls are sufficient for protection of
human health and the environment for the SRWU soils and that no remedial action with confirmatory
groundwater monitoring is deemed appropriate for the SRWU "M Area" groundwater aquifer.

The selected remedy is protective of human health and the environment, complies with Federal and State
requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-
effective. The size of the waste unit and the random distribution and low levels of contaminants preclude a
remedy in which treatment is a practical alternative. Because treatment of the principal threats of the site
was found to be impracticable, this remedy does not satisfy the statutory preference for treatment as a
principal element.

Institutional controls will result in hazardous substances, pollutants or contaminants remaining in the waste
unit. Section 300.430 (f)(4)(ii) of the NCP requires that a Five Year Review of the Record of Decision be
performed if hazardous substances, pollutants, or contaminants remain in the waste unit. The three Parties
have determined that a Five Year Review of the Record of Decision for the SRWU will be performed to
ensure continued protection of human health and the environment.

<IMG SRC 97025E>

Date

R. Lewis Shaw
Deputy Commissioner
Environmental Quality Control
South Carolina Department of Health and Environmental Control

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DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

Silverton Road Waste Unit (731-3A)

WSRC-RP-96-171
Revision 1
February 1997

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the

U. S. Department of Energy Under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

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I. Site and Operable Unit Name Location, and Description

The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina (Figure 1). SRS is a secured U.S. Government facility with no permanent residents. SRS is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina.

SRS is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. Chemical and radioactive wastes are by-products of nuclear material production processes. Hazardous substances, as defined by Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), are currently present in the environment at SRS.

The Federal Facility Agreement lists the Silverton Road Waste Unit (SRWU), 731-3A, (Figure 2) as a Resource Conservation and Recovery Act (RCRA)/CERCLA unit requiring further evaluation using an investigation/ assessment process that integrates and combines the RCRA Facility Investigation (RFI) process with the CERCLA remedial investigation (RI) to determine the actual or potential impact to human health and the environment.

The SRWU, 731-3A, is located in the northwestern part of the SRS in Aiken County (Figure 1), approximately 1.5 miles southwest of A/M Area (Figure 2). The SRWU area is an irregular quadrilateral which contains an unlined earthen depression dug into surficial soils and later filled with various waste materials. This area has been designated as "excavated area (filled)" on Figure 3. Soil borings conducted in 1993 identified the presence of waste buried beyond the excavated area. The additional area of waste disposal is within the orange ball markers and

covers an area of approximately 600 feet by 400 feet with waste being buried to a maximum depth of approximately 16 feet below ground level. The excavated area is larger than the soil boring

dimensions, but is less than the orange ball dimensions. Since characterization data indicated contamination of the surface soils, the planar area calculation for the SRWU includes the entire area within the orange balls. Therefore, the SRWU planar area of the SRWU is assumed to be 750 feet by 600 feet (450,000 ft 2). Using an average estimated depth of 6 feet for the excavated area, the approximate waste volume of the SRWU is 2,700,000 ft 3.

The SRWU is located on the southwestern flank of an interstream divide between Upper Three Runs Creek (approximately 4.5 miles to the southeast) and the flood plain of the Savannah River (approximately 1.5 miles to the west). The ground surface elevation at the unit averages 350 feet above mean sea level. Surface drainage is southwestward, along a series of dry-wash tributaries, into the flood plain of the Savannah River. The water table at the SRWU ranges from about 40 feet below ground level to the southwest to about 130 feet below ground level to the northeast.

The SRWU was first used before construction of the SRS. Although there is no written record of when disposal began at the SRWU, or what materials were accepted, it is believed that the SRWU was originally a borrow pit used as an "open dump" by the local municipalities including Old Ellenton before the land was acquired by the federal government. Municipal, agricultural, and commercial trash, rubbish, garbage, debris, and refuse probably constituted the waste stream until the early 1950's. The waste material at the dump was probably burned periodically, as was the practice at that time, for volume reduction. This practice would have eliminated many of the combustible organic materials while creating combustion by-products.

After procurement by the federal government, the SRWU land continued to be used as an open dump (a legal practice at the time) by SRS. Historical and aerial photographs show large piles of metal shavings (possibly aluminum), 55-gallon drums, cardboard drums, tires, lumber, wooden pallets, cardboard, construction debris, tanks, possibly

asbestos, and other unidentified metal and wood objects. No records of waste disposal activities were kept. In 1974, the disposal of waste at the SRWU ceased, and the area was bulldozed, graded

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covered with soil, and planted with grasses.

II. Operable Unit History and Compliance History

Operable Unit History

The SRWU was first used before construction of the SRS. Municipal, agricultural, and commercial trash, rubbish, garbage, debris, and refuse probably constituted the waste stream until the early 1950's. After procurement by the federal government, the SRWU land continued to be used as an open dump for disposal of metal shavings, 55-gallon drums, cardboard drums, tires, lumber, etc. No records of waste disposal activities were kept. In 1974, the disposal of the waste at the SRWU ceased, and the area was bulldozed, graded, covered with soil, and planted with grasses.

Compliance History

At SRS, waste materials are managed which are regulated under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities have required Federal operating or post-closure permits under RCRA. SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control (SCDHEC) on September 5, 1995. Part V of the permit mandates that SRS establish and implement an RFI Program to fulfill the requirements specified in Section 3004(u) of the Federal permit.

Hazardous substances, as defined by CERCLA, are present in the environment at the SRS. On December 21, 1989, SRS was included on the National Priorities List. This inclusion created a need to integrate the established RFI Program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA, DOE has negotiated a Federal Facility Agreement (FFA, 1993) with the U.S. Environmental Protection Agency (EPA) and SCDHEC to coordinate remedial activities at SRS into one comprehensive strategy which fulfills these dual regulatory requirements.

III. Highlights of Community Participation

Both RCRA and CERCLA require that the public be given an opportunity to review and comment on the draft permit modification and proposed remedial alternative. Public participation requirements are listed in the South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternatives for addressing the SRWU soils and groundwater. The Administrative Record File must be established at or near the facility at issue. The SRS Public Involvement Plan (DOE, 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS Public Involvement plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act SCHWMR R.61-79.124 and Section 117(a) of CERCLA, as amended, require the advertisement of the draft permit modification and notice of any Proposed remedial action and provide the public an opportunity to participate in the selection of the remedial action. The Statement of Basis/Proposed Plan for the Silverton Road Waste Unit (731-3A) (WSRC, 1996d), which is part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the SRWU.

The FFA Administrative Record File, which contains the information pertaining to the selection of the response action, is available at the EPA office and at the following locations:

U.S. Department of Energy

Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

Reese Library
Augusta State University
2500 Walton Way
Augusta, Georgia 30910
(706) 737-1744

Asa H. Gordon Library
Savannah State University
Tompkins Road
Savannah, Georgia 31404
(912) 356-2183

The public was notified of the public comment period through mailings of the SRS Environmental Bulletin, a newsletter sent to approximately 3500 citizens in South Carolina and Georgia, through notices in the Aiken Standard, the Allendale Citizen Leader, the Augusta Chronicle, the Barnwell People-Sentinel, and The State newspapers. The public comment period was also announced on local radio stations.

The 45-day public comment period began on September 17, 1996 and ended on October 31,

1996. A public comment meeting was held on October 15, 1996. A Responsiveness Summary was prepared to address comments received during the public comment period. The Responsiveness Summary is provided in Appendix A of this Record of Decision.

IV. Scope and Role of Operable Unit Within the Site Strategy

The overall strategy for addressing the SRWU was to: (1) characterize the waste unit delineating the nature and extent of contamination and identifying the media of concern (perform the RFI/RI); (2) perform a baseline risk assessment to evaluate media of concern, constituents of concern, exposure pathways, and characterize potential risks; (3) evaluate applicable technologies and identify a preferred technology to remediate the waste site, as needed; and, (4) perform a final action to remediate, as needed, the identified media of concern.

The SRWU is an operable unit located within the Savannah River Floodplain Swamp Watershed. Several source control and groundwater operable units within this watershed will be evaluated to determine impacts, if any, to associated streams and wetlands. SRS will manage all source control

and groundwater operable units to minimize impact to the Savannah River Floodplain Swamp Watershed. Based on characterization and risk assessment information, the SRWU does not significantly impact the watershed. Upon disposition of all source control and groundwater operable units within this watershed, a final, comprehensive evaluation of the watershed will be conducted to determine whether any additional actions are necessary.

The SRWU investigation considered all unit specific groundwater operable units - The "M Area" groundwater aquifer and the "Lost Lake" groundwater aquifer. Based on the investigation of the groundwater, low levels of contaminants have been detected in the "M Area" groundwater aquifer which minimally and infrequently exceed MCLs. The probable condition for the "M Area" groundwater aquifer is no significant groundwater contamination resulting from the SRWU. As a result no remedial action is deemed appropriate for the "M Area" groundwater aquifer. A oonfirmatory groundwater monitoring program

will be established to ensure that this is the appropriate remedial action. The contamination in the "Lost Lake" aquifer is attributable to upgradient sources. The "Lost Lake" aquifer will be remediated as committed to in the 1995 RCRA Permit for the A/M Area Western Sector Corrective Action Program.

The proposed actions for the SRWU soils and "M Area" groundwater aquifer are final actions. However, in the event that the probable condition for the "M Area" groundwater aquifer is no longer appropriate, DOE will evaluate the need for remedial action.

V. Summary of Operable Unit Characteristics

The SRWU was first used before construction of the SRS. Although there is no written record of when disposal began at the unit, or what materials were accepted, it is believed that the unit was originally a borrow pit. Historical aerial photographs indicate that the SRWU was used as an "open dump" by the local municipalities including Old Ellenton before the land was acquired by the federal government. The first aerial photograph (September 1938) shows a well established "open dump" around the excavated

area even though the excavated area is not visible in the photograph. Aerial photographs were taken

at regular intervals throughout the years and indicate a regular and consistent use of this property as a dump site. The photographs only vary by the size of the area being used as a dump. Therefore, SRWU has a history of at least 58 years of use.

Municipal, agricultural, and commercial trash, rubbish, garbage, debris, and refuse probably constituted the waste stream until the early 1950s. These items are visible in some of the early aerial photographs. The waste material at the dump was probably burned periodically, as was the practice at that time, for volume reduction. This practice would also have eliminated many of the combustible organic materials while creating combustion by-products.

After procurement by the federal government, this land continued to be used as an open dump (a legal practice at the time) by SRS. Aerial photographs suggest that the M-Area Fuel and Target Fabrication facilities continued using the existing open dump to dispose of its waste products. This is evidenced by the large piles of metal shavings (possibly aluminum) from the fabrication of fuel rods. Also, present in the photographs, but not necessarily related to the M-Area Fuel and Target Fabrication facilities, are 55 gallon metal drums, cardboard drums, many tires, lumber, wooden pallets, cardboard, construction debris, tanks, possibly asbestos, and other identified metal and wood objects. No records of waste disposal activities were kept. In 1974, the disposal of wastes at the SRWU ceased, and the area was bulldozed, graded, covered with soil, and planted with grasses.

Media Assessment

The Quality Control Summary Report for the Silverton Road Waste Unit RFI/RI Assessment (WSRC, 1994a), Final RFI/RI Report for the Silverton Road Waste Unit (U) (WSRC, 1996a), and the Final Baseline Risk Assessment for the Silverton Road Waste Unit (U) (WSRC, 1996b) contain detailed analytical data for all of the environmental media samples taken in the characterization of the unit.

Since this land was first used as an open dump prior to the government purchase of the land, almost any type of residential, commercial, or agricultural waste could have been disposed at

SRWU. It is known that SRS operational policy would not have permitted the disposal of any radioactive material at this site. Any radionuclides detected were likely naturally occurring (Radium-223) or were deposited by global fallout from nuclear testing (Cesium-137).

Soils

During the RFI/RI, thirteen soil borings were drilled at the site to collect surface and subsurface soil samples. Two runoff soil samples were collected from the SRWU. Two offsite soil borings were drilled to collect seven background soil samples. Soil samples were analyzed for numerous parameters including metals, volatile organic compounds, semi-volatile organic compounds, pesticides, polychlorinated biphenyls, dioxins, farans, and radionuclides. Analyte concentrations were screened using criterion background concentrations of twice the average background concentration.

The analyses of the soil samples were divided into three groups:

- surface soils, 0 to 0.5 feet (primary direct contact exposure interval for soils),
- subsurface soils, 0 to 6 feet (potential exposure interval for future scenarios where excavation may occur), and
- underlying soils, 6 to 42 feet (potential soil to groundwater migration).

These soil groups are identical in horizontal extent across the SRWU.

The primary contaminants (those exceeding twice the mean background and risk-based thresholds) in the surface soils (0-0.5 ft.) and subsurface soils (0-6 ft.) were arsenic, benzo(k)fluoranthene, potassium-40, dibenz (a,h)anthracene, cesium-137, and radium-223. Potassium-40 and radium-223 are naturally occurring radionuclides. The source of arsenic is not known. The levels of arsenic detected are consistent with the levels found throughout SRS. Arsenic may be natural, added to the soils as a pesticide (pre-SRS) or associated with site waste or fill. It will be evaluated on a site-wide scale during the

implementation of the Soil Background Study (or potentially the Site-Wide Soil Integrator, Operable Unit Workplan). Dibenz(a,h)anthracene and benzo(k)-fluoranthene were observed at maximum concentrations of 643 µg/kg and 219 µg/kg, respectively. Cesium-137 was observed at a maximum activity level of 2.1 pCi/g. This activity level is consistent with the observed activity from global fallout. Radium-223 was only detected once in each soil sample interval. Based on exposure point concentrations, the level of contaminants in the 0 to 0.5 foot interval was not significantly different from those in the 0 to 6 foot interval. The contaminants appear to be randomly and heterogeneously scattered throughout the 0 to 6 foot interval.

The primary contaminants (those exceeding twice the mean background and risk-based thresholds) in the underlying soils (6-42 ft.) were arsenic, beryllium, polycyclic aromatic hydrocarbons, dioxins/furans, and radionuclides. It should be noted that, per regulatory guidance, the underlying soils (6-42 ft.) are not required to undergo risk assessment, but are evaluated for potential migration of contaminants to the groundwater.

Uncertainty in the soil data set is caused by single detections for a large number of analytes. Contaminants that exceeded the twice the mean background and risk-based thresholds and were detected only once in the underlying soils (6-42 ft) include: baryllium, dioxins/furans, and radionuclides. Single hits indicate that contaminants my be found in only isolated areas. Additionally, many of the radionuclides could not be physically present due to their brief half-life and their detection on is probably due to measurement error. Potassium-40 is a naturally occurring analyte. The number of samples in the background data set for the soils was marginally adequate to be representative. This also adds to

the uncertainty in the data set.

The potential for migration of the soil contamination to the groundwater was quantitatively evaluated by comparing the mean concentration of each analyte to the proposed soil screening levels calculated by the simple site-specific method. For radiological analytes, the RESRAD model was used to predict the concentration in groundwater over a period of time. This model used both the maximum and

average radionuclide concentrations. The average concentrations used did not include non-detects, resulting in conservative modeling results. For each analyte evaluated in the study, all soil data from 0 to 42 feet was included in the determination of the mean concentrations.

Based on the fact that all the soil analytes passed either the simple site-specific or detailed site-specific method of screening, there is little or no chance for the residual waste at the SRWU to be a source of future contamination. Releases have probably occurred from the SRWU in the past, but due to the unit's age and natural attenuation, the remaining contaminants pose little, if any, threat for future contamination. In addition, no significant contaminants were contributed to any surface water streams.

Groundwater
Seventeen monitoring wells are screened within the "M Area" groundwater aquifer. The wells near the SRWU are shown on Figure 4.

Contaminants minimally and infrequently exceeding their maximum contaminant level (MCL) in the "M-Area" aquifer include:copper, lead, 1,2-dichloroethane, carbon tetrachloride, dichloromethane, tetrachloro-ethylene, and trichloroethylene. Chloroform and thallium concentrations were below their respective MCLs; however, they were above their respective risk-based thresholds.

Table 1 lists the "M Area" groundwater aquifer constituents, the number of detections, the detections that were above the MCL for the constituent, the maximum concentration, and the MCL.

The upgradient groundwater quality could not be characterized with certainty since one of the new

background wells installed in the "M Area" groundwater aquifer yielded no groundwater samples because it went dry. The loss of this well has not only introduced uncertainty in the spatial distribution of possible upgradient contamination, but it has also introduced statistical uncertainty caused by an insufficient background sample size for the "M Area" groundwater aquifer. As a result, the background concentrations were established with the use of only one background well. This led to the use of a maximum of 6

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Table 1 "M Area" Groundwater Constituents

Constituent	Units	Number of Detections	Maximum Concentration	MCL	Number of Detections Above MCL
Copper	µg/L	65/96	1430	1000 a	1/65
Lead	µg/L	64/96	36.2	15.0 b/50.0 a	16/64
1,2-Dichloroethane	µg/L	14/96	5.3	5.0	1/14
Carbon Tetrachloride	µg/L	40/96	9.9	5.0	15/40

Dichloromethane	µg/L	38/96	6.62	5.0	1/38
Tetrachloroethylene	µg/L	26/96	6.2	5.0	1/26
Trichloroethylene	µg/L	44/96	7.4	5.0	1/44

MCL - Maximum Contaminant Level
a - MCL set by the state
b - "At the tap" standard

samples with which to establish background concentrations.

The presence of 1,2-dichloroethane and dichloromethane in the remaining upgradient wells indicate a probable upgradient source of contamination. Additional constituents were also found in downgradient wells at the SRWU which were not found in the upgradient well which indicates that the SRWU probably has contributed additional contaminants to the "M-Area" groundwater aquifer as it flows beneath the unit.

Adding to further uncertainty are those analytes with only one positive detection. This is best typified by the pesticide analysis. Aldrin, dieldrin, and DDT were only detected once; and, they were not detected in subsequent samples from the wells in which they were originally detected. Single detections represent extreme uncertainty in the data because the results could not be reproduced in the same well. It is highly likely that single detections are due to sampling or measurement error.

VI. Summary of Operable Unit Risks

As a component of the RFI/RI process, a baseline risk assessment was prepared for the SRWU. The baseline risk assessment consists of human health and ecological risk assessments. Summary information for the human health and ecological risk assessments follows.

Human Health Risk Assessment

As part of the investigation/assessment process for the SRWU, a risk assessment was performed using the data generated during the assessment phase. Detailed information regarding the development of contaminents of potential concern, the fate and transport of contaminants, and the risk assessment can be found in the Final RFI/RI Report for the Silverton Road Waste Unit (U) (WSRC, 1996a) and the Final Baseline Risk Assessment for the Silverton Road Waste Unit U (WSRC. 1996b).

The process of designating the constituents of potential concern was based on consideration of background concentrations, frequency of detection, the relative toxic potential of the chemicals, and chemical nutrient status. Constituents of potential concern are the constituents that are potentially

site-related and whose data are of sufficient quality for use in the risk assessment.

An exposure assessment was performed to provide an indication of the potential exposures which could occur based on the chemical concentrations detected during sampling activities. The only existing (current) exposure scenario identified for the SRWU was for environmental researchers who may work or traverse the SRWU on an intermittent/limited basis. Future exposure scenarios identified for the SRWU included future environmental researchers as well as future residential adults and children and occupational workers. The reasonable maximum exposure concentration value was used as the exposure point concentration.

Per EPA guidance, the carcinogenic (cancer) risks and non-carcinogenic hazard were calculated to determine the appropriate remedial action for a waste unit. Carcinogenic risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of pathway-specific exposure to cancer-causing contaminants. The risk to an individual resulting from exposure to non-radioactive chemical carcinogens is expressed as the increased probability of cancer occurring over the course of a 70 year lifetime. Cancer risks are related to the EPA target risk range of one in ten thousand ($1x10^{-4}$) to one in one million ($1x10^{-6}$) for incremental cancer risk at National Priorities List

sites.

Non-carcinogenic effects are also evaluated-to identify a level at which there may be concern for potential health effects other than cancer-causing. The hazard quotient, which is the ratio of the exposure dose to the reference dose is calculated for each contaminant. Hazard quotients are summed for each exposure pathway to determine the specific hazard index for each exposure scenario. If the hazard index exceeds unity (1.0), there is concern that adverse health effects might occur.

The following sections discuss the noncarcinogenic hazards and carcinogenic risks for the current on-unit environmental researcher, the hypothetical future on-unit residential adult/child, the future on-unit residential child, and the future on-unit occupational worker.

Current Land Use - Noncarcinogenic Hazards

The Baseline Risk Assessment (WSRC, 1996b) shows that the total noncarcinogenic (noncancer) hazard index did not exceed unity for the environmental researcher evaluated in the current land use scenario. This indicates that potential adverse health effects are not likely to occur for the current environmental researcher.

Current Land Use - Carcinogenic Risks

Under the current land use scenario, the human health risks were characterized for the current on-unit environmental researcher. The total carcinogenic (cancer) risk from exposure to chemicals in soil was 2 x10 -7. The total carcinogenic risk for exposure to radionuclides in soils 3 xl0 -6. Dermal contact (with a risk of 2.7xl0 -6) with radionuclides (i.e., Cesium-137) in

the soil contributed to the risk. Cesium-137 was observed at a maximum activity level (2.1 pCi/g) that is consistent with observed activity from global fallout.

Future Land Use - Noncarcinogenic Hazards

Table 2 (0-0.5 ft) and Table 3 (0-6 ft.) provide a summary of the noncarcinogenic hazard indices and applicable constituents of concern associated with the future land use of the SRWU.

The noncancer hazard indices were below unity for the future case environmental sampler scenario and the hypothetical future occupational worker scenario. This indicates that potential adverse health effects are not likely to occur for the future environmental researcher or the hypothetical future occupational worker.

For the hypothetical future adult/child resident and child resident scenarios, exposure to chemicals in the "M Area" groundwater aquifer exceeded the hazard index of 1. Ingestion of carbon tetrachloride and thallium in the groundwater are the principal drivers for the noncancer hazards. Lead exposure from groundwater was modeled and shown to not pose any risk.

Future Land Use - Carcinogenic Risks

Table 4 (0-0.5 ft) and Table 5 (0-6 ft.) provide a summary of the carcinogenic risks and applicable

constituents of concern associated with the future land use of the SRWU.

Under the future land use scenario, the total carcinogenic (cancer) risk from exposure to chemicals or radionuclides in soils did not exceed a risk level of lxl0 -4 for the environmental researcher or the occupational worker.

For the environmental researcher, the total carcinogenic (cancer) risk from exposure to chemicals in soil was 2 x10 -7. The total carcinogenic risk for exposure to radionuclides in soils 3 xl0. Dermal contact (with a risk of 2.7xl0 -6 with radionuclides (i.e., Cesium-137) in the soil contributed to the risk. Cesium-137 was observed at a maximum activity level (2.1 pCi/g) that is consistent with observed activity from global fallout.

For the future occupational worker, the total carcinogenic risk associated with exposure to chemicals in the soil (2.0x10 -6) and the "M Area" groundwater aquifer (2.2xl0 -5) combined was 2x10 -5. The total carcinogenic risk associated with exposure to radionuclides in the soil (1.1x10 -6) and the "M Area" groundwater aquifer (4.2x10 -6) combined was 2x10 -5. The chemical risk drivers for soil ingestion are arsenic, dibenz(a,h)anthracene, and benzo(a)pyrene; for groundwater ingestion are arsenic, aldrin, dieldrin, and carbon tetrachloride. The radionuclide risk drivers for external exposure to soil is cesium-137; and for groundwater ingestion are total radium, radium-226, and thorium-228.

For the future resident adult/child model, the total carcinogenic risk associated with exposure to chemicals in the soil (1.5xl0 -5) and the "M Area" groundwater aquifer (l.lxl0 -4) combined was 1x10 -4. The total carcinogenic risk associated with exposure to radionuclides in the soil (4.5xl0 -5) and the "M Area" groundwater aquifer (8.8xl0 -5) combined was 1x10 -4. The chemical risk drivers for soil ingestion are arsenic, dibenz(a,h)anthracene, and benzo(a)pyrene; for dermal contact with soils are dibenz(a,h)anthracene and benzo(a)-pyrene; for produce ingestion are dibenz(a,h)-anthracene, benzo(a)pyrene, and benzo(b)fluoranthene; for groundwater ingestion are arsenic, aldrin, dieldrin, and carbon tetrachloride; for dermal contact with groundwater are dieldrin, bis(2-ethylhexyl)phthalate, and carbon tetrachlo-

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ride. The radionuclide risk driven for external exposure to soil is cesium-137; and for groundwater ingestion are total radium, radium-226, and thorium-228; and for groundwater inhalation are total radium and radium-226.

For the future resident child model, the total carcinogenic risk associated with exposure to chemicals in the soil (9.1×10^{-6}) and the "M Area" groundwater aquifer (4.2×10^{-6}) combined was 5×10^{-5}. The total carcinogenic risk associated with exposure to radionuclides in the soil (1.1×10^{-5}) and the "M Area" groundwater aquifer (2.3×10^{-5}) combined was 3×10^{-5}. The chemical risk drivers for soil ingestion are arsenic, dibenz(a,h)anthra-

cene, and benzo(a)pyrene; for dermal contact with soils are dibenz(a,h)anthracene and benzo(a)-pyrene; for produce ingestion are dibenz(a,h)-anthracene, benzo(a)pyrene, and benzo(b)fluoranthene; for groundwater ingestion are arsenic, aldrin, dieldrin, and carbon tetrachloride; and for groundwater inhalation are chloroform and carbon tetrachloride. The radionuclide risk drivers for external exposure to soil is cesium-137; and for groundwater ingestion are total radium, radium-226, and thorium-228; and for groundwater inhalation are total radium and radium-226.

Figures 5 through 7 are graphical summaries of the conceptual risk models for the future on-unit residential adult/child, residential child, and occupational worker.

In summary, the future case residential scenarios showed total hazard and risk levels which exceeded the EPA criterion values relative to the "M Area" groundwater aquifer pathway. Exposure to carbon tetrachloride and thallium in groundwater provided the primary contribution to the total noncancer hazard levels. The total carcinogenic risks (i.e., chemical/radionuclide specific risk > 1x10 -4) for the future residential scenarios were primarily associated with groundwater ingestion and/or inhalation for chemicals and radionuclides. Constituents of concern identified included carbon tetrachloride, chloroform, arsenic, aldrin, dieldrin, total radium, radium-226, and thorium-228.

Radium-226 and thorium-228 are naturally occurring radionuclides. Arsenic, aldrin and

dieldrin were only detected once out of 89 samples.

Ecological Risk Assessment

An ecological risk assessment was conducted to assess the potential impacts to biota caused by exposure to chemical and radionuclide constituents at the SRWU.

A site ecological reconnaissance survey was conducted in November 1994. No wetlands or threatened and endangered species were observed in the vicinity of the SRWU, and use of the site by threatened and endangered species is not expected.

Based on the ecological risk assessment, there is

"little or no risk of adverse ecological effects", therefore there is "no need for remediation" from an ecological standpoint (WSRC, 1996b).

Remedial Action Objectives

Remedial action objectives specify unit-specific contaminants, media of concern, potential exposure pathways, and remediation goals. The remedial action objectives are based on the nature and extent of contamination, threatened resources, and the potential for human and environmental exposure. Initially, preliminary remediation goals are developed based upon applicable or relevant and appropriate requirements (ARARs) under federal environmental or state environmental or facility siting laws , or other information from the RFI/RI and Baseline Risk Assessment Reports. These new goals should be modified, as necessary, as more information concerning the unit and potential remedial technologies become available. Final remediation goals are determined when the remedy is selected and establishes acceptable exposure levels that are protective of human health and the environment.

Constituents of potential concern are site- and media-specific, man-made and naturally occurring, inorganic and organic chemicals, pesticides, and radionuclides detected at a unit under investigation. Constituents of concern are isolated from the list of constituents of potential concern by calculating carcinogenic risks and noncarcinogenic hazard indices. A constituent of concern contributes significantly to a pathway that

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contributes to either a cumulative site carcinogenic risk greater than 1x10 -4 or a hazard index greater than 1.0. Risk levels at or above the upper-bound of the target risk range of 1x10 -4 are considered significant and these sites are expected to undergo remediation. Risk levels between 1x10 -6 and 1x 10 -4 require consideration for remediation.

ARARs are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under foderal, state, or local environmental law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a CERCLA site. Three types of ARARs; action-, chemical-, and location-specific; have been developed to simplify identification and compliance with environmental requirements. Action-specific requirements set controls on the design, performance and other aspects of implementation of specific remedial activities. Chermical-specific requirements are media-specific, health-based concentration limits

developed for site-specific levels of contaminants in specific media. Location-specific ARARs must consider federal, state, and local requirements that reflect the physiographical and environmental characteristics of the unit or the immediate area.

None of the risks associated with the SRWU soil have been found to be greater than 1x10 -4. However, the risks are within the intermediate risk range for the future resident adult/child and child only scenarios. The nonradiological intermediate risks were contributable to arsenic, benzo(a)pyrene, dibenz(a,h)anthracene, and benzo(b)fluoranthene. For all three future scenarios (future resident adult/child, future resident child, and future industrial worker), the radiological intermediate risks were attributable to cesium-137. However, the average activity levels for cesium-137 are consistent with those expected from global fallout. There were no HIs above 1.0 for the SRWU soil.

The remedial action objective for the future on-unit resident (adult/child and child) is to prevent ingestion of soil and produce, and dermal contact with soil from arsenic, benzo(a)pyrene, dibenz(a,h)anthracene, and benzo(b)fluoranthene.

Tables 6 (future resident) and 7 (occupational worker) list the Remedial Goal Options for

intermediate risk contaminants (1x10 -4 to 1x10 -6) for soil. The exposure point concentration is also provided in these tables to provide a comparison for the risks and hazards associated with the contaminants.

The "M Area" groundwater aquifer poses risks near 1x10 -4 for the future residential adult/child scenario and near 1x10 -5 for the future occupational worker scenario through groundwater ingestion, dermal contact, and groundwater inhalation. Dieldrin, arsenic, aldrin, chloroform, carbon tetrachloride, and bis(2-ethylhexyl) phthalate were the nonradiological contributors to the intermediate risk. Radium-226, radium-total, and thorium-228 were the radiological contributors to the intermediate risk. For the future residential adult/child and child scenarios, thallium and carbon tetrachloride were contributors to HIs above 1.0 for groundwater ingestion. There were no HIs above 1.0 for the future occupational worker associated with the "M Area" groundwater aquifer.

Bis(2-ethylhexyl)phthalate was detected only twice above its MCL; and aldrin and dieldrin were only detected once; and, they were not detected in subsequent samples from the well in which they were originally detected. It is highly likely that the single detection were due to sampling or measurement errors. Radium and thorium are naturally occurring radionuclides.

The preliminary remedial action objective for the future on-unit resident (adult/child and child) and occupational worker is to prevent ingestion, dermal contact, and inhalation of groundwater from constituents with concentrations that minimally and infrequently exceed MCLs.

Tables 8 (future resident) and 9 (future occupational worker) list the Remedial Goal Options for the "M Area" groundwater aquifer by receptor. The exposure point concentrations and MCLs are listed to provide a comparison for the risks and hazards associated with the constituents.

Based upon the levels and concentrations of the groundwater constituents, it was determined that development of final remediation goals was not needed for groundwater cleanup.

Table 6 Remedial Goal Options for Intermediate Risk Contaminants of Concern for the Future Residential Adult and Child at the SRWU (Soil)

Contaminant	Carcinogenic Risk			Noncarcinogenic Hazard			EPC
	$1x10^{-6}$	$1x10^{-5}$	$1x10^{-4}$	0.1	1.0	3.0	
Arsenic (mg/kg) a	0.43	4.3	43	2.3	23	69	1.02
Benzo(a)pyrene (mg/kg) a	0.088	0.88	8.8	NA	NA	NA	0.267
Benzo(b)fluoranthene (mg/kg) a	0.88	8.8	88	NA	NA	NA	0.277
Dibenze(a,h)anthracene (mg/kg) a	0.088	0.88	8.8	NA	NA	NA	0.192
Cesium-137 (pCi/g) b	$2.0x10^{-2}$	$2.0x10^{-1}$	2.0	NA	NA	NA	1.36

a- Risk- Based Concentration Table, July-December 1995 (EPA, 1995)
b- Risk- Based PRGs for Radionuclides (WSRC, 1994b)
EPC- Exposure Point Concentration
NA- Not Applicable

Table 7 Remedial Goal Options for Intermediate Risk Contaminents of Concern For the Future
Occupational Worker at the SRWU (Soil)

Contaminent	Carcinogenic Risk			Noncarcinogenic Hazard			EPC
	1x10 -6	1x10 -5	1x10 -4	0.1	1.0	3.0	
Arsenic (mg/kg) a	3.8	3.8	380	61.0	610	1830	1.02
Benzo(a)pyrene (mg/kg) a	0.78	7.8	78	NA	NA	NA	0.267
Dibenz(a,h)anthracene (mg/kg)	0.78	7.8	78	NA	NA	NA	0.192
Cesium-137 (pCi/g) b	8.33x10 -2	8.33x10 -1	8.33	NA	NA	NA	1.36

a- Risk- Based Concentration Table, July- December 1995 (EPA 1995)
b- Risk- Based PRGs for Radionuclides (WSRC, 1994b)
EPC- Exposure Point Concentration
NA- Not Applicable

Table 8 Remedial Goal Options for Contaminants of Concern for the Future Residential Adult
and Child at the SRWU ("M Area" Groundwater Aquifer)

Contaminant	Carcinogenic Risk			Noncarcinogenic Hazard			EPC	MCL
	1x10 -6	1x10 -5	1x10 -4	0.1	1.0	3.0		
Arsenic (mg/L) a	0.000045	0.00045	0.0045	0.0011	0.011	0.033	0.00102	0.05
Aldrin (mg/L) a	0.000004	0.00004	0.0045	NA	NA	NA	0.0000468	NA
Bis(2-ethylhexyl) phthalate (mg/L) a	0.0048	0.048	0.48	NA	NA	NA	0.0192	0.006

Carbon Tetrachloride (Mg/L) a	0.00016	0.0016	0.016	0.02	0.20	0.60	0.00754	0.005
Chloroform (mg/L) a	0.00015	0.0015	0.015	NA	NA	NA	0.015	0.10
Dieldrin (mg/L) a	0.0000042	0.000042	0.00042	NA	NA	NA	0.00013	NA
Radium-226 (pCi/L) b	0.00418	0.0418	0.418	NA	NA	NA	2.06	20
Radium, total (pCi/L) b	0.0184	0.184	1.84	NA	NA	NA	2.54	5
Thorium-228 (pCi/L) b	0.000162	0.00162	0.0162	NA	NA	NA	167	NA

a - Risk-Based Concentration Table, July-December 1995 (EPA, 1995)
b - Risk-Based PRGs for Radionuclides (WSRC, 1994b)
EPC - Exposure Point Concentration NA - Not Applicable

Table 9 Remedial Goal Options for Contaminants of Concern for the Future Occupational Worker at the SRWU ("M Area" Groundwater Aquifer)

Contaminant	Carcinogenic Risk			Noncarcinogenic Hazard			EPC	MCL
	1x10 -6	1x10 -5	1x10 -4	0.1	1.0	3.0		
Arsenic (mg/L) a	0.00016	0.0016	0.016	0.0086	0.086	0.258	0.00102	0.05
Aldrin (mg/L) a	0.000017	0.00017	0.0017	NA	NA	NA	0.0000468	NA
Bis(2-ethylhexyl) phthalate (mg/L) a	0.0048	0.048	0.48	NA	NA	NA	0.0192	0.006
Carbon Tetrachloride (Mg/L) a	0.0029	0.029	0.29	0.02	0.20	0.60	0.00754	0.005
Dieldrin (mg/L) a	0.000018	0.00018	0.0018	NA	NA	NA	0.00013	NA
Thallium (mg/L) a	NA	NA	NA	0.0023	0.023	0.069	0.00100	0.002
Radium-226 (pCi/L) b	1.30	13.0	130	NA	NA	NA	2.06	20
Radium, total pCi/L) b	1.60	16.0	160	NA	NA	NA	2.54	5
Thorium-228 (pCi/L) b	16.0	160	1600	NA	NA	NA	167	NA

- Final Baseline Risk Assessment - Appendix H Table 6 (WSRC, 1996b)
- Final Baseline Risk Assessment - Appendix H - Table 7 (WSRC, 1996b)
EPC - Exposure Point Concentration NA- Not Applicable

VII. Description of the Considered Alternatives

VII.A Description of the Considered Alternatives for the SRWU Source Control Operable Unit

Four alternatives were evaluated for remedial action at the SRWU source control operable unit. Each alternative is described below:

Alternative S1 - No Action

Under this alternative, no action would be taken at the SRWU. EPA policy and regulations require the consideration of a no action alternative to serve as a baseline against which the other alternatives can be compared. Because no further action would be taken at the unit and the SRWU would remain in its present condition, there are no costs associated with this alternative. There would be no reduction of risk.

Alternative S2 - Institutional Controls

Under this alternative, Institutional Controls would be implemented at the SRWU. The primary purpose of institutional controls is to prevent the exposure of the general public or potential future resident to the contaminants present in the surface soils.

Implementation of this alternative will require both near- and long-term actions. For the near-term, signs will be posted at the waste unit which indicate that this area was used for the disposal of waste material and contains buried waste. In addition, existing SRS access controls will be used to maintain the use of this site for industrial use only.

In the long-term if the property is ever transferred to non-federal ownership. the U.S. Government would create a deed for the new property owner which would include information needed for

compliance with Section 120(h) of CERClA. The deed shall include notification disclosing former waste management and disposal activities as well as remedial actions taken on the site, and any continuing groundwater monitoring commitments. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of

construction debris and other materials, including hazardous substances.

The deed shall also include restrictions precluding residential use of the property. However, the need for these deed restrictions may be reevaluated at the time of transfer in the event that contamination no longer poses an unacceptable risk under residential use.

In addition, if the site is ever transferred to non-federal ownership, a survey plat of the area will be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

The soil sample analyses indicate that a majority of the contamination is located 8 - 32 feet below the surface. Institutional controls would prevent excavation to these depths and prevent future residential use of this waste unit. The present worth cost associated with this alternative is approximately $18,060. This cost includes land surveys, installation of signs, filing with the Aiken County Records, inspection and maintenance, and record of decision reviews every 5 years for 30 years.

Alternative S3 - Excavation, Debris Removal, and Offsite Disposal

This alternative consists of excavating the soil (to a depth of 6 feet) from the source control operable unit, screening it to remove rubble and debris, and disposing of the debris in an off-site disposal facility. The excavated area would then be backfilled with soil. Treatment of the residual deeper soils would not be necessary since fate and transport analysis has shown that there is little or no chance for the residual waste at the SRWU to be a source of future groundwater contamination. The present worth cost for this alternative is approximately $60,115,350. This cost includes site preparation (i.e., vegetation removal,

excavation, required utilities, etc.), backfill, site closure (reseeding), and groundwater monitoring. If the property is ever transferred to non-federal ownership, the U.S. Government would create a deed for the new property owner which would include information needed for compliance with Section 120(h) of CERCLA with notification and restrictions similar to Alternative S2. Deed restrictions under this alternative would be

necessary to prevent excavation of buried waste and groundwater use.

Alternative S4 - Placement of a Cap

Under this alternative, a low-permeability cover (i.e., clay layer, 30-mil flexible membrane liner, and a vegetative soil cover) would be placed on top of the SRWU source control operable unit. The primary purpose of the cover is to prevent exposure to surface soils. The low permeability cover would also further reduce any potential contaminant migration into the underlying soils and groundwater. The low permeability cover would be required to cover a planar area of approximately 450,000 ft 2 or 10 a cres. The present worth cost for this alternative is approximately $6,475,350. This cost includes placement of the low permeability cover, deed notifications and restrictions, inspection and maintenance, groundwater monitoring, and record of decision, reviews every 5 years for 30 years. If the property is ever transferred to non-federal ownership, the U.S. Govemment would create a deed for the new property owner which would include information needed for compliance with Section 120(h) of CERCLA with notification and restrictions similar to Alternative S2. Deed restrictions, under this alternative would be necessary to prevent excavation of buried waste and groundwater use.

VII.B Description of the Considered Alternatives for the SRWU

Groundwater ("M Area" Aquifer)

Four alternatives were also evaluated for remedial action at the SRWU groundwater ("M Area") operable unit. Each alternative is described below:

Alternative GW1 - No Action

Under this alternative, no action would be taken at the SRWU "M Area" groundwater operable unit. EPA policy and regulations require the consideration of a no action alternative to serve as a baseline against which the other alternatives can be compared. Because no further action would be taken at the unit and the SRWU "M Area" groundwater operable unit would remain in its present condition; there are no costs associated with this alternative. There would be no reduction of risk.

Alternative GW2 - Institutional Controls

Under existing controls at the SRS, the shallow groundwater at the SRWU is not used for drinking or industrial use. Upon transfer of the property, deed notifications and restrictions would be needed to prevent use of the groundwater for domestic purposes (consumption or hygiene). Groundwater monitoring would need to continue at the site on a semi-annual basis to determine potential future groundwater impacts as well as the source of groundwater contamination. For cost estimating purposes only, the groundwater monitoring was based on sampling eight wells for 30 years. However, at the five-year Record of Decision review, the groundwater monitoring data will be evaluated to determine if any changes in the groundwater remedy are appropriate. Based on the current concentrations in groundwater, the probable condition for the "M Area" groundwater aquifer is no significant groundwater contamination resulting from the SRWU. As a result, no remedial action is deemed appropriate for the "M Area" groundwater aquifer. However, a confirmatory groundwater monitoring program will be established to ensure that this is the appropriate remedial action for the "M Area" groundwater aquifer.

The present worth cost for this alternative is expected to be approximately $725,060. This cost includes placement of the deed notifications and restrictions, inspection and maintenance groundwater monitoring, and record of decision

reviews every 5 years for 30 years. If the property is ever transferred to non-federal ownership, the U.S. Government would create a deed for the new property owner which would include information needed for compliance with Section 120(h) of CERCLA with notification and resrictions similar to Alternative S2.

Alternative GW3- Extraction, Reverse Osmosis, Reinjection

Under this alternative, the groundwater would be extracted and treated by reverse osmosis. The reverse osmosis system would consist of semi-permeable membrane elements mounted in pressure tubes, high pressure water pump(s), pressure gauges, temperature gauges, and flow meters. Pre-treatment components consisting of

filters or pH-adjustment may be part of this system. The present worth cost for this alternative is expected to be approximately $2,622,070. This cost includes placement of the deed notifications and restrictions, inspection and maintenance, purchase and installation of extraction wells and a reverse osmosis unit, operation of the extraction wells and a reverse osmosis unit groundwater monitoring, and record of decision reviews every 5 years for 30 years. It should be noted that four groundwater extraction wells were estimated to be sufficient. There was no capture zone analysis conducted to determine the exact number of wells that would needed, so the estimate for the wells may be >+50 percent if more wells are required. If the property is ever transferred to non-federal ownership, the U.S. Government would create a deed for the new property owner which would include information needed for compliance with Section 120(h) of CERCLA with notification and restrictions similar to Alternative S2.

Altemative GW4 - Extraction, Recirculation Wells, Reinjection

Under this alternative, the groundwater would be extracted and treated by recirculation wells. The recirculation wells would operate by transferring the contaminants from the aqueous phase to the gaseous phase and subsequent treatment of the contaminants. The present worth cost for this alternative is expected to be approximately $722,000 for pilot test costs only and $4,620,350 for full scale remediation. This cost includes placement of the deed notifications and restrictions, inspection and maintenance, purchase and installation of extraction and recirculation wells, operation of the extraction and recirculation wells, groundwater monitoring. and record of decision reviews every 5 years for 30 years. It should be noted that for the pilot-scale system, two groundwater extraction wells and 6 monitoring well clusters were estimated to be sufficient. Full scale remediation was estimated to require 10 additional wells. There was no capture zone analysis conducted to determine the exact number of wells that would needed for either the pilot-scale or full-scale remediation system, so the estimate for the wells may be >+50 percent if more wells are required. If the property is ever transferred to non-federal ownership, the U.S. Government would create a deed for the new property owner which would include information

needed for compliance with Section 120(h) of CERCLA with notification and restrictions similar to Alternative S2.

VIII. Summary of Comparative Analysis of the Alternatives

Description of Nine Evaluation Criteria

Each of the remedial alternatives was evaluated using the nine criteria established by the National Oil and Hazardous Substances Contingency Plan (NCP). The criteria were derived from the statutory requirements of CERCLA Section 121. The NCP [40 CFR § 300.430 (e) (9)] sets forth nine evaluation criteria that provide the basis for evaluating alternatives and selecting a remedy. The criteria are:

- overall protection of human health and the environment,
- compliance with ARARs,
- long-term effectiveness and permanence,
- reduction of toxicity, mobility, or volume through treatment,

- short-term effectiveness,
- implementability,
- cost,
- state acceptance, and
- community acceptance.

In selecting the preferred alternative, the above mentioned criteria were used to evaluate the alternatives developed in the Silverton Road Waste Unit Corrective Measures Study/Feasibility Study (U) (WSRC, 1996c). Seven of the criteria we used to evaluate all the alternatives, based on human health and environmental protection, cost, and feasibility issues. The preferred alternative is further evaluated based on the final two criteria: state acceptance and community acceptance. Brief descriptions of all nine criteria are given below.

Overall Protection of Human Health and the Environment - The remedial alternatives are assessed to determine the degree to which each alternative eliminates, reduces, or controls threats to human health and the environment through treatment, engineering methods, or institutional controls.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) - ARARs are Federal and state environmental regulations that

establish standards which remedial actions must meet. There are three types of ARARs: (1) chemical-specific, (2) location-specific, and (3) action-specific.

Chemical-specific ARARs we usually health- or risk-based levels or methodologies which, when applied to unit-specific conditions, result in the establishment of numerical values. Often these numerical values are promulgated in Federal or state regulations.

Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in

specific locations. Some examples of specific locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats.

Action-specific ARARs are usually technology- or remedial activity-based requirements at limitations on actions taken with respect to hazardous substances or unit-specific conditions. These requirements are triggered by the particular remedial activities that we selected to accomplish a remedy.

The remedial activities are assessed to determine whether they attain ARARs or provide grounds for invoking one of the five waivers for ARARs. These waivers are:

- the remedial action is an interim measure and will become a part of a total remedial action that will attain the ARAR,
- compliance will result in greater risk to human health and the environment than other alternatives,
- compliance is technically impracticable from an engineering perspective,
- the alternative remedial action will attain an equivalent standard of performance through use of another method or approach,
- the state has not consistently applied the promulgated requirement in similar circumstances or at other remedial action sites in the state.

In addition to ARARs, compliance with other criteria, guidance, and proposed standards that are not legally binding, but may provide useful information or recommended procedures should be

reviewed as To-Be-Considered when setting remedial objectives.

Long-Termn Effectiveness and Permanence - The remedial alternatives are assessed based on their ability to maintain reliable protection of human health and the environment after implementation.

Reduction of Toxicity, Mobility, or Volume Through Treatment - The remedial alternatives are assessed based on the degree to which they employ treatment that reduces toxicity (the harmful nature of the contaminants), mobility (ability of the contaminants to move through the environment), or volume of contaminants associated with the unit.

Short-Term Effectiveness - The remedial alternatives are assessed considering factors relevant to implementation of the remedial action, including risks to the community during implementation, impacts on workers, potential environmental impacts (eg., air emissions), and the time until protection is achieved.

Implementability - The remedial alternatives are assessed by considering the difficulty of implementing the alternative including technical feasibility, constructability, reliability of technology, ease of undertaking additional remedial actions (if required), monitoring considerations, administrative feasibility (replatory requirements), and availability of services and materials.

Cost - The evaluation of remedial alternative must include capital and operational and maintenance costs. Present value costs are estimated within +50/-30 percent, per EPA guidance. The cost estimates given with each alternative are prepared from information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope, final project schedule, and other variable factors. As a result, the final project costs may vary from the estimates presented herein.

State Acceptance - In accordance with the FFA, the State is required to comment on/approve of the RFI/RI Report, the Baseline Risk Assessment, the

Corrective Measures Study/Feasibility Study, and the Statement of Basis/Proposed Plan.

Community Acceptance - The community acceptance of the preferred alternative is assessed by giving the public an opportunity to comment on the remedy selection process. A public comment period was held and public comments concerning

the proposed remedy are addressed in the Responsiveness Summary (Appendix A) of this Record of Decision.

Detailed Evaluation

The remedial action alternatives discussed in Sections VII.A and VII.B have been evaluated using the nine criteria just described. Table 10 presents the evaluation of the soil remedial alternatives. Table 11 presents the evaluation of the "M Area" groundwater remedial alternatives.

IX. The Selected Remedy

Based on the SRWU Baseline Risk Assessment (WSRC, 1996b), for the residential scenarios the total site carcinogenic risk for exposure to chemicals ranged from 1x10 -4 to 5x.10 -5 and the cumulative noncarcinogenic hazard indices exceeded 1.0. The total site carcinogenic risks for exposure to radionuclides ranged from 1x10 -4 to 3x10 -5 for the residential scenarios. Groundwater is the only pathway that exceeds risks of 10 -4 and a hazard index of 1.0. For the industrial scenarios, the total site carcinogenic risks for exposure to chemicals ranged from 2x10 -5 to 3xl0 -3 and the noncarcinogenic hazard indices were below 1.0. The total site carcinogenic risks for exposure to radionuclides ranged from 1x10 -5 to 3xl0 -6 for the industrial scenarios. The primary contributors for the carcinogenic risks and noncarcinogenic hazard were from groundwater. It should be noted that based on the size of the SRWU (approximately 10 acres), the contaminants of concern are present in low concentrations over a large area. Some contaminants had a low frequency of detection and were present at levels that just exceeded the most conservative contaminant level goals. Fate and transport analyses indicated that residual contaminants in the soils will not migrate to the groundwater. The presence of surface soil contamination prevents the use of this waste unit for residential use. Therefore, for the SRWU source control operable

unit, the preferred alternative is Institutional Controls. This alternative is considered to be the least cost option which is still protective of human health and the environment. Institutional Controls meets the RAOs for the SRWU soils by precluding future on-site residential use of the area.

Implementation of this alternative will require

both near- and long-term actions. For the near-tem signs, will be posted at the waste unit which indicate that this area was used for disposal of waste material and contains buried waste. In addition, existing SRS access controls will be used to maintain the use of this site for industrial use only. Further, excavation below 8 feet will be prohibited.

In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government would create a deed for the new property owner which would include information o for compliance with Section 120(h) of CERCLA. The deed shall include notification disclosing former waste management and disposal activities as well as remedial actions taken on the site, and any continuing groundwater monitoring commitments. The deed notification shall, in perpetuity, notify any potential purchaser that the property his been used for the management and disposal of construction debris and other materials, including hazardous substances.

The deed shall also include restrictions precluding residential use of the property. However, the need for these deed restrictions may be reevaluated at the time of transfer in the event that contamination no longer poses an unacceptable risk under residential use.

In addition, if the property is ever transferred to non-federal ownership, a survey plat of the area will be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

In the "M Area" groundwater aquifer, low levels of contaminants have been detected which minimally and infrequently exceed MCLs and the groundwater is currently not used as a drinking water source. The probable condition for the "M Area" groundwater aquifer is no significant groundwater contamination resulting from the SRWU. As a result, no remedial action is deemed

Evaluation Criteria Alternative S1 Alternative S2
Alternative S3 Alternative S4
No Action Institutional Controls
Excavation, Debris Removal Cap

and offsite Disposal
and Offsite Disposal
Overall Protection of This alternative is the least This alternative is
protective of This alternative is protective of This alternative would be
Human Health and the protective of human health human health. Future
human health. Most of the possible protective of human health.
Environment risk. However, risks due to residential use of the
area source of contamination would be The potetial source of
soil exposure are within would be prevented. There
was removed. There was no significant contamination would be
EPA's target risk range. no significant ecological
risks ecological risks for the unit. covered.
There was no significant for the unit.
ecological risks for the unit.

Compliance with ARARs There were no chemical- or There were no chemical- or
There were no chemical, or location- There were no chemical-or
location-specific ARARS location-specific ARARs
specific ARARs identified for the location-specific ARARs
identified for the waste unit. identified for the waste
unit. waste unit. Compliance with the identified for the waste unit.
Since this alternative does Since this alternative
does not Clean Air Act in limiting the amount Compliance with the Clean
not require any action at the require any action at the
unit, of dust created through this Air Act in limiting the amount
unit, there are no action- there are no action-
specific alternative would be required. Land of dust created through this
specific ARARs to be met. ARARs to be met.
disposal restrictions for disposal of alternative would be required.

any wastes generated would also be All activities would be
any wastes generated would also beAll activides would be

required. All activities would be required to comply with

required to comply with OSHA OSHA standards. However,

standards. RCRA guidance on caps are

To-Be-Considered.

Long- term effectiveness This alternative will not This alternative will
provide This alternative provides long-term This alternative will provide
and permanence reduce risks wich are within long-term effectiveness
and effectiveness through removal of long-term effectiveness and
EPA's target risk range. permanence as long as the
deed most of the waste materials. permanence as long as the
notifications are
enforced. low permeability cover is

notifications are enforced. low permeability cover Is

properly maintianed.

Reduction of toxicity, This alternative does not This alternative does not reduce This alternative provides reduction This alternative would mobility, or volume reduce toxicity, mobility, or toxicity, mobility, or volume in the mobility of contaminants by provide reduction in the through treatment volume through treatment through treatment since there is removing the source of mobility of the contaminents since there is no treatment no treatment process. contamination to a managed facility. since migration of the process. contaminents is reduced.

Table 10 Evaluation of Remedial Alternatives Considered for the SRWU Source Control Operable Unit (cont'd).

Evaluation Criteria Alternative S1 Alternative S2 Alternative S3 Alternative S4
No Action Institutional Controls Excavation, Debris Removal Cap

and Offsite Disposal
Short-term effectiveness This alternative does not This alternative does not This alternative may potentially The workers will not be provide any active provide any active remediation expose the workers to the waste exposed to the waste disposed remediation and would and would therefore not expose disposed of at the unit. The use of of at the unit. The use of therefore not expose any any workers to hazards heavy equipment poses typical risks heavy equipment poses typical workers to hazards associated with remedial to the workers involved. This risks to the workers involved. associated with remedial activities. This alternative alternative would not expose the This alternative would not activities. This alternative would not expose the surrounding community to short-term expose the surrounding would not expose the surrounding community to risk as site access is restricted. community to short- term risk surrounding community to short-term risk as site access is as site access is restricted. short-term risk as site restricted. access is restricted.

Implementability	This alternative is currently in-place. There is no action involved with this alternative.	This alternative is easily implementable requiring the filing of deed notifications, require earth and debris removal as well as the location of an appropriate disposal location for the debris and earth removed from the unit.	This alternative is probably the most difficult to implement since it would require earth and debris removal as activities. In addition, the location of a large quantity of suitable clay borrow material would need to be found.	This alternative would require the filing of deed notifications to notify any potential purchasers of the land that the land has been used for waste management and disposal
Cost	There are no costs involved with this alternative.	The total cost for this alternative is estimated to be $18,060.	The total cost for this alternative is estimated to be $6,475,350.	The total cost for this alternative is estimated to be $60,115,350.
State Acceptance	This criterion will be completed following review by the appropriate regulatory agencies.	This criterion will be completed following review by the appropriate regulatory agencies.	This criterion will be completed following review by the appropriate regulatory agencies.	This criterion will be completed following review by the appropriate regulatory agencies.
Community Acceptance	This criterion will be completed following public review.	This criterion will be completed following public review.	This criterion will be completed following public review.	This criterion will be completed following public review.

Table 11 Evaluation of Remedial Alternatives Considered for the SRWU "M Area" Groundwater Operable Unit

Evaluation Criteria	Alternative GWI	Alternative GW2	Alternative GW3	Alternative GW4
	No Action	Institutional Controls	Extraction, Recirculation, Reinjection	Extraction, Reverse Osmosis, Wells, Reinjection
Overall Protection of Human Health and the Environment	This alternative is the least protective of human health. This alternative would treat the contaminants from the "M Area" groundwater to below MCLs.	This alternative is protective of human health. This alternative would treat the contaminents from the "M Area" groundwater to below MCLs.	This alternative is protective of human health. Future use of the groundwater would be prevented.	This alternative is protective of human health. This alternative would treat the contaminents from the "M Area" groundwater to below MCLs.
Compliance With ARARs	There were no location-specific ARARs determined for the groundwater. This alternative would meet all action-specific ARARs as this alternative does not involve any action at the unit. This alternative would not meet all MCL goals. However, the groundwater minimally and infrequently exceeded the MCL goals which indicate	There were no location- specific ARARs determined for the groundwater. Compliance with the Clean Air Act in air releases; with the Clean Water Act for discharge limitations; with the Safe Drinking Water Act for MCLs; and with the South Carolina Well Standards and Regulations would be required for this low levels of contaminents in the groundwater minimally and infrequently exceeded the MCL goals which indicate	There were no location- specific ARARs determined for the groundwater. Compliance with the Clean Air Act in air releases; with the Clean Water Act for discharge limitations; with the Safe Drinking Water Act for MCLs; and with the South Carolina Well Standards and Regulations would be required for this alternative. All work would need to comply with OSHA standards.	There were no location- specific ARARs determined for the groundwater. This alternative would meet all action-specific ARARs as this alternative does not involve any action at the unit. This alternative would not meet all MCL goals. However, the levels of contaminents in the groundwater minimally and infrquently exceeded the MCL goals wich indicate that there is no significant groundwater threat.

that there is no significant groundwater threat.

Long-term effectiveness and permanence This alternative provides long- term effectiveness through treatment of contaminents in the groundwater. This alternative will not provide long- term effectiveness through The groundwater plume is minimal and possibly depleting; and there is no potential future unit impact to the groundwater This alternative will provide long- term effectiveness and notifications are enforced. This alternative provedes long- term effectiveness through treatment of organic contaminents in the groundwater.

Reduction of toxicity, mobility, or volume through treatment This alternative provides reduction in toxicity, mobility, and volume by treating the contaminents in the groundwater. This alternative does not reduce toxicity, mobility, or volume through treatment process. This alternative does not reduce toxicity, mobility, or volume through treatment since there is no treatment process. This alternative provides reduction in toxicity, mobility, and volume by treating the organic contaminents in the groundwater.

Evaluation Criteria	Alternative GW1 No Action	Alternative GW2 Institutional Controls	Alternative GW3 Extraction, Reverse Osmosis, Reinjection	Alternative GW4 Extraction, Recirculation Wells, Reinjection
Short-term effectiveness	This alternative does not provide any active remediation and would remediation workers during remediation and would workers implementation. The use of equipment poses typical risks to the workers involved. Strict adherence to OSHA guidelines would limit the risks. This alternative would not expose	This alternative provides minor risk to workers during implementation. The use of equipment poses typical risks to the workers involved. Strict adherence to OSHA guidelines would not expose	This alternative does not provide any active remediation and would remediation workers during remediation and would workers implementation. The use of equipment poses typical risks to the workers involved. Strict adherence to OSHA guidlines the surrounding community to	This alternative provides minor risk to workers during implementation. The use of equipment poses typical risks to the workers involved. Strict adherence to OSHA guidlines the surrounding community to

short- alternative would not expose the would limit the risks. This
the surrounding community to term risk as site access is
surrounding community to short-term alternative would not expose the
short-term risk as site access restricted.
risk as site access is restricted. surrounding community to short-
is restricted.
term risk as site access is

restricted

Implementability This alternative is currently This alternative is easily
This alternative would require the filing This alternative would require
in-place. There is no action implementable requiring the
filing of deed notifications and the the filing of deed notifications
involved with this alternative. of deed notifications and
the continuation of groundwater monitoring. and the continuation of
continuation of groundwater
Additional permits would be required groundwater monitoring. This
monitoring.
for operation of the equipment. This alternative is also an innovative

alternative is readily available. technology that may be more

difficult to implement correctly.

Cost There are no costs involved The total cost for this
alternative The total cost for this alternative is The total cost for this
alternative
with this alternative. is estimated to be $725,060.
estimated to be $2,622,070. is estimated to be $4,620,350.
However, confirmatory
groundwater monitoring will
be implemented.

State Acceptance This criterion will be This criterion will be
completed This criterion will be completed This criterion will be completed
completed following review following review by the
following review by the appropriate following review by the
by the appropriate regulatory appropriate regulatory
agencies. regulatory agencies. appropriate regulatory agencies.
agencies.

Community Acceptance This criterion will be This criterion will be
completed This criterion will be This criterion will be completed
completed following public following public review.
following public review. following public review.
review.

appropriate for the SRWU "M Area" groundwater aquifer. However, a confirmatory groundwater monitoring program will be established to ensure that this is the appropriate remedial action for the "M Area" groundwater aquifer. In the event that the probable condition is no longer appropriate, DOE will evaluate the need for remedial action. There are no groundwater RAOs to be met for the "M Area" groundwater aquifer since the selected remedy for the aquifer is no remedial action with confirmatory groundwater monitoring.

Under this groundwater monitoring program, additional background monitoring well(s) will be installed since one of the original background wells for the "M Area" groundwater operable unit went dry and was never monitored. The background well(s) will be used to further evaluate the upgradient concentrations of the contaminants in the "M Area" groundwater operable unit. In addition to the new background well(s), the existing background well and approximately six existing "M Area" wells will also be monitored. This monitoring is intended to evaluate trends in the groundwater contamination. Groundwater monitoring was assumed to be conducted on a semi-annual basis for 30 years (for cost estimating purposes only). However, at the five-year ROD review, the groundwater monitoring data will be evaluated to determine if any changes in the groundwater remedy are appropriate.

The number and location of the new background well(s), a list of the existing wells to be monitored, the frequency of monitoring, and the submittal frequency of the groundwater data for regulatory review will be listed in the SRWU Corrective Measures Implementation/ Remedial Action Report (CMI/RAR) post-ROD document. The CMI/RAR will also identify a groundwater strategy which will include trend analysis and recommendations based on the interpretation of the data in the post-ROD groundwater monitoring reports.

The SCDHEC has modified the SRS RCRA permit to incorporate the selected remedy.

This proposal is consistent with EPA guidance and is an effective use of risk management principles.

X. Statutory Determinations

Based an the SRWU RFI/RI Report and the Baseline Risk Assessment, the SRWU poses no significant risk to the environment and minimal risk to human health. Therefore, a determination has been made that institutional controls are sufficient for protection of human health and the environment for the SRWU soils and that no remedial action with confirmatory groundwater monitoring is deemed appropriate for the "M Area" groundwater aquifer.

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The size of the waste unit and the random distribution and low levels of contaminants preclude a remedy in which treatment is a practical alternative. Because treatment of the principal threats of the site was found to be impracticable, this remedy does not satisfy the statutory preference for treatment as a principal element.

Institutional controls will result in hazardous substances, pollutants, or contaminants remaining in the waste unit. Section 300.430 (f)(4)(ii) of the NCP requires that a Five Year Review of the ROD be performed if hazardous substances, pollutants, or contaminants remain in the Waste Unit. The three Parties have determined that a Five Year Review of the ROD for the SRWU will be performed to ensure continued protection of human health and the environment.

XI. Explanation of Significant Changes

The 45-day public comment period for the Statement of Basis/Proposed Plan for the Silverton Road Waste Unit (731-3A) (WSRC, 1996d) began on September 17, 1996 and ended on October 31, 1996. A public meeting was held on October 15, 1996. During the public comment period, there were three comments received. These comments are addressed in Appendix A of this Record of Decision. Based on these comments, there were no significant changes made to the preferred alternative originally presented in the SRWU Statement of Basis/Proposed Plan. However, based on a review of recent groundwater data indicating minimal and infrequent MCL

exceedances, the ROD no longer references an ACL/MZ demonstration for the groundwater. The proposed action for the groundwater is no remedial action with confirmatory groundwater monitoring.

XII. Responsiveness Summary

There were three comments received during the public comment period. The Responsiveness Summary (see Appendix A) of this Record of Decision addresses these comments.

XIII. Post-ROD Document Schedule

The post-ROD document schedule is listed below and is illustrated in Figure 8:

1. Corrective Measures Implementation/ Remedial Action Report (CMI/RAR) (rev. 0) for the SRWU will be submitted for EPA and SCDHEC review four months after issuance of the ROD.

2. EPA and SCDHEC review of the SRWU CMI/RAR (rev. 0) - 90 days.

3. SRS revision of the SRWU CMI/RAR (rev. 0) after receipt of regulatory comments - 60 days.

4. EPA and SCDHEC final review and approval of the SRWU CMI/RAR (rev/ 1) - 30 days.

<IMG SRC 97025P>

XIV. REFERENCES

DOE (U.S. Department of Energy), 1994. Public Involvement, A Plan for the Savannah River Site. Savannah River Operations Office, Aiken, South Carolina.

EPA (U.S. Environmental Protection Agency), 1995. EPA Region III Risk-Based Concentration Table. July-December 1995. Roy L. Smith, October 20,1995.

FFA, 1993. Federal Facility Agreement for the Savannah River Site, Administrative Docket No. 89-05-FF, (Effective Date. August 16, 1993).

WSRC (Westinghouse Savannah River Company), 1994a. Quality Control Summary Report for the Silverton Road Waste Unit RFI/RI Assessment (U), ESH-EMS-94-0532, Rev. 0. Westinghouse Savannah River Company, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1994b. Risk-Based Preliminary Remediation Goals for Radionuclides. Scoping Phase Calculations (U), WSRC-TR-94-0181, Rev. 1, Westinghouse Savannah River Company, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1996a. Final RFI/RI Report for the Silverton Road Waste Unit (U), WSRC-RP-95-214, Rev. 1.2, Westinghouse Savannah River Company, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1996b. Final Baseline Risk Assessment for the Silverton Road Waste Unit (U), WSRC-RP-95-215, Rev. 1.1, Westinghouse. Savannah River Company, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1996c. Silverton Road Waste Unit Corrective

Measures Study/Feasibility Study (U), WSRC-RP-96-100, Rev. 1.1, Westinghouse Savannah River Company, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1996d. Statement of Basis/Proposed Plan for the Silverton Road Waste Unit (731-3A) (U), WSRC-RP-96-118, Rev. 1.2,. Westinghouse Savannah River Company, Aiken, South Carolina.

APPENDIX A

RESPONSIVENESS SUMMARY

Responsiveness Summary

The 45-day public comment period for the Statement of Basis/Proposed Plan for the Silverton Road Waste Unit (731-3A) began on September 17, 1996 and ended on October 31, 1996. A public meeting was held on October 15, 1996. During the public meeting, there were two questions received during the Public Meeting and Comment Session on the Limited Action Proposed Plans/Permit Modifications presentations; and, there was one public comment received during the Formal Public Comment Session. All of the comments are listed as recorded in the Savannah River Site Information Exchange transcript based on the October 15, 1996 Public Meeting.

Specific comments and responses are noted below. The comments are italicized and the responses are
bolded.

Public Comments

The following two comments were received during the Limited Action Proposed Plans/Permit Modifications
presentations.

1)Public Citizen:What risk is there for animals or I guess future environmental, like if you were going to
turn this into a park?

Response to Comment 1):

As part of the baseline risk assessment process for the Silverton Road Waste Unit (SRWU), an ecological risk assessment was conducted to consider the potential impacts to animal and plant life caused by exposure to chemical and radionuclide constituents at the SRWU. The process included a site ecological reconaissance survey that determined no wetlands important to animal or plant habitats or threatened and endangered species were in the vicinity of the SRWU; and use of this site by threatened and endangered species would not be expected.

Based on the ecological risk assessment, there is no reason to expect any advese effects on animal or plant life from the SRWU areas were to be turned into a park in the future.

A more detailed discussion of the ecological risk assessment may be found in Section 2 of the Final Baseline Risk Assessment for the Silverton Road Waste Unit (WSRC, 1996b).

2)Public Citizen: Are you using like private landfills and private - or I guess what other communities
have developed? I mean it looks like a landfill to me. And it looks like there are landfills all over the
country and there's a whole lot of landfills that have turned into like parks and stuff. Is that an
opportunity here to turn it into a park or to use private models and maybe look at who has done this a
lot? I guess the EPA guy was talking about streamlining. Are you guys using private streamlining
ideas?

Response to Comment 2):

The SRS is currently considered to be a national environmental research park and as such, the site is/will be used for environmental research. For the institutional controls units, the only thing that our remedial decision has done is to state that these waste units will not be used
for any residential use. The selected remedy is consistent with what other federal, state, municipal, and private entities are doing.

Due to the proximity of the SRWU to the site boundary, there is a potential that this area could be converted for recreational use (i.e. used as a park). For the SRWU, the risk levels

for the soils alone barely exceed the threshold for residential (both adult and child) use; and the presence of buried debris should not interfere with the use of the SRWU as a park. However, there are low levels of groundwater contamination present at the SRWU that could prevent use of the groundwater as a drinking water source. There are constituents present in the groundwater that minimally and infrequently exceed primary drinking water standards.

It should be noted that the use of the SRWU as a park or any other recreational use would be evaluated at the time of property transfer or change in use.

The following comment was received during the Formal Public Comment Session.

3)Mike Rourak: My name is Mike Rourak and my question is directed directly to Mr. Brian Hennessey's earlier discussion (unintelligible) Silverton Road property, for example. In the Future Use Manual that was sent out to some of us about the disposal of close to a million acres of property for DOE, in your deed restrictions there're things that we cannot do. And we're going to need a little bit before we can respond back to Washington. Those of us who received the manual, we almost are going to need to know what those deed restrictions are because if we cannot have a subdivision then there's no need to bid the price accordingly or say that's what we want to use it for. If we cannot graze cattle there like we do in Tennessee at [unintelligible] or something or grow crops because we cannot put a well in for contamination, then we are left with only looking at it for the pine trees.

So being federal, you own this property. Even with deed restrictions you've got to give us either a Phase I, II, or III audit. In this case, it's the seller who has to provide this liability not necessarily the buyer's neglect of liability to due diligence. So it would really help if we knew what deed restrictions would be there to a more extent and also what we can use the land for. If I want to use it for applying 50 - - under the Code of Federal Regulations 503, if I want to use it for bio solid disposal, can I do so? Because it's adjacent to your other property. So the deed restrictions that you brought up were of immense concern about responding back to the future use and the disposal of roughly 849,000 acres nationwide for - to be put back into - I understand from Washington, they would like to put it back mainly into public use to get the taxes off of it. Maybe not so much for the government, but

for the
local entities who lose the tax base. Thank you.

Response to Comment 3):

The SRS Future Use Project Report was distributed to inform citizens of the planned future uses
of SRS. The recommendations that were presented in the report may change over time and will
be discussed with the stakeholders. Deed restrictions for federal property are not determined
until the land is transferred to non-federal control at the time of property transfer, the need for
deed restrictions will be evaluated due to natural attentuation, decay, etc., the conditions at
specific areas may not warrant any deed restrictions. All legal requirements will be met at the
time of property transfer.

I

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 03/27/1997
Operable Unit: 45
ROD ID: EPA/541/R-97/026

Media: Soil

Contaminant: Hydrocarbons, chlorinated hydrocarbons.

Abstract: The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. SRS is a secured U.S. Government facility with no permanent residents. The site is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company. The Grace Road site is located 800 yards east of the intersection of Grace Road and SRS Road 2 and covers an area of approximately 9 3/5 acres.SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. Chemical and radioactive wastes are by-products of nuclear material production processes. Hazardous substances are currently present in the environment at SRS. Prior to the establishment of SRS, Grace Road site was part of a tenant-operated farm. After purchase by the government, the area in and around the farm was used as a laydown yard for materials used in the construction of B Area.The chemical and radioactive wastes have been treated, stored, and in some cases, disposed at SRS. Past disposal practices have resulted in soil and groundwater contamination. No records of any type of waste management activity have been found for the Grace Road site. The SRS was included on the National Priorities List (NPL) in 1989. Between February and May 1992, all the debris, drums and concrete slabs were removed from the Grace Road site. Investigations and sampling have concluded that contaminants are at minimal levels and

poses no unacceptable risk to human health and the environment at the Grace Road site.

Remedy: The selected remedy for this site is No Action.

Text: Full-text ROD document follows on next page.

<IMG SRC 970260>

<IMG SRC 97026A>

APR 01 1997

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

4WD-FFB

Mr. Keith Collinsworth, FFA Project Manger
Federal Facility Agreement Section
Division of Site Engineering and Screening
Bureau of Solid & Hazardous Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

SUBJ: Transmittal of Signed Records of Decision for Gunsite 720, Gunsite 113, Grace Road, D-Area Burning/Rubble Pits,F-Area Burning/Rubble Pits, and Silverton Road Waste Unit

Dear Mr. Collinsworth:

Enclosed you will find six (6) Records of decision for the above referenced sites. The Environmental Protection Agency (EPA) has signed these documents. We are transmitting them to you for signature by the State of South Carolina. After signature, please forward the signed documents to the Department of Energy so that they may be included in the administrative record.

If you have any questions, please contact me at (404)562-8551 or Jeffery L. Crane, FFA Project Manger at (404)562-8546.

<IMG SRC 97026B>

cc: Brian Hennesey, DOE-SRS
Kim Wierzbicki, WSRC
Donna Brumley, DOE-SRS
Hammett. DOE-SRS

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<IMG SRC 97206C>

Record of Decision
Remedial Alternative Selection (U)

Grace Road Site (631-22G)
Operable Unit: Final Action

WSRC-RP-96-00160
Revision.1
January 1997

Savannah River Site
Aiken County, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U.S. Department of Energy Under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

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DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

Grace Road Site (SRS Bldg. # 631-22G)
Savannah River Site
Aiken, South Carolina

The Grace Road Site (631-22G) is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) solid waste management unit/Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site.

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Grace Road Site located at the Savannah River Site near Aiken, South Carolina. The selected action was developed in accordance with CERCLA, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The selected remedy satisfies both CERCLA and RCRA 3004(u) requirements. This. decision is based on the Administrative Record File for this specific RCRA/CERCLA unit.

Description of the Selected Remedy

The results of the Resource, Conservation and Recovery Act Facility Investigation/Comprehensive Environmental Response Compensation and Liability Act Remedial Investigation, indicate that the Grace Road Site poses no unacceptable risk to human health or the environment. Therefore, no action is needed at the Grace Road Site. This is the final RCRA/CERCLA action for the Grace Road Site. The South Carolina Department of Health and Environmental Control has modified the SRS RCRA permit to incorporate the selected remedy.

Declaration Statement

Based on the results of the remedial investigation, no action is necessary at the Grace Road Site to ensure the protection of human health and the environment. Since Grace Road Site poses no unacceptable threat to human health or the environment, and no action is needed, the CERCLA Section 121 requirements are not applicable. This action is protective of human health and the environment and is meant to be a permanent solution, final action, for the Grace Road Site. No five-year remedy review is needed or will be performed.

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Decision Summary
Remedial Alternative Selection (U)
for the
Grace Road Site (631-22G)
Operable Unit: Final Action

WSRC-RP-96-00160
Revision.1

January 1997

Prepared by:
Westinghouse Savannah River Company
Aiken, South Carolina
Prepared for the U.S. Department of Energy Savannah River Operations Office
Under Contract DE-AC09-96SR18500

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DECISION SUMMARY
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I. Site and Operable Unit Name, Location, and Description

The Savannah River Site (SRS) occupies approximately 803 square kilometers (310 square miles) of land adjacent to the Savannah River, principally in Aiken and Barnwell Counties of South Carolina (Figure 1). SRS is a secured U.S. government facility with no permanent residents. SRS is located approximately 40 kilometers (25 miles) southeast of Augusta, Georgia, and 32 kilometers (20 miles) south of Aiken, South Carolina.

SRS is owned by the Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided nuclear materials for the space program and for medical, industrial, and research efforts. Chemical and radioactive wastes are by-products of nuclear material production processes.

The Federal Facility Agreement (FFA, 1993) for SRS lists the Grace Road Site (631-22G) as a RCRA/CERCLA unit that required further evaluation.

The Grace Road Site is located approximately 1.3 kilometers (0.8 mi) south of B-Area and about 244 meters (800 yards) east of the intersection of Grace Road and SRS Road 2. The unit is roughly rectangular in shape and has a northwest-southeast orientation running parallel to Grace Road (Figure 2). The unit is

approximately 396.3 meters (1300 ft) by 97.6 meters (320 ft). It covers an area of about 3.8 hectares (9.6 acres).

The Grace Road Site consisted of numerous drums and cans, concrete slabs, brick foundations (pre-SRS) and miscellaneous debris. Small mounds of concrete, bricks, shingles, car and truck parts and large concrete blocks that appeared to be pieces of a bridge were also found at the unit. The unit also contained numerous drums and cans varying in size from 1/2 gallon cans to 55 gallon drums and various car parts. Most of the debris was on the surface or partially buried in scattered locations across the unit. Markings on a few of the smaller drums and cans indicated that they once contained oil and grease. There is no evidence that any recent disposal activity has occurred or that the disposal activity was more widespread. Also, there is no evidence of any burning or excavation at this waste unit.

II. Operable Unit History and Compliance History

Operable Unit History

Prior to the establishment of SRS, Grace Road Site was part of a tenant-operated farm owned by Mrs. Elise Grace. The farm consisted of about 217.6 hectares (544 acres) of which 92 hectares (230 acres) were under cultivation, and the remaining 125.6 hectares (314 acres) were in woodlands and swamp lands. Transfer records of this land to the U. S. Government in January 1951 indicate that this land had been a farm (part of the Red Hill Plantation) since the late 1890's.

Buildings on the farm consisted of a main house, dog kennel, machine shed, oil house, two cottages, two turkey houses, two barns, garage, cook house, two-story barn, water tower with meat house, storage shed, grain storehouse, hay storage barn and an outhouse (privy). The majority of the buildings had a foundation of bricks, concrete or tile blocks. Several buildings, including the dog kennels and turkey houses, had concrete slab floors. The water tower also had massive concrete blocks that were used to hold treated timber stanchions that supported the water tank. Photographs of the farm show at least two gasoline powered tractors in the machine shed, a truck and other assorted farm machinery.

After purchase by the Government, the area in and around the farm was utilized as a laydown yard for materials used in the construction of the B Area. The

length of time that it was utilized for this purpose is unknown, but is estimated to be two to three years. There are no records to indicate that this unit has been used for any other purpose since it was closed as a laydown yard in the mid-1950s.

Between February and May 1992, all the debris, drums and concrete slabs were removed from the Grace Road Site. The items removed were either used at soil erosion control areas or were disposed of in the sanitary landfill. The EPA and SCDHEC granted approval prior to SRS removing the materials from the waste unit.

No records of any type of waste management activity have been found for the Grace Road Site. Based upon available information, i.e., literature search and records search, no hazardous materials have been managed or disposed of at Grace Road.

Compliance History

At SRS, waste materials regulated under the Resource Conservation and Recovery Act (RCRA) are managed in accordance with the requirements of RCRA. Certain SRS activities have required treatment, storage, disposal

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or post-closure permits under RCRA. Non-regulatory units, called solid waste management units (SWMU), include any activity where hazardous constituents may remain uncontrolled and may potentially release to the environment. Investigation and potential corrective action for these SWMU(s) are mandated under RCRA 3004(u). In 1995, SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control (SCDHEC) which includes corrective action requirements. Specifically, part V of the permit mandates that SRS establish and implement a RCRA Facility Investigation (RFI) Program to fulfill the requirements specified in Section 3004(u) of RCRA.

Hazardous substances, as defined by CERCLA, are also present in the environment at SRS. On December 21, 1989, SRS was placed on the National Priorities List

(NPL). A site placed on the NPL comes under the requirements of CERCLA. In accordance with Section 120 of CERCLA, DOE has entered into an FFA with the EPA and SCDHEC to coordinate cleanup activities at SRS into one comprehensive strategy that fulfills RCRA Section 3004(u) and CERCLA assessment, investigation, and response action requirements.

The remedial investigation for Grace Road Site was completed in 1994. The results of the investigation indicate that there is no impact (or potential impact) to human health or the environment from the Grace Road Site. Therefore, no action is warranted. No other alternatives were considered.

According to EPA guidance, if there is no current or potential threat to human health and the environment and no action is warranted, the CERCLA 121 requirements are not triggered. This means that there is no need to evaluate other alternatives or the no action alternative against the nine criteria specified under CERCLA.

The remedy selected satisfies both the CERCLA and RCRA 3004(u) requirements. The SCDHEC has modified the SRS RCRA permit to incorporate the selected remedy.

Public participation requirements are listed in Sections 113 and 117 of CERCLA. These requirements include the establishment of an Administrative Record File that documents the selection of remedial alternatives and allows for review and comment by the public regarding those alternatives. The Administrative Record File must be established "at or near the facility at issue." The SRS Public Involvement Plan (DOE, 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. Section 117(A) of CERCLA, as amended, requires the preparation of a proposed plan as part of the site remedial process. The

Statement of Basis/Proposed Plan for the Grace Road Site (WSRC, 1996a), which is part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing of the Grace Road Site.

The statement of basis/proposed plan (SB/PP) submitted fulfills the requirements of CERCLA Section 117(a) by providing the public an opportunity to participate in the remedy selection process. The SB/PP presented the preferred alternative and the rationale for selecting the alternative. DOE, in consultation with

EPA - Region IV and SCDHEC, selected the final action for the Grace Road Site following the public comment period.

III. Highlights of Community Participation

The Administrative Record File, which contains information pertaining to the selection of the response action, is and has been available at the following locations:

U.S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

Similar information was also made available through the following repositories:

Reese Library
Augusta State University
2500 Walton Way
Augusta, Georgia 30910
(706) 737-1744

Asa H. Gordon Library
Savannah State University
Tompkins Road
Savannah, Georgia 31404
(912)356-2183

The public was notified of the comment period for the SB/PP through mailings of the SRS Environmental Bulletin, a newsletter sent to more than 3400 citizens in South Carolina and Georgia, and through notices in many local newspapers.

The 45-day public comment period began on September

17, 1996, and ended on October 31, 1996. No comments were received.

IV. Scope and Role of Operable Unit within the Site Strategy

The overall strategy for addressing the Grace Road Site was to: 1) determine if there had been a release of hazardous substances; 2) determine the nature and extent of any contamination; 3) perform a baseline risk assessment; and 4) evaluate the need for remedial action to address any potential risk to human health and the environment.

The investigation and risk assessment have been completed for the Grace Road Site. Since the results of the investigation indicate that there is no impact to human health or the environment, no action was recommended.

The Grace Road Site is part of the larger Upper Three Runs watershed consisting of several surface and groundwater units. The Grace Road Site does not contribute contamination to groundwater within the watershed. Although the risk assessment indicated that the Grace Road Site does not impact human health or the environment, arsenic was detected above unit specific background. The arsenic does not appear to be from the waste unit. It is possible it is from farming activities prior to SRS being built. Arsenic has also been detected at several other waste units and other Site areas. Arsenic will be evaluated on a Site-wide basis as part of the Soil Background Study.

V. Summary of Operable Unit Characteristics

There is no documented information available regarding past hazardous or non-hazardous waste disposal activities at the Grace Road Site. Markings on the drums found at the unit suggest that they once contained oil and grease. There is no evidence that any recent disposal activity has occurred or that the disposal activity was more wide spread. Also, there is no evidence of any burning or excavation at this waste unit.

Media Assessment

Only surface disposal activities appear to have occurred at the Grace Road Site. Based on this, the conceptual release model consisted of a release to surface soils with a potential for leaching to subsurface soils. Therefore, only surface and subsurface soils were investigated. For

a detailed explanation of the release model, potential receptors and the fate and transport of contamination, see the RFI/RI report for the Grace Road Site (631-

22G). WSRC-RP-95-93 (WSRC, 1996b).

Soil/vadose zone and groundwater investigations were conducted between 1990 and 1994. The initial investigation was based on a 1988 soil gas survey which detected low levels of hydrocarbons and chlorinated hydrocarbons. Detailed descriptions of the investigation and characterization conducted at the Grace Road Site may be found in the RCRA Facility Investigation/Remedial Investigation Report for the Grace Road Site (631-22G), WSRC-RP-95-93 (WSRC, 1996b) and the RCRA Facility Investigation Remedial Investigation Plan for the Grace Road Site WSRC-RP-90-1250 (WSRC, 1990).

Groundwater

Groundwater data from wells near the Grace Road Site indicate that there is no groundwater contamination.

Surface Water/Sediment

No surface water or sediment sampling was conducted because the nearest surface water feature is located over 1 mile from the Grace Road Site.

Soils

The soils investigation was designed to assess the horizontal extent and vertical migration of any hazardous constituents at the unit and to evaluate (prove/disprove) the release model.

The soils investigation included taking soil samples (1990 and 1994), an electromagnetic survey (1990), a ground penetrating radar (GPR) survey (1994) and a soil gas survey (1994).

The magnetometer survey and the GPR survey indicate that there are no buried materials at the unit.

An extensive soil gas survey was performed in 1994. A total of 85 sample locations were established and samples collected at each location. Species monitored for this survey were: light hydrocarbons; gasoline range normal paraffins; gasoline range aromatic hydrocarbons; diesel range hydrocarbons; selected organics; and mercury.

The level of volatiles and diesel range organics observed

in the survey were very low with most below minimum detection levels. Levels of light hydrocarbons and mercury were indicative of background concentrations in the SRS area. No evidence of contamination was detected at this unit by the soil gas survey.

Confirmation soil sampling served as a screening for semi-volatile and volatile organic compounds, metals,

and radionuclides. In addition, Appendix IX parameters were also analyzed. Results from the soil gas survey conducted in 1988 and the location of the debris/rubble were used to select soil sample locations. Background samples were also obtained for comparison purposes.

Metals found in concentrations greater than analytical method detection limits were arsenic, barium, cadmium, chromium, mercury, lead, selenium, tin, vanadium and zinc. Acetone, methylene chloride and bis(2-ethylhexyl)phthalate were also detected. Phthalate species are used as plasticizers for cellulose, glass, plastic, and rubber products. Other substances detected, such as acetone, xylene, and methylene chloride are commonly used as laboratory solvents. Radionuclide indicator parameters (gross alpha, non-volatile beta) were within background. See Table 1 for constituent concentrations and background levels.

The concentration levels of the analytes, with the exception of arsenic and lead, were within background levels. The concentration level of arsenic detected at the unit, ranged from 2.6 to 3.2 mg/kg and for lead, the range is 0.9 to 48.1 mg/kg.

The level of arsenic detected is consistent with the levels found throughout SRS. The arsenic may be naturally occurring or added to the soils as a pesticide prior to SRS operations. Arsenic will be evaluated on a Site-wide basis during the implementation of the Site-wide Soils Background Study.

VI. Summary of Operable Unit Risks

Human Health Risks

As part of the RCRA/CERCLA process for the Grace Road Site, a risk assessment was performed using data generated during the assessment phase. Detailed

information regarding the development of chemicals of potential concern, fate and transport of contaminants and risk assessment can be found in the RFI/RI Report for Grace Road Site (631-22G), WSRC-RP-95-93 (WSRC, 1996b).

After combining analytical data and eliminating those analytes not detected in any samples, the data were evaluated on the basis of quality with respect to sample quantitation limits, frequency of detection, relative toxic potential of the constituent, laboratory qualifiers and codes, and blanks. The remaining data (constituents detected) were compared to two times the unit-specific background and EPA developed Risk-Based Concentrations (RBCs).

RBCs developed by EPA Region III (EPA, 1995) were used to screen the chemicals of potential concern for the Grace Road Site. This guidance provides reference doses

and carcinogenic potency data for nearly 600 chemicals. These toxicity constants have been combined with "standard" exposure scenarios to calculate RBCs - chemical concentrations corresponding to fixed levels of risk (i.e., a hazard quotient of 1, or a lifetime cancer risk of one in one million). The RBCs are very similar to preliminary remediation goals which are concentration goals for individual chemicals for a specific medium and land use combinations at CERCLA units.

Following the comparison to background and RBCs (Table 1), only two chemicals remained to be studied further, arsenic and lead.

The screening level for lead in soil is 400 mg/kg for residential land use. This value is described in OSWER Directive # 9355.4-12, Revised Internal Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, dated July 14, 1994 and issued by the USEPA (EPA, 1994). Because lead concentrations range from 0.9 to 48.1 mg/kg, which are far below the EPA guidance level, lead was eliminated as a COPC.

Since arsenic was not eliminated from the screening process, calculations were performed to determine the risk for the on-unit resident scenario. Note, however, that arsenic was used as a component of agricultural chemicals in the period before SRS existed and that Grace Road was a farm. Thus, a few of the detected values may be a result of farming activities prior to 1950. SRS wide values for arsenic range from less than 0.5 mg/kg to 15.2 mg/kg. The SRS maximum concentration level for arsenic in Blanton (the soils type found at Grace Road) soils is 7.05 mg/kg.

Only one land use scenario was considered: future land use (residential). The potential human receptor addressed was a hypothetical future on-unit resident. A current on-unit worker scenario was not performed because no worker activity is conducted in the area.

Cancer risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of pathway-specific exposure to carcinogenic contaminants. The risk to an individual resulting from exposure to non-radioactive chemical carcinogens is expressed as the increased probability of a cancer occurring over the course of a 70 year lifetime. Cancer risks are related to the EPA target range of one in ten thousand (1 x 10 -04) to one in one million (1 x 10 -06) for incremental cancer risk at NPL sites. In order to account for simultaneous exposure to multiple carcinogens through a given pathway, the risks calculated for each individual carcinogen in that medium were summed to obtain an estimate of the total cancer risk for the pathway.

Table 1. COMPARISON OF UNIT SPECIFIC SOIL CONCENTRATION TO TWO TIMES BACKGROUND CONCENTRATIONS AND RISK-BASED CONCENTRATIONS (RBC)

Contaminant (units)	Maximum Concentration	Average Background Soil Concentration (GRS-10)	Two Times Background	RBC Value* (mg/kg)
Bis(2-ethylhexyl) Phthalate (mg/kg)	6.8	4.7	9.4	46
Carbon Disulfide (mg/kg)	0.002 J	Not Detected	Not Detected	7800
DDT(mg/kg)	0.0063 J	Not Detected	Not Detected	1.9
Styrene (mg/kg)	0.004 J	Not Detected	Not Detected	16000
Acetone (mg/kg)	0.002 J	Not Detected	Not Detected	7800
Toluene (mg/kg)	0.003 J	Not Detected	Not Detected	16000
Di-n-Butyl Phthalate (mg/kg)	53 J	Not Detected	Not Detected	7800
Trichloroethylene (mg/kg)	0.004	Not Detected	Not Detected	58
Xylene (mg/kg)	0.007	Not Detected		

Not Detected 160,000
Arsenic (mg/kg) 3.2 Not Detected
Not Detected 0.37
Barium (mg/kg) 48.4 Not Detected
Not Detected 5500
Cadmium (mg/kg) 1.8 Not Detected
Not Detected 39
Chromium (VI) (mg/kg) 29.6 4.2
8.4 390
Mercury (mg/kg) 0.15 Not Detected
Not Detected 23
Lead (mg/kg) 48.1 1.4
2.8 400**
Selenium (mg/kg) 1.3 Not Detected
Not Detected 390
Tin (mg/kg) 32.5 Not Detected
Not Detected 47000
Vanadium (mg/kg) 61.8 Not Detected
Not Detected 550
Zinc (mg/kg) 7.0 Not Detected
Not Detected 23000

* EPA Region III, Risk-Based Concentration Table, January-June 1995, dated March 7, 1995
J = estimated value
** The screening level for lead in soil is 400 mg/kg for residential land use. This value is described in OSWER
Directive # 9355.4-12, Revised Internal Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action
Facilities, dated July 14, 1994 and issued by Elliott P. Lewis of the USEPA. The screening level for lead was
calculated using the USEPA new integrated exposure uptake biokinetic model with default parameters.

Table 2. Carcinogenic/Non-Carcinogenic Results for 3.2 mg/kg Arsenic.

Pathway	Carcinogenic Risk Adult and Child (Unitless)	Non-Carcinogenic Risk Adult and Child (Unitless)	Child only (Unitless)
Dermal Contact	4.7xl0 -08	0.00039	0.00026
Ingestion	8.8xlO -06	0.15	0.14
Inhalation	2.9x10 -05	0.055	0.047
Total Risk	3.8x10 -05	0.2	0.19

Non-carcinogenic effects are evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a reference dose (RfD) derived for a similar exposure period. To evaluate the non-carcinogenic effects of exposure to soil contaminants, the hazard quotient (HQ),(the ratio of the exposure dose to the RfD) is calculated for each contaminant. The non-carcinogenic HQ assumes that below a given level of exposure (i.e., the RfD), even sensitive populations are unlikely to experience adverse health effects. HQs are summed for each exposure pathway to create a pathway specific hazard index (HI) for each exposure scenario. The more the HI exceeds one (1), the greater the concern that adverse health effects will occur. The hazard quotient is not a percentage or probability.

The maximum concentration value was used as the exposure point concentration.

Current Land Use

Since there is no current activity at the Grace Road Site, the current land use scenario is not applicable.

Future Land Use

Under the future land use scenario, carcinogenic risks and non-carcinogenic hazards were calculated for exposure of the future on-unit resident (adult and child) to surface soils and air. The on-site resident scenario was used because it is more conservative than the industrial scenario.

The estimate of the total risk for carcinogens, for the future residential scenario, is 3.8x10 -05. All estimated carcinogenic risk is due to arsenic.

The cancer risk from the ingestion of soil at the Grace Road Site was 8.8x10 -6. Estimated risk was 4.7xl0 -8, below the EPA point of departure of 1x10 -6, for dermal contact with soils at the unit. Total cancer risk for inhalation of particulates from soils at Grace Road is 2.9x10 -5 which is above the EPA point of departure of 1x10 -6, but within the 1x10 -4 to 1x10 -6 range of concern. Arsenic is the responsible contaminant for the above risk estimates. The levels of arsenic detected are consistent with the levels found throughout SRS.

The non-carcinogenic HI for the soil pathways were calculated for adulthood and childhood exposures combined and for childhood exposure only. All of the exposure pathways for the on-unit resident have a non-carcinogenic hazard/risk of less than one.

Ecological Risks

The ecological information base for Grace Road Site consists of a unit-specific threatened, endangered and sensitive species survey and a unit-specific ecological reconnaissance. Additional information is contained in the existing unit history, preliminary unit evaluation, and unit characterization data. This information can be summarized as follows:

- There is no evidence of vegetation stress or ecological impact related to the unit;
- There are no threatened or endangered species known to exist at or in the vicinity of the unit;
- Review of the unit characterization data indicates that there are no constituents in the physical media at Grace Road which are significantly different from the unit specific background condition.

Based on the physical and analytical data obtained for this unit, there is no compelling evidence that waste materials were managed or disposed at Grace Road. Therefore, it is reasonable to conclude that the unit presents no significant ecological risk.

VII. Description of the No Action Alternative

Based on the risk assessment, the only contaminant contributing to a risk above $1x10^{-6}$ is arsenic. The levels of arsenic present which pose no unacceptable risk to human health or the environment, do not appear to be associated with the disposal activities at the Grace Road Site. Therefore, no action is needed at Grace Road Site and no other alternatives were considered. However, arsenic will be evaluated on a Site-Wide basis during the Site-wide Soils Background Study.

Under the No Action alternative, no treatment will be performed because there is no waste to treat. No new institutional controls or engineering controls will be implemented and there is no cost associated with implementing the alternative. According to CERCLA regulations, Section 121, if no action is the preferred action, then no Applicable, Relevant and Appropriate Requirements (ARARs) apply to the waste unit.

Since Grace Road Site poses no risk and the no action alternative is warranted, it does satisfy the CERCLA criteria. The no action alternative is intended to be the final action for Grace Road Site. This solution is meant to be permanent and effective in both the long and short term. The no further action decision is the least cost option with no capital, operating, or monitoring cost and is protective of human health and the environment. SCDHEC has modified the SRS RCRA permit to reflect this ROD.

VIII. Explanation of Significant Changes

No significant changes were made to the Record of Decision based on the public comment period for the proposed plan.

IX. References

DOE (U.S. Department of Energy), 1994. Public Involvement, A Plan for the Savannah River Site. Savannah River Operations Office, Aiken, South Carolina.

EPA (U.S. Environmental Protection Agency), 1989 Guidance on Preparing Suspending Decision Documents Office of Solid Waste and Emergency Response - OSWER Directive 9355.3-02.

EPA (U.S. Environmental Protection Agency), 1991a. Role of Baseline Risk Assessment in Superfund Remedy Selection Decisions. Office of Solid Waste and Emergency Response - OSWER Directive 9355.0-30.

EPA (U.S. Environmental Protection Agency), 1994 Revised Internal Soil Lead Guidance for CERCLA Sites and RCRA Corrective Actions Office of Solid Waste and Emergency Response - OSWER Directive 9355.4-12.

EPA (U.S. Environmental Protection Agency), Risk-Based Concentration Table, EPA-III, January-June 1995, dated March 7, 1995

FFA, 1993. Federal Facility Agreement for the Savannah River Site, Administrative Docket

Number 89-05-FF (effective date: August 16, 1993).

WSRC (Westinghouse Savannah River Company), RCRA Facility Investigation/ Remedial Investigation Plan for the Grace Road Unit (U), WSRC-RP-90-1250, Rev.0, Westinghouse Savannah River Company, Aiken, SC, (1990).

WSRC (Westinghouse Savannah River Company), Statement of Basis/ Proposed Plan for the Grace Road Site: Final Action (U) WSRC-RP-96-105 (1996a)

WSRC (Westinghouse Savannah River Company), RFI/RI Report for Grace Road Site (631-22G) (U), WSRC-RP-95-93, Rev. 1, Westinghouse Savannah River Company, Aiken, SC. (includes baseline risk assessment) (1996b)

APPENDIX A

RESPONSIVENESS SUMMARY

No comments received

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 05/14/1997
Operable Unit: 11
ROD ID: EPA/541/R-97/207

Media: Soil,groundwater

Contaminant: Arsenic, beryllium, iron, octachlorodibenzo-p-dioxin (OCDD), polychlorinated biphenyl (PCB), tritium, plutonium, waste oils, plastics, degreasers, rubber, organic solvents, cesium-137

Abstract: Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiden and Barnwell counties of South Carolina. SRS is a secured U.S. Government facility with no permanent residents. SRS is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina.SRS is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense.The Central Shops Burning Rubble Pit - 6G (BRP6G) operated from 1951 to 1955 for the disposal and burning of waste materials. The site consisted of a shallow unlined excavation, approximately 10 feet deep. A survey detected two areas of disturbed soil which could have been disposal sites. The largest area is rectangular in shape and is approximately 20 feet wide by 180 feet long. A second area of disturbed soil forms an ellipse approximately 20 feet wide by 40 feet long. The survey did not find buried waste within the smaller disturbed soil area. This smaller disturbed soil area was likely a borrow pit used to provide waste cover.Materials believed to be disposed of in the pit included waste oils, rags, paper, cardboard, plastics, degreasers, wood, rubber, and drummed organic solvents. These materials were periodically

burned in the pit, usually on a monthly basis. The volume of waste disposed of at BRP6G was not recorded. The materials burned in the burning/rubble pit included potentially hazardous substances, such as organic solvents. In 1955, after disposal activities ceased, the area was covered with soil. Due to the potential that hazardous substances, which if present, could have migrated into the surrounding soil and/or groundwater, BRP6G was designated as a Solid Waste Management Unit (SWMU).The BRP6G is located to the south and is immediately adjacent to the construction laydown area. In addition, the BRP6G is located approximately 300 feet southeast of the Ford Building Seepage Basin and is also located southeast and downgradient of the Ford Building Waste Site.

Remedy: The selected remedy for BRP6G is no action. The South Carolina Department of Health and Environmental control has modified the SRS Resource Conservation and Recovery Act (RCRA) permit to incorporate the selected remedy.

Text: Full-text ROD document follows on next page.

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Printed in the United States of America

Prepared for
U.S. Department of Energy
and
Westinghouse Savannah River Company
Aiken, South Carolina

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION
FOR THE CENTRAL SHOPS BURNING/RUBBLE PIT (631-6G) (U)

WSRC-RP-96-873
Revision 1
April 1997

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the

U.S. Department of Energy Under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

Record of Decision for the Central Shops Burning/Rubble Pit (631-6G) (U)
WSRC-RP-96473
Savannah Piver Site
Revision 1
April 1997
Declaration

DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

Central Shops Burning/Rubble Pit (631-6G)
Savann2h River Site
Aiken, South Carolina

The Central Shops Burning/Rubble Pit (631-6G) (BRP6G) is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) solid waste management unit/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS).

Statement of Basis and Purpose

This decision document presents the selected remedial alternative for the BRP6G located at the SRS in Aiken, South Carolina. The selected alternative was developed in accordance with CERCLA, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this specific RCRA/CERCLA unit.

Description of the Selected Remedy

The selected remedy for BRP6G is No Action. Other remadial alternatives for this unit were not considered because the risk levels fall within the risk range designated as requiring a risk management decision for all potential future receptors. The risk levels were developed in the Baseline Risk Assessment (BRA), which considered both the future residential and future indtistrial use scenarios. The cumulative soil related risks for the future residential land use scenario are less than one excess cancer in one hundred thousand (1 x 10 -5). In the future industrial land use scenario, all of the soil related risks are below 1 x 10 -6. The

expected future use of
this area is industrial. The South Carolina Department of Health and Environmental control has modified the
SRS RCRA permit to incorporate the selected remedy.

In the future residential land use scenario, the contaminants that contributed to the risk were arsenic, beryllium,
iron, octachlorodibenzo-p-dioxin (OCDD), and polychlorinated biphenyl (PCB) 1254. Of these the concentrations of arsenic, beryllium, iron, and OCDD were not significantly elevated with respect to unit-
specific background levels. The only risk directly attributable to the pit soil is 2 x 10 -6 due to PCB-1254 via
ingestion of produce grown on-site. The maximum concentration of PCB-1254 detected in the pit was 0.115
mg/kg, approximately 10% of the residential action level for PCBs of 1 mg/kg (EPA, 1990). Drinking water
standards for groundwater were exceeded in one well, on one occasion, for two compounds. Since these results
were not reproducible in subsequent sampling, the exceedances are considered to be atypical and not unit
related. Therefore, no action is appropriate.

If the property is ever transferred to non-federal ownership, the U.S. Government will create a deed for the
new property owner which will contain information in compliance with CERCLA 120 (h). The deed shall
include notification disclosing former waste management and disposal activities as well as remedial actions
taken at the site. The deed notification shall, in perpetuity, notify any potential purchaser that the property has
been used for the management and disposal of construction debris and other materials, including hazardous
substances. In addition, if the site is ever transferred to non-federal ownership, a survey plat of the area will be
prepared, certified by a professional land surveyor, and recorded with the appropriate county agency.

Declaration

Statutory Determination

Based on the BRP6G Resource Conservation and Recovery Act (RCRA) Facility Investigation/Remedial Investigation (RFI/RI) Report and the Baseline Risk Assessment, the BRP6G poses no significant risk to the
environment and to human health. It is, therefore, proposed that No Action be performed for the BRP6G. Me
selected remedy is protective of human health and the environment and complies with Federal and

state
requirements that are legally applicable or relevant and appropriate to the remedial action.

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1. SITE AND OPERABLE UNIT NAME, LOCATION, AND DESCRIPTION

SRS occupies approximately 800 square kilometers (310 square miles) of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. SRS is a secured U.S. Government facility with no permanent residents. SRS is located approximately 40 kilometers (25 miles) southeast of Augusta, Georgia and 32 kilometers (20 miles) south of Aiken, South Carolina.

SRS is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense.

BRP6G is located in the Central Shops Area near the center of the SRS (Figure 1). Figure 2 shows the relative location of BRP6G with respect to Central Shops Area facilities. The BRP6G Solid Waste Management Unit is on the southeastern side of a divide that separates the drainage basins of the Pen Branch Creek [approximately 1.6 km (1 mile) to the southeast] and Fourmile Branch [approximately 4 km (2.5 mile) to the northwest]. The ground elevation is approximately 88.4 m (290 feet) above mean sea level. Surface drainage is southward to an unnamed tributary of Pen Branch.

II. OPERABLE UNIT HISTORY AND COMPLIANCE HISTORY

Operable Unit History

The BRP6G operated from 1951 through 1955 for the disposal and burning of waste materials. The unit consisted of a shallow unlined excavation, approximately 3 m (10 ft) deep. Historical records indicated that the disposal area at the BRP6G was approximately 83.8 m (275 ft) long and 9.1 m (30 ft) wide. A ground penetrating radar survey indicated that most of the soil in this area was undisturbed. This survey detected two areas of disturbed soil which could have been disposal

sites. The largest area (Zone 1) is rectangular in shape and is approximately 6.1 m (20 ft) wide by 54.86 m (180 ft) long. A second area of disturbed soil (Zone 2) forms an ellipse approximately 6.1 m (20 ft) wide by 12.2 m (40 ft) long. The GPR survey did not find buried waste within the smaller disturbed soil area. This smaller disturbed soil area was likely a borrow pit used to provide waste cover.

Materials believed to be disposed of in the pit included waste oils, rags, paper, cardboard, plastics, degreasers, wood, rubber, and drummed organic solvents. These materials were periodically burned in the pit, usually on a monthly basis. The volume of waste disposed of at BRP6G was not recorded. The materials burned in the burning/rubble pit included potentially hazardous substances, such as organic solvents. In 1955 after disposal activities ceased, the area was covered with soil. Due to the potential that hazardous substances, which if present, could have migrated into the surrounding soil and/or groundwater, BRP6G was designated as a Solid Waste Management Unit (SWMU) subject to the RCRA/ CERCLA process.

The BRP6G is located to the south and is immediately adjacent to the construction laydown area. In addition, the BRP6G is located approximately 300 feet southeast of the Ford Building Seepage Basin and is also located southeast and downgradient of the Ford Building Waste Site. The Federal Facility Agreement (FFA) field start for the RFI/RI for the Ford Seepage Basin is scheduled for 10/20/97. A time-critical removal action for Cesium-137 began on 12/18/96 for the Ford Building Waste Site.

Compliance History

At SRS, waste materials regulated under the Resource Conservation & Recovery Act (RCRA)

are managed in accordance with the requirements of RCRA. Certain SRS activities have required treatment, storage, disposal or post-closure permits under RCRA. Non-regulated units, called solid waste management units (SWMU), include any activity where hazardous constituents may remain

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uncontrolled and may potentially release to the environment. Investigation and potential corrective action for these SWMU(s) are mandated under RCRA 3004(u). On September 5, 1995, SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control (SCDHEC) which includes corrective action requirements. Specifically, part V of the permit mandates that SRS establish and implement a RCRA Facility Investigation (RFI) Program to fulfill the requirements specified in Section 3004(u) of RCRA.

Hazardous substance, as defined by CERCLA, are also present in the environment at the SRS. On December 21, 1989, SRS was included on the National Priorities List. This inclusion created a need to integrate the established RFI Program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA, DOE has negotiated a Federal Facility Agreement (FFA, 1993) with U. S. Environmental Protection Agency (EPA) and SCDHEC to coordinate remedial activities at SRS into one comprehensive strategy which fulfills these dual regulatory requirements.

The remedial investigation for the Central Shops Burning/Rubble Pit (631-6G) (BRP6G)was completed in 1995. The results of the investigation

indicate that there is no impact (or potential impact) to human health or the environment from the BRJP6G. Therefore, no action is warranted. No other alternatives were considered.

According to EPA guidance, if there is no current or potential threat to human health and the environment and no action is warranted, the CERCLA 121 requirements, are not triggered. This means that these is no need to evaluate other alternatives or the no action alternative against the nine criteria specified under CERCLA.

The remedy selected satisfies both the CERCLA and RCRA 3004(u) requirements. The SCDHEC has modified the SRS RCRA permit to incorporate the selected remedy.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Both RCRA and CERCLA require that the public be given an opportunity to review and comment on the draft permit modification and proposed remedial alternative. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternatives for addressing the BRP6G soils and groundwater. The Administrative Record File must established at or near the facility at issue. The SRS Public Involvement Plan (DOE, 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS Public Involvement Plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act. SCHWMR R.61-79.124 and Section 117(a) of CERCLA, as amended, required the advertisement of the draft permit modification and notice of any proposed remedial action and provided the public an opportunity to participate in the selection of the remedial action. The Statement of Basis/Proposed Plan for the Central Shops Burning/Rubble Pit 631-6G) (WSRC, 1996b), which is part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the BRP6G.

The FFA Administrative Record File, which

contains the information pertaining to the selection of the response action, is available at the EPA office and at the following locations:

U.S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

Reese Library
Augusta State University
2500 Walton Way
Augusta, Georgia 30910
(706) 737-1744

Asa H. Gordon Library
Savannah State University
Tompkins Road
Savannah, Georgia 31404
(912) 356-2183

The public was notified of the public comment period through mailings of the SRS Environmental Bulletin, a newsletter sent to approximately 3500 citizens in South Carolina and Georgia, through notices in the Aiken Standand, the Allendale Citizen Leader, the Augusta Chronicle, the Barnwell People-Sentinel, and The State newspapers. The public comment period was also announced on local radio stations.

The 45-day public comment period began on December 10, 1996 and ended on January 23. 1997. A Responsiveness Summary was prepared to address comments received during the public comment period. The Responsiveness Summary is

provided in Appendix A of this Record of Decision. The public comment period for the RCRA Permit Modification began on January 27, 1997 and ended on March 12, 1997.

IV. SCOPE AND ROLE OF OPERABLE UNIT WITHIN THE SITE STRATEGY

The overall strategy for addressing the BRP6G was to: (1) characterize the waste unit delineating the nature and extent of contamination and identifying the media of concern (perform the RFI/RI); (2) perform a baseline risk assessment to evaluate media of concern, constituents of concern (COCs), exposure pathways, and characterize potential risks; and (3) evaluate and perform a final action to remediate, as needed, the idendfied media of concern.

The BRP6G is a source control and groundwater operable unit which is included in the Pen Branch watershed. Drainage from the Pen Branch water shed area which includes the BRP6G eventually flows to Pen Branch. The Pen Branch watershed area which includes the BRP6G is approximately 15 square miles (9,600 acres). The BRP6G covers 0.75 acres or 0.008 percent of the water shed.

No remedial action, which is the preferred remedy, is a final action.

V. SUMMARY OF OPERABLE UNIT CHARACTERISTICS

Media Assessment

The Data Summary Report (WSRC, 1995) and RFI/RI/BRA (WSRC, 1996a) contain detailed analytical data for all of the environmental media samples taken in the characterization of BRP6G. These documents are available in the Administrative Record File.

The soils were sampled in two investigations. In the first investigation (March - April 1994), ten soil borings were made. A minimum of four samples were collected from each borehole. Samples included surface soil samples, subsurface soil samples, and deep soil samples down to the water table. The second investigation (November 2 - December 30, 1994) included 12 soil borings, the collection of six surface samples, collection of five surface water/sediment samples, and the installation of three temporary groundwater

monitoring wells.

The 17 onsite borings were labeled CS6G 1-9, 11-17, and 22. The five background borings were labeled CS6G 10, 18, 19, 20, and 21 (See Figure 4).

Samples from three permanent groundwater monitoring wells were also in this study. The wells used were designated as follows: CBR1 (upgradient); CBR2, 3, 4, and 6

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(sidegradient/downgradient); and CBR5 (downgradient) (see Figure 3). The results of the investigation are discussed in the following sections.

Soils

A total of 74 soil samples were collected and analyzed. Low levels of metal, semi-volatile, volatile, pesticide, polychlorinated biphenyl (PCB), dioxin/furan, and radionuclide indicators were detected in the soil samples from soil borings in this unit. The constituents were detected in greatest concentrations in samples located at the bottom of the pit in the soils, as expected based on the conceptual model.

The following three sections provide a summary of the nature and extent of constituents exceeding background and focuses on those constituents that exceed risk assessment and leachability screening criteria.

Surface Soil (0-2 feet) Summary

Constituents that were detected above the two times average background concentration include 21 metals, 16 semi-volatiles, 13 volatiles, 4 pesticides, PCB-1254, octachlorodibenzo-p-dioxin

(OCDD), and radionuclide indicators (three locations). The locations where the exceedances of background occurred are fairly evenly distributed between borings located inside and outside of the pit. Of all of the constituents found above background, seven were designated as contaminants of potential concern (COPCs) in the baseline risk assessment, which are presented in Table 1. With the exception of OCDD, which was found only in the eastern third of the unit, the other constituents were randomly distributed across the unit. PCB-1254 was detected only once in soil boring location CS6G-12. Octachlorodibenzo-p-dioxin was detected at three locations outside of the pit and one inside the pit.

Risks (hat were determined for surface soils constituents of potential concern can be found in Section VI.

Shallow Subsurface Soil (0-5 feet) Summary

Constituents that were above the two times average background concentration are essentially the same as in the surface soils, which is consistent with the conceptual site model given that this zone is predominantly fill material. Eight of the constituents found above two times the average background concentration were designated as COPCs, which is presented in Table 2. Beryllium, the additional COPC not included in the 0-2 foot interval, is also randomly distributed across the unit.

These COPCs were evaluated for their potential contribution to risk in Section IV. The 0-5 foot soil interval is evaluated for a possible future excavation scenario which could bring these constituents to the surface where they could come into contact with humans or the environment

Leachability From Soils

One of the concerns regarding the site specific contaminants (SSCs) that have been identified in the vadose zone is whether the potential exists for these contaminants to migrate to the water table in a sufficient quantity over time such that future groundwater concentrations could create a risk (i.e. exceed MCLs or other risk based criteria). The SSCs are contaminants found in the vadose zone from 0 feet to the water table. Contaminants were identified as SSCs based upon their frequency of detection above two times the average

background and their health risks and/or mobility. The SSCs include seven inorganic constituents, nine semi-volatiles, six volatiles, two pesticides and OCDD. The average soil concentration of the SSCs were compared to generic EPA soil screening levels (SSLs). Those failing generic SSLs were further compared to site specific soil screening levels. Only barium, chromium, benzo(a)pyrene, benzo(b)-fluoranthene, and dieldrin possessed an average concentration which was above the site specific SSL value. This screening process is demonstrated in Table 3.

Table 1 Analytes and COPCs in Surface Soil (0-2 ft) Used in Calculations of Risk & Hazard

Analyte	Unit	Number of Detects	Total Number for Samples	Detection Limit Range for Undetects	Maimmum Detected Concentration	Exposure Concentration UL 95	Average Concentration (a)	(Background)
2-Hexanone	mg/kg	1	7	0.1-0.12	0.00038	0.000228	0.000228	Not Detected
Anthracene	mg/kg	1	25	0.2-0.25	0.0146	0.000554	0.000554	Not Detected
Arsenic	mg/kg	4	25	0.74-0.9	7.92	1.97	1.97	Not Detected
Benzo (g,h,i)perylene	mg/kg	1	25	0.21-0.25	0.0219	0.000643	0.000643	Not Detected
Iron	mg/kg	25	25	No undetects	31400	14302.98	14302.98	13487.78
OCDD	mg/kg	8	25	0.05	0.00759	0.001358	0.001358	0.00033
PCB-1254	mg/kg	2	25	10.6-12	0.115	0.02302	0.023023	Not Detected

(a) Exposure concentration is the lesser of the maximum detected and the UL 95.

Table 2 Analytes and COPCs in Shallow Subsurface Soil (0-5 ft) Used in Calculations of Risk & Hazard

Analyte	Unit	Number of Detects	Total Number of Samples	Detection Limit Range for Undetects	Maximum Detected Concentration	Exposure Concentration UL 95 (a)	Average Concentration (Background)
2-Hexanone	mg/kg	1	9	0.1-0.12	0.00038	0.000194	0.000194	Not Detected
Anthracene	mg/kg	1	37	0.21-0.33	0.0146	0.000405	0.000405	Not Detected
Arsenic	mg/kg	7	37	0.74-1.24	9.22	2.379	2.379	1.15
Benzo (g,h,i)perylene	mg/kg	1	37	0.21-0.33	0.0219	0.000445	0.000445	Not Detected
Beryllium	mg/kg	37	37	No detects	0.37	0.161	0.161	0.15
Iron	mg/kg	37	37	No detects	49300	20218.560	20218.56	17127.86
OCDD	mg/kg	14	37	0.05-0.07	0.0194	0.004	0.004064	0.00096
PCB-1254	mg/kg	2	37	10.6-16.6	0.115	0.01925	0.019254	Not Detected

(a) Exposure concentration is the lesser of the maximum detected and the UL 95.

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The two contaminants, benzo(a)pyrene and benzo(b)fluoranthene, had exceedingly high average concentrations due mainly to the two samples from borings in the pit. These samples CS6G 1404 (4-6 ft.) and CS6G 0902 (3.56-5.6 ft.) had inordinately high concentrations of all of the polycyclic aromatic hydrocarbons because of their position in the pit, that is, the samples were taken directly at the position of the burned material at the base of the pit. The samples taken two feet below these samples exhibited concentrations in the range of ten to one hundred times lower than the previous samples, and were considerably lower than the EPA SSL values. The inherent insolubility of polycyclic aromatic hydrocarbons and the soil cover of this burning/rubble pit has apparently served to inhibit the movement of these

substances toward the groundwater, as the highest concentrations are located where they were forty years ago when the pit was covered.

Dieldrin was also noted as having an average concentration above the site specific SSL. This contaminant was only detected in five out of seventy-four samples. Three of the samples are above the SSL, with an average of 0.0022 mg/kg. The average concentration of dieldrin was based on only five detections out of seventy-four samples analyzed which is very conservative. If all the samples were taken into consideration for determining the average, the average would be considerably less. Thus based on the conservative assumptions used in the model and the empirical data, dieldrin is not expected to impact groundwater in the future. Dieldrin was only detected in the top four feet of the samples analyzed.

The RCRA Facility Investigation/Remedial Investigation/Baseline Risk Assessment performed an analysis that indicates that dieldrin could migrate to the groundwater and would reach the groundwater in 28.1 years with a concentration of 0.00219 mg/L. The risk at this concentration is calculated to be 7.89 x 10 -6, which is above the 10 -6 threshold. The length of time that the site has been undisturbed is in excess of the 28.1 years, and dieldrin has not migrated to detectable quantities below the four foot level in soils and has

not been detected in groundwater. Further, the limited soil data that is available delineates a clayey soil which would also inhibit migration.

Barium was detected in the soil with an average concentration of 23.56 mg/kg. Modeling predicted that measurable levels of barium would reach the groundwater, however, the hazard index calculation showed that barium poses no undue risk to future residents or future industrial workers.

Groundwater modeling also predicted that chromium would migrate to the groundwater in measurable levels. Chromium +3, the dominant oxidation state for this environment, poses a minimal risk with a hazard index of 0.004 for the future resident from ingestion of groundwater peaking at a time in excess of 570 years in the future. Although not considered to be present, chromium in the +6 state would pose a risk with a

hazard index of 2 for the future resident from ingestion of groundwater. The time to peak groundwater concentration is in excess of 570 years in the future. For these reasons, chromium will not have an unacceptable impact on future groundwater quality.

Barium, chromium, benzo(a)pyrene, benzo(b) fluoranthene, and dieldrin exhibit average soil detection concentrations which exceed site specific SSLs. Based on the previous discussions regarding the behavior of the specific BRP6G SSCs in the environment, groundwater modeling results, and the results of the comparison to site specific SSLs, the contaminants present in the soils at the BRP6G have little likelihood of impacting future groundwater quality. This is due mainly to the nature of the locations of the highest contaminants concentrations being in the charred material in the case of the polycyclic aromatic hydrocarbons (PAHs), minimal increases in the hazard indices for future residents from ingestion of groundwater predicted from groundwater modeling for barium and chromium which peak at over 570 years from the present, and detections only in the upper four feet of soil in the case of the dieldrin.

Sediment/Surface Water

There are no surface water impoundments in the vicinity of BRP6G. Drainage water samples were collected in the downgradient ditch at five locations. The source of the drainage water is not entirely from BRP6G. Upgradient surface water runoff originates from a large construction materials lay-down yard and the Ford Building area. Both upgradient and downgradient surface water samples indicated the presence of metals, semi-volatile organics, volatile organics, and radionuclides.

Both upgradient and downgradient sediment samples indicated the presence of various metals, small amounts of volatiles organics, semi-volatile organics, gross alpha radionuclides, and OCDD.

Because of the uncertainty of the origin of the

analytes detected in the surface water and sediment, the data collected cannot be utilized to effectively characterize the BRP6G site. Regardless of their origin, the levels of contaminants detected would pose insignificant human health risk based on typical exposure assumptions. The potential environmental impact of these contaminants will be addressed on a larger scale in the Pen Branch watershed assessment.

Groundwater

A total of 27 groundwater samples were collected. Compounds that were intermittently detected more than once in wells downgradient from the pits include: aluminum, bis(2-ethylhexyl)phthalate (B2EHP), bromo-dichloromethane, chloroform, and dibromo-chloromethane.

The following is a list of groundwater contaminants of potential concern (COPCs) with their maximum detected levels for all constituents and the criteria that they exceed, and the Standard Value.

COPC	Maximum Value (pg/L)	Criteria Exceeded	Standard (µg/L)
Aluminum	41,400	4	50
Arsenic	5.1	1,2	50
Beryllium	0.409	1	4
Iron	98,900	2,4	300
Lead	89.1	3,5	15,50
Manganese	297	4	50
B2EHP	6.11	1,2,3	6

1) caused risk in excess of 1 x 10 -6
2) caused Hazard Index (HI) values to exceed 1
3) exceeded MCLs (federal or State)
4) exceeded the Secondary Drinking Water Standards
5) exceeded EPA at-the-tap action level.

Lead was detected at a concentration above the EPA at-the-tap action level (15 µg/L) and the South Carolina groundwater protection standard (50 µg/L) in well CBR4 with a detection of 89.1 µg/L. This sample was collected with a bailer and was very turbid. Turbid samples tend to have much higher levels of metals present than clear samples. For this reason, this level of lead is suspect and may not represent the actual conditions in the groundwater. A subsequent sample taken from the same well 25 days later

showed a level of only 11.8 pg/L which is below both the EPA and the South Carolina standards.

Bis(2-ethylhexyl)phthalate, a semi-volatile, exceeded the Primary Drinking Water Standard concentration of 6.0 µg/L in the same sample with a value of 6.11 µg/L. Subsequent sampling in the same well 25 days later showed bis(2-ethylhexyl)phthalate at 0.254 µg/L.

All of the constituents (arsenic, beryllium, lead, and bis(2-ethylhexyl)phthalate) providing risk or detections above MCLs were obtained from monitoring well CBR4. None of these constituents was consistently detected above their associated MCLS. Well CBR4 is located west of the unit in a hydrologically side to up gradient position. It would be unlikely that any constituents detected in this well could be from this unit. The most likely source, if constituents were consistently detected in this well, would be upgradient of this unit. It should be noted that these constituents were not detected above MCLs in the downgradient well

(CBR5). This data, in conjunction with the frequency and occurrence of detections, suggest that there is little or no impact from the unit to the groundwater.

The Secondary Drinking Water Standards are primarily for esthetic purposes and are not enforceable standards for groundwater.

The uncertainty associated with the groundwater results is discussed further in the Uncertainty section.

VI. SUMMARY OF OPERABLE UNIT RISKS

As a component of the remedial investigation process, a baseline risk assessment was prepared for the BRP6G. The baseline risk assessment consists of human health and ecological risk assessments. Summary information for the human health and ecological risk assessments follows.

Human Health Risk Assessment

As part of the investigation/assessment process for BRP6G, a BRA was performed using data generated during the assessment phase. The BRA is described in the RFI/RI/BRA report (WSRC, 1996a).

The BRA designates the COPCs based on a conservative screen against background concentrations, and the relative potential of the chemicals to cause toxic or carcinogenic effects.

An exposure assessment was performed to provide an indication of the potential exposures which could occur based on the chemical concentrations detected during sampling activities. The only current exposure scenario identified for BRP6G was for on-site visitors. Conservative future exposure scenarios identified for BRP6G included future industrial workers and future resident adults and children. The reasonable maximum exposure (RME) concentration value was used as the exposure point concentration.

Carcinogenic risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of pathway-specific exposure to cancer-causing contaminants. The risk to an individual resulting from exposure to non-radioactive chemical carcinogens is expressed as the increased probability of cancer occurring over the course of a 70 year lifetime. Cancer risks are related to the EPA target risk range of one in ten thousand (1×10^{-4}) to one in one million (1×10^{-6}) for incremental cancer risk at NPL sites. Risk levels in the 1×10^{-4} to 1×10^{-6} range require a risk management decision where specific actions to reduce risk may be considered while cancer risk levels below 1×10^{-6} are considered to be insignificant.

Non-carcinogenic effects are also evaluated to identify a level at which there may be concern for potential non-carcinogenic health effects. The hazard quotient, which is the ratio of the exposure dose to the reference dose (RfD), is calculated for each contaminant-Hazard quotients are summed for each exposure pathway to determine the specific hazard index (HI) for each exposure scenario. If the HI exceeds unity (1.0), the potential exists that adverse health effects might occur.

Current Land Use - Noncarcinogenic Hazards

The BRA shows that potential adverse noncarcinogenic health effects are not likely to occur, because none of the HIs exceeded a value of one.

Current Land Use - Carcinogenic Risks

Under the current land use scenario, human health risks were calculated for both the current material yard worker and the current groundwater sampler. The only pathway that exceeded 1 x 10 -6 was inhalation of groundwater which was 2 x 10 -6 from chloroform. The risk for inhalation from groundwater was calculated using very conservative methods which assumed that all of the chloroform in the water vaporized and was inhaled during the groundwater sampling. Thus

the total risks to current workers are considered to be insignificant. Figure 5 summarizes these calculations.

Future Industrial Land Use - Noncarcinogenic Hazards

The only HI value for the hypothetical future industrial worker that exceeds 1.0 is for ingestion of groundwater (see Figure 6). The 2.5 value for ingestion of water is driven by iron.

Future Industrial Land Use - Carcinogenic Risks

For the hypothetical future worker, only the total carcinogenic risk, by pathway, from ingestion of groundwater (1 x 10 -5) exceeds 1 x 10 -6 (see Figure 6). This risk is driven by arsenic and beryllium.

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Future Residential Land Use - Noncarcinogenic Hazards

Two HIs for hypothetical future resident adults exceeded a value of 1.0 (see Figure 7). These were: 1.1 for ingestion of soil, driven by iron and arsenic; and 23 for ingestion of groundwater, driven by iron. One HI exceeded 1.0 for a hypothetical future resident child. This was 16 for ingestion of groundwater, driven by iron (from the bailed sample).

Future Residential Land Use - Carcinogenic Risks

The total carcinogenic risk for the hypothetical future resident adult is 8 x 10 -5 (see Figure 7). The following carcinogenic risks equaled or exceeded 1 x 10 -6: 2 x 10 -6 for inhalation of soil from arsenic, 8 x 10 -6 from ingestion of soil from arsenic, 1 x 10 -6 for inhalation of groundwater driven by bis(2-ethylhexyl)phthalate and bromodichloro-methane, 6 x 10 -5 for ingestion of groundwater due to arsenic and beryllium, 4 x 10 -6 for ingestion of homegrown tuberous produce due to OCDD and PCB-1254, and 7 x 10 -6 for ingestion of homegrown fruit due to OCDD and PCB-1254.

The total carcinogenic risk for the hypothetical future child resident is 3 x 10 -5. Several carcinogenic risks equaled or exceed 1 x 10 -6: 1 x 10 -6 for inhalation of soil driven by arsenic; 6 x 10 -6 for ingestion of soil driven by arsenic and beryllium; 2 x 10 -5 for ingestion of groundwater driven by arsenic and beryllium 1 x 10 -6 from ingestion of homegrown tuberous produce due to OCDD and PCB-1254, and 2 x 10 -6 from ingestion of homegrown fruit due to OCDD and PCB-1254.

Uncertainty

Risks from arsenic, beryllium, and iron in the pit soil were calculated since a conservative screening method (comparison of site maximum to two times

the background mean) indicated that they were elevated above background levels. Background levels of organic compounds (e.g., OCDD) are not considered in the risk assessment, however, the

observed concentration ranges for both on-site and background samples are very similar. OCDD was detected in both surface and shallow subsurface background samples. OCDD has been found randomly distributed in SRS background samples. A statistical comparison between site samples and background samples for arsenic, beryllium, and OCDD indicated with 90 percent confidence that the site and background samples are part of the same distribution with the exception of arsenic in the 0-5 foot interval.

The contribution of risk (from background concentrations of arsenic and iron are significant when compared to the onsite values. For the 0-5 ft exposure unit, the background RME for arsenic is 2.30 mg/kg, as compared to 2.38 mg/kg on unit. The background RME for iron is 22,710, as compared to the on unit value of 20,218 mg/kg.

The main contributors to groundwater risk are arsenic and beryllium. Lead exceeded the EPA at the-tap guidance while bis(2-ethylhexyl)phthalate exceeded the groundwater MCL. The analytical values used for all four of these constituents came from the December 3, 1994 sampler from well CBR4. This sample was highly turbid. A subsequent sample taken from the same well 25 days later showed reduced values for all of these constituents. If this sample was not included in the risk analysis, arsenic and beryllium would contribute considerably lower risks. Removal of this sample from consideration would also eliminate the only MCL exceedeaces (lead and bis(2-ethylhexyl)phthalate) found at BRP6G. The values from these sampling events are shown below:

Constituent	(µg/L) 12/3/94	(µg/L) 12/28/94
Arsenic	5.1	ND
Beryllium	0.739	0.409
Lead	89.1	11.8
B2EHP	6.11	0.254

The risk for groundwater ingestion from arsenic is based on one detection in a bailed sample. This risk is highly suspect since only one of 27 groundwater samples detected arsenic and this was

from a bailed sample. Bailed samples often remove water which contains suspended solids and concentrated levels of contaminants which may not be, representative of the actual groundwater. To verify this anomaly, an additional sample was taken from this same well 25 days later. Arsenic was not detected in this sample.

The only detection of beryllium in groundwater in excess of two times background was from the same 12/3/94 turbid sample taken from well CBR4.

The only groundwater detection of lead and bis(2 ethylhexyl)phthalate in excess of their respective maximum contaminant levels (MCL) was from the same 12/3/94 turbid, bailed sample from CBR4.

All of the detections for aluminum, manganese, and iron which exceeded the Secondary Drinking Water Standards were also from the turbid samples taken from well CBR4. The levels of iron used to calculate HIs of 23 for future residents and 16 for a future child for ingestion of groundwater attributed were also obtained from the same samples. Elimination of the data from these turbid samples would remove all detections over the Secondary Drinking Water Standards and the HIs for ingestion of groundwater in excess of 1.

All of the constituents (arsenic, beryllium, lead, and bis(2-ethylhexyl)phthalate) providing risk or detections above MCLs were obtained from monitoring well CBR4. None of these constituents was consistently detected above their associated MCLS. Well CBR4 is located west of the unit in a hydrologically side to up gradient position. It would be unlikely that any constituents detected in this well could be from this unit. The most likely source, if constituents were consistently detected in this well, would be upgradient of this unit. It should be noted that these constituents were not detected above MCLs in the downgradient well (CBR5). This data, in conjunction with the frequency and occurrence of detections, suggest that there is little or no impact from the unit to the groundwater.

Discounting the analysis of This sample would eliminate any MCL exceedences for groundwater associated with BRP6G.

Ecological Risk Assessment

Based on characterization of the environmental setting at BRP6G and identification of potential receptor organisms (plants and animals), a conceptual site model was developed to determine how plants and animals could be exposed to COPCS.

Evaluation of the concentrations of lead, copper, PCB, and cadmium along with their toxicity, and the limited habitat provided by BRP6G result in a determination that ecological risk is insignificant.

Site-Specific Considerations

Site-specific considerations, based on the conclusions of the BRA and RFI/RI, which suggest limited or no potential for significant risk include:

1) BRP6G contains a large volume of buried nonhazardous waste material and cover soil.

2) The levels of surface soil contamination recognized during characterization are generally very low. The contaminants in the trench bottom soils are very stable chemically and exhibit limited mobility in the soil as indicated by the deep soil sampling results.

3) The groundwater monitoring program indicates that there has not been significant impact from the waste materials in the pits.

Remedial Action Objectives

Remedial action objectives specify unit-specific contaminants, media of concern, potential exposure pathways, and remediation goals. Remediation goals are developed based upon ARARs or can be risk-based.

ARARs are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal, state, or local environmental law that specifically

address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Other available information that is not an ARAR (e.g., advisories, criteria, guidance) may be considered in the analysis if it helps to ensure protectiveness or is otherwise appropriate for use in a specific alternative. These guidances are referred to as to-be-considered (TBC) guidances. Three types of ARARs; action-, chemical-, and location-specific; have been developed to simplify identification and compliance with environmental requirements. Action-specific requirements set controls on the design, performance and other aspects of implementation of specific remedial activities. Chemical-spicific requirements are media specific, health-based concentration limits developed for site-specific levels of contaminants in specific media. Location-specific ARARs must consider federal, state, and local requirements that reflect the physiographical and environmental characteristics of the unit or the immediate area.

In the future industrial land use scenario which is probable based on current land-use designation for this area all of the soil related risks are below 1×10^{-6}.

In the future residential land use scenario, the contaminants that contributed to the risk exceeding 1×10^{-6} from soil exposure were arsenic, beryllium, iron, OCDD, and PCB-1254. Of these, the concentrations of arsenic, beryllium, iron, and OCDD were statistically either shown to be equivalent to background levels or insignificantly elevated above background. The only remaining risk attributed to the pit soil is 2×10^{-6} due to PCB-1254 via ingestion of produce grown on-site. The maximum concentration of PCB-1254 detected in the pit was 0.115 mg/kg and PCBs were detected in only two of 37 samples. For these reasons, soil remediation is not needed at BRP6G to be protective of human health and the environment. Potential future risks associated with the residual contamination at the unit,are acceptable.

There were no remedial action-specific or location-specific ARARs relevant to establishing

remedial action objectives for the BRP6G source

unit. There also were no chermcal-specific ARARs identified, however there is TBC guidance. TBC guidance for PCB contamination in soils is found in the Toxic Substances Control Act and EPA guidance (EPA, 1990). These TBC guidances list soil action levels of 1 ppm PCB in soils for residential use and 10-25 ppm in soils for industrial use. BRP6G is well below the residential soil action level.

One potential remedial action objective for groundwater is to ensure that all groundwater is below MCLs. The only MCL that was exceeded was for bis(2-ethylhexyl)phthalate. The maximum value detected was 6.11 µg/L which slightly exceed the MCL of 6 µg/L. This value is likely not representative of the concentration of bis(2 ethylhexyl)phthalate in the groundwater because a subsequent sample taken from the same well 25 days later showed a value of only 0.254 pg/L.

An additional potential remedial action objective is for the groundwater to meet the EPA's at-the-tap guidance. Lead is the only constituent to exceed this guidance. The 12/3/94 turbid sample from CBR4 had a value of 89.1 µg/L which exceeds the guidance value of 15. A subsequent sample taken from the same well 25 days later measured 11.8 µg/L.

Arsenic and beryllium both are risk-based containinants of concern for groundwater at the BRP6G. Arsenic was found in only one of 27 groundwater samples and was not included in risk calculations based on the low frequency of detection. In addition, when the well was resampled 25 days later, arsenic was not detected. This indicates that this was an atypical value and is not representative of the actual groundwater conditions.

Beryllium was found in only one groundwater sample at levels that exceeded two times the background level for groundwater. This was from a turbid sample and likely contains higher levels of metals than a truly representative sample would contain. Beryllium is not associated with known activities in the BRP6G, but is prevalent in the

clayey soils in the area. For these reasons, it is unlikely that the groundwater is being contaminated with berylhum from BRP6G.

For the reasons stated above, there are no remedial actions required for soil or groundwater to protect human health and the environment. The remedial action objective for BRP6G is, therefore, no remedial action.

VII. THE SELECTED REMEDY

The selected remedy for BRP6G is No Action.

If the property is ever transferred to non-federal ownership, the U. S. Government will create a deed for the new property owner which will contain information in compliance with CERCLA 120 (h). The deed shall include notification disclosing former waste management and disposal activities as well as remedial actions taken at the site. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of construction debris and other materials, including hazardous substances. In addition, if the site is ever transferred to non-federal ownership, a survey plat of the area will be prepared, certified by a professional land surveyor, and recorded with the appropriate county agency.

This proposal is consistent with EPA guidance and is an effective use of risk management principles. The Statement of Basis/Proposed Plan provided for involvement with the community through a document review process and a public comment period. Public input is documented in the responsiveness summary in Appendix A.

VIII. STATUTORY DETERMINATIONS

Based on the BRP6G RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report, the Baseline Risk Assessment (BRA), and the uncertainty analysis, the BRP6G poses no significant risk to human health and the environment. While unit-related risk levels exceed 1×10^{-6}, a risk management decision was made to implement the No action alternative.

The selected remedy is protective of human health and the environment and complies with federal and

state requirements that are legally applicable or relevant and appropriate to the remedial action. No Action will result in hazardous substances, pollutants, or contaminants remaining in the source Unit.

IX. EXPLANATION OF SIGNIFICANT CHANGES

There were no significant changes made to the Record of Decision based on comments received during the public comment period for the Statement of Basis/Proposed Film Comments that were received during the public comment period are addressed in Appendix A.

X RESPONSIVENESS SUMMARY

A Responsiveness Summary of the comments received during the public comment period is included in Appendix A.

XI. REFERENCES

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APPENDIX A

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

The public comment period for the Statement of Basis/Proposed Plan for the Central Shops Burning/Rubble
Pit (631-6G) began on December 10, 1996 and ended on January 23, 1997. The public comment period for
the RCRA Permit Modification began on January 27, 1997 and ended on March 12, 1997.

Public Comments

No oral, written, phoned, or e-mailed comments were received from the public.

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 05/14/1997
Operable Unit: 16
ROD ID: EPA/541/R-97/205

Media: Groundwater,Soil,Water

Contaminant: Tritium, plutonium, nuclear materials

Abstract: The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiden and Barnwell counties of South Carolina. SRS is a secured U.S. Government facility with no permanent residents. SRS is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina.SRS is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. Chemical and radioactive wastes are by-products of nuclear material production processes. Between November 1954 and mid-May 1955, 9 to 14 million gallons of wastewater were discharged to the basin, which served as an unlined seepage basin for the purpose of reducing radioactive substance concentrations. Wastewater included overhead condensates from evaporators, laundry washwaters, non-reactor cooling water from F and H Areas, and possibly other chemicals.Since 1955, the Old F-Area Seepage Basin (OFASB) received occasional discharges of cooling waters and rainfall runoff. During a three month period in 1969, spent nitric acid solutions used to etch depleted uranium were discharged to the basin. Wastewater disposal was discontinued after the 1969 discharge. An estimated 1.8 curies (Ci) of radioactive releases occurred during the use of the basin. Due to natural radioactive decay, an estimated inventory of

less than 0.8 curies remains. Releases to the basin of various non-radioactive chemicals also occurred during basin use. The inactive basin is currently fenced, open, and contains mature trees, shrubs, and grasses. Standing water is present during wet seasons.

Remedy: The preferred alternative for the OFASB vegetation is to remove vegetation and dispose of it at an off-unit facility. This alternative will eliminate direct radiation hazards associated with vegetation.The preferred alternative for the OFASB pipeline and pipeline soils is institutional controls. This alternative will restrict this land to future industrial use and limit access to the soil, which might expose future workers to low concentrations of hazardous constituents through use of administrative controls such as site use and site clearance permits, as well as access controls such as filling or grouting pipeline manholes. Implementation of the institutional controls alternative will involve both short- and long-term actions. For the short-term, signs will be posted at the waste unit which indicate that this area was used for the disposal of waste material and contains buried waste. In addition, existing SRS access controls will be used to maintain the use of this site for industrial use only. In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government will create a deed for the new property owner. The deed shall include notification disclosing former waste management and disposal activities as well as cleanup actions taken on the site, and any continuing groundwater monitoring commitments. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of radioactive materials and hazardous substances. The deed shall also include deed restrictions precluding residential use of the property. However, the need for these restrictions may be reevaluated in the event that contamination no longer poses an unacceptable risk under residential use. In addition, if the site is ever transferred to non-federal ownership, a survey of the area will be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.This alternative will eliminate direct radiation hazards and minimize potential future impacts to the groundwater from OFASB soils. Along with the institutional controls identified above, implementation of this alternative will involve excavation of contaminated effluent ditchline soils to two feet below land surface, placement of these removed ditchline soils in the OFSAB, stabilizing the ditchline soils and the top two feet of contaminated soils in the basin, and covering the basin area with a permeability cap.The preferred alternative for OFSAB groundwater is to continue existing institutional controls and monitor the extent of the groundwater contaminant plume. A groundwater mixing zone application (demonstration) has been approved by the appropriate

regulatory agencies based on data from monitoring wells around the OFSAB and groundwater modeling. This alternative will demonstrate that remedial action objectives will be met, maximum contaminant levels (MCLs) will be achieved throughout the groundwater aquifer, and MCLs will be achieved at the compliance point as described in the approved groundwater mixing zone application.

Text: Full-text ROD document follows on next page.

<IMG SRC 9872050>

<IMG SRC 970205A>

WSRC-RP-96-872
Revision 1.1 Final
March 1997

DISCLAIMER

This report was prepared by Westinghouse Savannah River Company (WSRQ) for the United States Department of Energy under Contract No. DE-AC09-96SR18500 and is an account of work performed under that contract. Reference, herein to any specific commercial product, process, or services by trademark, name, manufacturer or otherwise does not necessarily constitute or imply endorsement, recommendation, or favoring of same by WSRC or by the United States Government or any agency thereof.

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Prepared for
U.S. Department of Energy
by

Westinghouse Savannah River Company
Aiken, South Carolina

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

Old F-Area Seepage Basin (904-49G)

WSRC-RP-96-872
Revision 1.1 Final

March 1997

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U.S. Department of Energy Under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

DECLARATION FOR THE RECORD OF DECISION
Unit Name and Location
Old F-Area Seepage Basin (SRS Building Number 904-49G)
Savannah River Site
Aiken, South Carolina

The Old F-Area Seepage Basin (OFASB)(904-49G) is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Unit/Comprehensive Envirownental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site. This operable unit includes the source unit (vegetation, soils [basin and ditchline], pipeline, and pipeline soils) and the groundwater unit.

Statement of Basis and Purpose

This decision document presents the selected remedial alternative for the OFASB located at the SRS in Aikm South Carolina. The selected alternative was developed in accoirance with CERCLA, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this specific RCRA/CERCLA unit.

Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision, may present an imminent

and
substantial endangerment to public health, welfare or tbe environment.

Description of the Selected Remedy

The preferred alternative for the OFASB vegetation is to remove vegetation and dispose at an off unit facility. This alternative will eliminate direct radiation hazard associated with vegetation.
Implementation of this alternative will involve removal of contaminated vegetation from the OFASB and transporation disposal at an off unit disposal facility.

The preferred alternative for the OFASB pipeline and pipeline soils is institutoinal controls. This
alternative will restrict this land to future industrial use and limit access to the soil which might
expose future workers to low concentrations of hazardous constituents through use of administrative controls such as site use and site clearance permit as well as access controls such
as filling or grouting pipeline manholes. Implementation of the institutional controls alternative
will involve both short- and long-term actions. For the short-term signs will be posted at the waste
unit which indicate that this arm was used for the disposal of waste material and contains buried
waste. In addition, existing SRS access controls will be used to maintain the use of this site for
industrial use only. In the long-term, if the property is ever transferred to non-federal ownership,
the U.S. Government, will create a deed for the new property owned which will contain information
in compliance with Section 120(h) of CERCLA. The deed shall include notification disclosing
former waste management and disposal activities as well as remedial actions taken on the site, and

any continuing groundwater monitoring commitments. The deed notification shall, in perpetuity,
notify any potential purchaser that the property has been used for the management and disposal of
radioactive materials and hazardous substances. The deed shall also include deed restrictions
precluding residential use of the property. However, the need for these restrictions may be
reevaluated in the event that contamination no longer poses an unacceptable risk under residential
use. In addition, if the site is ever transferred to non-federal ownership, a survey plat of the area
will be prepared, certified by a professional land surveyor, and recorded with the appropriate
county recording agency.

Along with the institutional controls identified above, the preferred alternative for the OFASB

soils
(basin and (ditchline) is to remove the top two feet of soils in the ditchline and place in the OFASB
followed by in situ stabilization of the top two feet of basin soils and the ditchline soils placed in
the basin, and cover with a low permeability cap. This alternative will eliminate direct radiation
hazards and minimize potential future impacts to the groundwater from OFASB soils.
Implementation of this alternative will involve excavation of contaminated effluent ditchline soils to
two feet below land surface, placement of these removed ditchline soils in the OFASB, stabilizing
the ditchline soils and the top two feet of contaminated soils in the basin, and covering the basin
area with a minimim 10 -5 cm/sec permeability cap.

The preferred alternative for OFASB groundwater is to continue existing institutional controls and
monitor the extent of the groundwater contaminant plume. A groundwater mixing zone application
(demonstration) has been approved by the appropriate regulatory agencies based on data from
monitoring wells around the OFASB and groundwater modeling. This alternative will demonstrate
that remedial action objectives will be met, MZCLs will be achieved through the groundwater
aquifer, and MCLs will be achieved at the compliance point as described in the approved
groundwater mixing zone application. Implementation of this alternative involves installation and
monitoring of groundwater wells as described in the groundwater mixing zone application.

Statutory Determinations

Based on the OFASB RCRA Facilfty Investigation/Remedial Investigation (RFI/RI) Report and
the Baseline Risk Assessment, the OFASB poses no significant risk to the environment but poses
significant risk to human health. Therefore, treatment and capping is necessary for the OFASB
soils (basin and ditchline), institutional controls are necessary for the OFASB pipeline and pipeline
soils, and monitoring of the existing groundwater consituents with the groundwater
mixing zone application. The size, location of the waste unit, and contaminant levels preclude a
remedy in which contaminants could be excavated and heated effectively.

The selected remedy is protective of human health and the environment, complies with Federal and
State requirements that are legally applicable or relevant and appropriate to the remedial action,
and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or
resource recovery) technology to the maximum extent practicable, and satisfies the statutory
preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a
principal element. Section 300.430(f)(4)(ii) of the NCP requires that a Five Year Review of the
ROD be performed if hazardous substances, pollutants, or contaminants remain in the waste unit.
Since hazardous substances will remain on-site above health-based standards, the three Parties

have determined that a Five Year Review of the ROD for the OFASB will be performed to ensure continued protection of human health and the environment.

<IMG SRC 97205B>

DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

Old F-Area Seepage Basin (904-49G)

WSRC-RP-96-872
Revision 1.1 Final
March 1997

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U. S. Department of Energy Under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

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I. Site and Operable Unit Name, Location, and Description

The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina (Figure 1). SRS is a secured U.S. Government facility with no permanent resident. SRS is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken South Carolina.

SRS is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. Chemical and radioactive wastes are by-products of nuclear material production processes. Hazardous substances, as defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), are currently present in the environment at SRS. The Federal Facility Agreement lists the Old F-Area, Seepage Basin (OFASB), 904-49G, (Figure 2) as a Resource Conservation and Recovery Act (RCRA)/CERCLA unit requiring further evaluation using an investigation/assessment process that integrates and combines the RCRA Facility Investigatim (RFI) process with the CERCLA Remedial Investigation(RI) to determime the actual or potential impact to human health and to environment.

The OFASB is located within the SRS, approximately 600 feet north of F Area and 1 mile east of Road C and is located in Aiken County. The Savannah River and associated swamps are located approximately 6 miles

west of the basin. The OFASB is located at the top of a gentle slope at an elevation of 285 feet above mean sea level. The water table is approximately 75 feet below ground surface in the area of the OFASB. Surface drainage is to

the north toward Upper Three Runs Creek which is at an elevation of 130 feet above mean sea level (155 feet below the basin elevation).

The OFASB is designated as Building Number 904-49G and covers a total area of 1.3 acres. Approximate dimensions of the OFASB are 200 fed by 300 feet with an earthen berm in the interior dividing the basin into two areas. The basin remains open with growing vegetation and serves as a wet weather pond. This unit also includes one effluent ditchline adjacent to the basin which leads toward Upper Three Runs Creek and one process sewer line which fed the basin and has an average depth of 9 to 10 feet below land surface and is about 800 feet in length. Groundwater in the area has also been included m the unit assessment.

Between November 1954 and mid-May 1955, 9 to 14 million gallons of wastewater were discharged to the basin which served as an unlined seepage basin for the purpose of reducing radioactive substance concentrations. Wastewater included overhead condensates from evaporators, laundry washwaters, non-reactor cooling water from F and H Areas, and possibly other chemicals.

Since 1955, the OFASB received occasional discharges of cooling waters and rainfall runoff. During a three month period in 1969, spent nitric acid solutions used to etch depleted uranium (M Area operations) were discharged (via tanker truck) to the basin. Wastewater disposal was discontinued after the 1969 discharge. An estimated 1.8 curies (Ci) of radioactive releases occurred during the use of the basin. Due to natural radioactive decay an estimated inventory of less than 0.8 curies remains. Releases to the basin of various nonradioactive chemicals also occurred during basin use. The inactive basin is currently fenced, open, and contains mature trees, shrubs, and grasses. Standing water is present during wet seasons.

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<IMG SRC 97205D>

II. Operable Unit History and Compliance History

Operable Unit History

The OFASB was first used between November 1954 and mid-May 1955. Nine to fourteen million gallons of wastewater were discharged to the basin which served as an unlined seepage basin for the purpose of reducing radioactive substance concentrations. Wastewater included overhead condensates from evaporators, laundry washwaters, non-reactor cooling water from F and H Areas, and possibly other chemicals.

Since 1955, the OFASB received occasional discharges of cooling waters and rainfall runoff. During a three month period in 1969, spent nitric acid solutions used to etch depleted uranium (M Area operations) were discharged (via tanker truck) to the basin. Wastewater disposal was discontinued after the 1969, discharge.

An estimated 1.8 curies (Ci) of radioactive releases occurred during the use of the basin. Due to natural radioactive decay an estimated inventory of less thin 0.8 curies remains. Releases to the basin of various nonradioactive, chemicals also occurred during basin use.

The inactive basin is currently fenced, open, and contains mature trees, shrubs, and grasses. Standing water is present during wet seasons.

Compliance History

At SRS, waste materials are managed which

are regulated RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities have required Federal operating or post-closure permits under RCRA. SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control on September 5, 1995.

Module IV of the permit mandates that SRS establish and implement an RFI Program to fulfill the requirements specified in Section 3004(u) of the Federal permit.

Hazardous substances, as defined by CERCLA, are also present in the environment at the SRS. On December 21, 1989. SRS was included on the National Priorities List. This inclusion created a need to integrate the established RFI Program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA, DOE has negotiated a Federal Facility Agreement (FFA, 1993) with U. S. Environmental Protection Agency (EPA) and SCDPEC to coordinate remedial activities at SRS into one comprehensive strategy which fullfils these dual regulatory requirements.

Section V provides a detailed description of the operable unit, history of operation, and the impact of releases to human health and the environment.

III. Highlights of Community Participation

Both RCRA and CERCLA require that the public be given an opportunity to review and comment on the draft permit modification and proposed remedial alternative. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternatives for addressing the OFASB soils and groundwater. The Administrative Record File must be established at or near the facility at issue. The SRS Public Involvement Plan (DOE, 1994) is designed to facilitate public involvement in the decision-making process for

permitting, closure, and the selection of remedial alternatives. The SRS Public

Involvement Plan addresses the requirements of RCRA, CERCLA and the National Environmental Policy Act SCHWMR R.61-79.124 and Section 117(a) of CERCLA, as amended, require the advertisement of the draft permit modification and notice of any proposed remedial action and provide the public an opportunity to participate in the selection of the remedial action. The Statement of Basis/Proposed Plan for the Old F-Area Seepage Basin (904-49G)(WSRC, 1996b), which is part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the OFASB.

The FFA Administrative Record File, which contains the information pertaining to the selection of the response action, is available at the EPA office and at the following locations:

U. S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
Umversity of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

Similar information is available through the repositories listed below:

Reese Library
Augusta State University
2500 Walton Way
Augusta, Georgia 30910
(706) 737-1744

Asa H. Gordon Library

Savannah State University
Tompkins Road
Savannah, Georgia 31404
(912) 356-2183

The public was notified of the public comment period through mailings of the SRS Environmental Bulletin, a newsletter sent to approximately 3500 citizens in South Carolina and Georgia, through notices in the Aiken Standard, the Allendale Citizen Leader, the Augusta Chronicle, the Barnwell People-Sentinel, and The State newspapers. The public comment period was also announced on local radio stations.

The 45-day public comment period began on September 17, 1996 and ended on October 31, 1996. A public comment meeting was held on October 15, 1996. A Responsiveness Summary was prepared to address comments received during the public comment period. The Responsiveness Summary is provided in Appendix A of this Record of Decision.

IV. Scope and Role of Operable Unit Within the Site Strategy

The overall strategy for addressing the OFASB was to: (1) characterize the waste unit delineating the nature and extent of contamination and identifying the media of concern (perform the RFI/RI); (2) perform a baseline risk assessment to evaluate media of concern, chemicals of concern (COCS), exposure pathways, and characterize potential risks; and (3) evaluate and perform a final action to remediate, as needed, the identified media at concern.

The OFASB is an operable unit located within tbe Upper Three Runs Watershed. Several source control and groundwater operable units within this watershed will be evaluated to determine impacts, if any, to associated streams and wetlands. SRS will manage all source control and groundwater operable units to minimize impact to the watershed. Based on characterization and risk assessment information, the OFASB does not significantly impact the watershed. Upon disposition of all source control and groundwater operable units

within this watershed, a final, comprehensive evaluation of the watershed will be conducted to determine whether any additional actions are necessary. The OFASB investigation considered all unit specific groundwater. Based on the investigation of the groundwater, the contamination in the water table aqiufer is apparently attributable to the OFASB wastes. The proposed action for the OFASB vegetation, ditchline and basin soils, pipeline and pipeline soils, and groundwater is a final action.

V. Summary of Operable Unit Characteristics

The OFASB was first used between November 1954 and mid-May 1955. Nine to fourteen million gallons of wastewater were discharged to the basin which served as an unlined seepage basin for the purpose of reducing radioactive substance concentrations. Wastewater included overhead condensates from evaporators, laundry washwaters, non-reactor cooling water from F and H Areas, and possibly other chemicals.

Since 1955, the OFASB received occasional discharges of cooling waters and rainfall runoff. During a three mouth period in 1969, spent nitric, acid solutions used to etch depleted uranium (M Area operations) were discharged (via tanker truck) to the basin. Wastewater disposal was discontinued after the 1969 discharge.

An estimated 1.3 curies (Ci) of radioactive releases occurred during the use of the basin. Due to natural radioactive decay an estimated inventory of less than 0.8 curies remains. Releases to the basin of various nonradioactive chemicals also occurred during basin use.

The inactive basin is currently fenced, open (bottom of basin is -10 feet below surrounding land surface), and contains mature trees,

shrubs, and grasses. Standing water is present during wet seasons.

The conceptual unit model for the OFASB is depicted in Tables 2 and 3 which identify that radionuclide contaminated soils are the primary contaminants which pose risk to both the future resident and worker scenarios. These radionuclide risks are primarily associated with external radiation exposure to basin and ditchline soils as well as ingestion of groundwater.

Media Assessment

The Data Summary Report for the Old F-Area Seepage Basin (U) (WSRC, 1995b), RFI/RI Report for the Old F-Area Seepage Basin (U) (WSRC, 1995c), and Baseline Risk Assessment for the Old F-Area Seepage Basin (U)(WSRC, 1995a) contain detailed analytical data for all of the environmental media samples taken in the characterization of the OFASB.

Pipeline & Pipeline Soils
The RFI/RI Work Plan identified a data quality objective (DQO) process which determined that characterization of the pipeline soils would be characteristic of the pipeline and pipeline soil contaminants due to:

- The length of operating history (less than 9 of batch wastewater disposal through the pipieline),
- Pipe materials (verified clay pipe with a bell and hub design would not provide for long term leak prevention),
- Minimal sediments (due to the short operating life of the OFASB pipeline sediments are not expected to be present in any appreciable quantities), and
- Pipeline leakage (significant leakage is expected from historical service information on the materials and pipe design used).

Based on these factors, it is believed that the probable condition is that any contribution of

contaminants from within the pipeline would not significantly increase the contaminant inventory or affect the remedy selected (institutional controls) for the pipeline and pipeline soils.

Evaluations using modeling in the CMS/FS identified that pipeline soils did not pose a risk from either direct exposure (pipe is an average of 10-12 fed below land surface) and activity levels in the pipeline soils do not pose future impact to groundwater concerns.

Basin & Ditchline Soils
Analytical data indicate that significant impact to the soil media associated with the OFASB has occurred from both radiological and nonradiological contaminants. Radiological contaminants approach background at about 25 feet below the bottom of the basin. Nonradiological contaminants are bound in the top 2 feet of the basin soils. Surficial soil contamination is isolated to the confines of the fenced basin area and effluent ditchline areas.

Gross alpha concentrations in basin soils occur above background (i.e. >50 pCi/g) to a depth of 25 feet below ft bottom of the basin while nonvolatile beta concentrations above background (i.e. >50 pCi/g) in basin soils occur to a depth of 15 feet below the bottom of the basin. Although contaminants are present above background levels at depth, the predominant inventory of radiological contaminants are bound in the top 2 feet of the basin soils. Treatability testing, use of contaminant transport calculations, and evaluation of the decrease in contaminant concentrations by depth indicate that radiological contaminants present below 2 feet pose no potential future impact to the groundwater.

Major contaminants in the soils are cesium-137 and mercury. Cesium is present at a maximum

concentration of 1345 pCi/g at 0 to 1 foot below the basin bottom (53% of the cesium-137 is found in the top 2 feet). Mercury is present at a maximum concentration of 35.6 mg/kg at 0 to 1 foot below the basin bottom (97% of the mercury is found in the top 2 feet).

Groundwater

Iodine-129, nitrate, strontium-90, and tritium have been detected above MCLs and uranium has been detected above proposed MCIs based on groundwater monitoring data. Although radium has been decreasing over time, it has also exceeded MCLs. The groundwater plume has been identified from 8 local wells. The groundwater plume in the water table aquifer has migated beyond the surface boundaries of the OFASB by mom than 200 feet toward the Upper Three Runs Creek which is more than 2500 feet to the north of the OFASB.

VI. Summary of Operable Unit Risks

As a component of the remedial investigation process, a basline risk assessment was prepared for the OFASB. The baseline risk assessment consists of human health and ecological risk assessments. Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision may present an imminent and substantial endangerment to public health welfare, or the environment. Summary information for the human health and ecological risk assessments follows and has been summarized in Table 1 below.

Human Health Risk Assessment

As part of the investigation/assessment process for the OFASB waste unit, a BRA was performed using data generated during the assessment phase. Detailed information regarding the development of constituents of potential concern (COPCs), the fate and transport of contaminants, and the risk

assessment can be found in the RFI/RI Report for the Old F-Area Seepage Basin (U) (WSRC, 1995c) and the Baseline Risk Assessment for the Old F-Area Seepage Basin (U) (WSRC, 1995a).

The process of designating the COPCs was based on consideration of background

concentrations, freguency of detection, the relative toxic potential of the chemicals, and chemical nutrient status. COPCs are the constituents that are potentially site-related and whose data are of sufficient quality for use in the risk assessment.

An exposure assessment was performed to provide an indication of the potential exposures which could occur based on the chemical concentrations detected during sampling activities. The only current exposure scenario identified for the OFASB was for the on unit visitor (researchers and samplers). Conservative future exposure scenarios identified for the OFASB included future occupational workers and future resident adult and children. The reasonable maximum exposure concentration (95th percentile) value was used as the exposure point concentration.

Carcinogenic risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of pathway-specific exposure to cancer-causing contaminants (carcinogens). The risk to an individual resulting from exposure to non-radioactive chemical carcinogens is expressed as the increased probability of cancer occurring over the course of a 70 year lifetime. Cancer risks are related to the EPA Target Risk Range (TRR) of one in ten thousand (1.0 x 10 -4) to one in one million (1.0 x 10 -6) for incremental, cancer risk at NPL sites.

Noncarcinogenic effects are also evaluated to identify a level at which there may be concern for potential noncarcinogenic health effects. The hazard quotient (HQ), which is the ratio of the exposure dose to the reference dose (RfD), is calculated for each contaminant. HQs are summed for each exposure pathway to determine the specific hazard index (HI) for each exposure scenario. If the HI exceeds unity (1.0), there is concern that adverse health effects might occur.

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Current Land Use - Noncarcinogenic Hazards

The Baseline Risk Assessment shows that potential adverse noncarcinogenic health effects are not likely to occur, because the sum of the HIs for the current on unit visitor scenario do not exceed a value of one.

Current Land Use - Carcinogenic Risks

Under the current land use scenario, human health risks were characterized for the current on unit visitor. The sum of the estimated nonradiological cancer risks were less than 1.0×10^{-6}. Media evaluated include soil inside the basin, soil outside the basin, soil surrounding the process sewer line, soil in the effluent ditchlines, associated airborne soil particulates, surface water and sediment in the stream/wetland, and groundwater.

Estimated radiological cancer risks for exposure due to external radiation is 4.5×10^{-5} indicating that carcinogenic risk from the unit is limited. External radiation exposure risk results from cesium-137 (95%) and cobalt-60 (2.5%) contamination. Other exposure pathways evaluated estimated radiological cancer risk less than 1.0×1^{-6}.

Tbe total of all estimated cancer risks for this exposure scenario is 4.6×10^{-5} which identifies external radiation as the primary exposure pathway (98%) for the current unit visitor.

Future Land Use - Noncarcinogenic Hazards

The HIS exceed unity for both conservative future exposure scenarios (on unit worker and on unit resident). His greater than unity for the future on unit worker were exceeded for ingestion of groundwater primarily caused from elevated levels of manganese and lead. HIs greater than unity for the future on unit resident were exceeded for ingestion of the groundwater due to manganese, lead, and

arsenic; ingestion of basin soil (mercury), and ingestion of fruits and vegetables grown in basin soils (mercury). Manganese and arsenic are likely naturally occurring in Southeast regional soils. Also, discharge records show

that manganese was not a component of any liquid discharge to the basin.

Future Land Use - Carcinogenic Risks

No significant risk for the future on unit "worker" due to nonradiological carcinogenic risks greater than the Tarket Risk Range were identified. Exposure due to ingestion of groundwater for the future on unit "resident" estimated significant nonradiological carcinogenic risks greater than tbe EPA's Target Risk Range. This exposure was based on elevated arsenic concentrations which are below area background concentration averages.

The ingestion of groundwater exposure pathway for the future on unit worker estimated nonradiological carcinogenic risks within the EPA's Target Risk Range based on beryllium and arsenic. Ingestion of groundwater (beryllium), ingestion of surficial basin soft (PCB-1254), ingestion of surficial effluent ditchline and process sewer line soil (arsenic), and ingestion of fruits and vegetables grown in effluent ditchline and process sewer line soil (arsenic) exposure pathways for the future on unit resident estimated nonradiological carcinogenic risks within the EPA's Target Risk Range.

Exposure pathways for the future on unit worker which estimate significant, radiological carcinogenic risks greater than the EPA's Target Risk Range are external radiation from the basin soil (cesium-137), ingestion of groundwater (iodine-129, potassium-40), and external radiation from the effluent ditchline soil (cesium-137). Exposure pathways for the future on unit resident which estimate significant radiological carcinogenic risks greater than the EPA's Target Risk Range are

external radiation from the basin soil (cesium 137), ingestion of fruits and vegetables grown in basin soils (cesium-137), external radiation from the effluent ditchline soil (cesium-137), and ingestion of basin soil (plutonium-239).

Significant carcinogenic risks for the future on unit worker are driven by exposure from direct radiation from the basin soils contaminated with cesium-137 and cobalt-60. Significant carcinogenic risks for the future on unit resident are driven by exposure from direct radiation from the basin soils contaminated with cesium-137, cobalt-60, radium-228, and europium-154. These risks are estimated at 9.4×10^{-3} for the future on unit worker and 1.6×10^{-2} for the future on unit resident.

The total of all estimated cancer risks for the future on unit resident exposure scenario is 1.8×10^{-2} which identifies external radiation as tha primary exposure pathway (88%) for this receptor. Ingestion of groundwater serves as a secondary risk contributor (8%).

The total of all estimated cancer risks for the future on unit worker exposure scenario is 1.0×10^{-2} which identifies external radiation as the primary exposure pathway (96%) for this receptor. Ingestion of groundwater serves as a secondary risk contributor (3%). Human health risk tables (conceptual unit model) for the on unit resident (Table 2) and on unit worker and visitor (Table 3) are provided below.

Ecological Risk Assessment

Based on characterization of the environmental setting and identification of potential receptor organisms, a conceptual site model was developed to determine the complete exposure pathways through which receptors could be exposed to COPCs.

Interpretation of the ecological significance of the unit-related contamination at the OFASB

indicated that there was essentially no likelihood of unit-related chemicals causing significant impacts to the community of species in the vicinity of the unit. None of the COPCs identified in soil at the OFASB are estimated to pose significant ecological risk based on their toxicity at the concentration at which they are present.

Remedial Action Objectives

Remedial action objectives specify unit-specific contaminants, media of concern, potential exposure pathways, and remediation goals. The remedial action objectives are based on the nature and extent of contamination, threatened resources, and the potential for human and enviromental exposure. Initially, preliminary remediation goals are developed based upon ARARs, or other information from the RFI/RI Report and the BRA. These goals should be modified, as necessary, as more information concerning the unit and potential remedial technologies becomes available. Final remediation goals will be determined when the remedy is selected and shall establish acceptable exposure levels that are protective of human health and the environment.

Constituents of potential concern are site- and media-specific, man-made and naturally occurring inorganic and organic chemicals, pesticides, and radionuclides detected at a unit under iuvestigation. Constituents of concern are isolated from the list of constituents of potential concern by calculating carcinogenic risks and noncarcinogenic hazard indices. A constituent of concern contributes significantly to a pathway having a carcinogenic risk greater than 1 x 10 -6 and a hazard index greater than 1.0. Risk-levels at or above the upper-bound of the target risk range (1 x 10 -4) are considered significant and these sites are expected to undergo remediation. Risk levels between 1 x 10 -6 and 1 x 10 -4 require consideration for remediation.

<IMG SRC 97205F>

<IMG SRC 97205G>

IMG SRC 97205H>

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Dear Mr. Collinsworth and Mr. Crane:

SUBJECT: Transmittal of Copies of the Signed Records of Decision and Approved Implementation Schedules

Enclosed is a copy of the signed Record of Decision for:

Old F-Area Seepage Basin (904-49G)
Central Shops Burning/Rubble Pit (631-6G)

Also enclosed is a copy of the approved Post-ROD Implementation Schedule for:

Old F-Area Seepage Basin (904-49G)

J. L. Crane and K. A. Collinsworth JUL 16 1997

Questions from you or your staff may be directed to me at (803) 725-7032.

<IMG SRC 97205HA>

BTH/GFS:gs

OD-97-0317

Enclosures
1. Record of Decision, Remedial Alternative Selection for the Old F-Area Seepage Basin (904-49G)(WSRC-RP-96-872, Revision.1.1, March 1997)
2. Record of Decision, Remedial Alternative Selection for the Central Shops Burning/Rubble Pit (631-6G)(WSRC-RP-96-873, Revision.1, April 1997)
3. Post-ROD Implementation Schedule for Old F-Area Seepage Basin (904-49G)

cc: with Enclosure 3 only
J. K. Lindler, SCDHEC - Columbia
J. T. Litton, SCDHEC - Columbia
G. K. Taylor, SCDHEC - Columbia
C. B. Warren, EPA-IV

C. A. Jones, EPA-IV
K. B. Feely, EPA-IV
SRS Administrative Record Files (Palmer, 730-2B)

ARARs are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal, state, or local environmental law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Three types of ARARs; action-, chemical-, and location-specific; have been developed to simplify identification and compliance with environmental requirements. Action-specific requirements set controls on the design, performance, and other aspects of implementation of specific remedial activities.

Chemical-specific requirements are media-specific and health-based concentration limits developed for site-specific levels of constituents in specific media. Location-specific ARARs must consider Federal, State, and local requirement that reflect the physiographical and environmental characteristics of the unit or the immediate area.

There were no action-specific or location-specific ARARs relevant to establishing remedial action objectives for the OFASB operable unit. Only Uranium Mill Tailings Radiation Control Act levels have been identified as a chemical-specific ARAR for the OFASB source unit and the waste unit currently meets these levels. Only MCLs (as identified in South Carolina R.61-58.5 State Primary Drinking Water Regulations and Federal 40 CFR 141 National Primary Drinking Water Regulations) have been identified as chemical specific ARARs for the OFASB groundwater unit. The groundwater is not a current source of drinking water, however, all groundwater in South Carolina is classified as GB under South Carolina R.61-68 Water Classification and Standards and as such is required to be addressed in some manner (State of South Carolina groundwaters must undergo active remediation, to achieve

MCLs unless a groundwater mixing zone is granted). The remedial action objectives

identified below are met by the preferred remedy by ensuring that through natural mixing zone processes the nearest groundwater receptor as defined in the groundwater mixing zone application is not exposed to groundwater contaminated above MCLs and access controls are in place through establishment of institutional controls to prevent exposure to the groundwater plume.

The selected remedial action objectives for the OFASB operable unit are to:

- Prevent external exposure to radiological constituents,
- Prevent inhalation of radiological constituents,
- Prevent ingestion of soil or produce grown in soil with radiological constituents, and to
- Prevent or mitigate the release of constituents of concern to the groundwater.
- Prevent or mitigate the impact to the nearest groundwater receptor located at the Upper Three Runs Creek,
- Restore the aquifer through natural mixing processes and other processes (radioactive decay) to achieve MCLs throughout the groundwater plume (groundwater mixing zone application modeling estimates that MCLs throughout the entire groundwater aquifer will be achieved in approximately 200 years), and
- Achieve, State Of South Carolina groundwater mixing zone objectives
    a) control source to minimize addition of contaminants to the groundwater,
    b) establish plume monitoring and compliance wells to ensure concentrations limits and/or maximum contaminant levels established in the groundwater mixing zone application, and

c) monitor to ensure contaminated groundwater remains on SRS until MCLs achieved throughout the plume and to ensure groundwater area or plume is decreasing concentrations.

VII. Description of the Considered Alternatives

As part of the investigation/assessment process for the OFASB waste unit, a CMS/FS was performed using data generated during the assessment phase. Detailed information regarding the development and evaluation of remedial alternatives can be found in the Corrective Measures Study/Feasibility Study for the Old F-Area Seepage Basin (U) (WSRC, 1996a).

The RFI/RI and BRA indicate the OFASB soil poses significant risk to human health. External radiation from basin soils for the current on unit visitor, and future on unit worker and resident result in risk within the EPAs Target Risk Range for the current land use and significant risk greater than the EPA's Target Risk Range for future use scenarios. Risks are also associated with ingestion of groundwater for the future on unit worker and resident. Therefore, a CMS/FS was conducted which included detailed analyses for soil/vegetation and groundwater alternatives. The preferred alternative for the OFASB pipeline and pipeline soils is institutional controls. This alternative will restrict this land to future industrial use and limit access to the soil which might expose future workers to low concentrations of hazardous constituents through use of administrative controls such as site use and site clearance permits as well as access controls such as filling or grouting pipeline manholes.

VII.A Description of the Considered Alternatives for the OFASB Operable Unit Soil/Vegetation

Five alternatives were evaluated for remedial action of the OFASB operable unit soil/vegetation. Each alternative is described below.

Alternative S1 - No Action

Under this alternative, no action would be taken at the OFASB. EPA policy and regulations require consideration of a no action alternative to serve as a basis against which other alternatives can be compared. Because no action would be taken and the OFASB would remain in its present condition, there are minimal associated costs related to normal SRS maintenance activities and there would be no reduction of risk. Since five year reviews of the remedy are required, the estimated present value for these reviews and existing maintenance activities for the next 30 years is $280,000.

Alternative S2 - Cap the Basin and Vegetation

This alternative involves the placement of effluent ditchline soils (~167 yards) and contaminated vegetation (~25 cubic yards) into the OFASB and construction of a cap over the OFASB. Initially, the waste unit would be prepared by clearing the trees, vegetation, fencing, and other physical obstructions immediately surrounding the OFASB. Contaminated effluent ditchline soils would be excavated and placed directly into the OFASB. Contaminated vegetation would be segregated from uncontaminated vegetation and the contaminated vegetation would be chipped and spread evenly over the OFASB soils.

The basin would then be backfilled and compacted to grade. After sufficient compaction, an engineered cap would be

constructed over the OFASB to minimize surface infiltration and reduce the potential for contaminant migration.

The low permeability engineered soil cap will have a minimum thickness of 2 feet of compacted low-hydraulic: conductivity soil (in-place saturated hydraulic conductivity of 1 x

10 -5 cm/sec or less). The cap will also have an upper surface with a slope to promote surface runoff and minimize surface erosion. The topsoil (vegetative soil layer will be placed at a minimum thickness of 3 inches and will have the ability to survive and function with little or no maintenance. The surface slope will also promote runoff and minimize surface erosion. The cap would cover an area of approximately 3.5 acres (Figure 3). This alternative would reduce the risks associated with direct radiation exposure and minimize future potential migration of contaminants to the groundwater.

Existing SRS institutional controls would remain in effect and the capping system would be maintained resulting in a present value cost of $1,300,000.

Alternative S3A/B - In Situ Grout Soils To 2 Feet & Incinerate Vegetation at CIF or Dispose of Vegetation Off Unit

This alternative involves the consolidation of effluent ditchline soils with the OFASB soils followed by in situ grouting at the top 2 feet of the OFASB (~4,500 cubic yards) and effluent ditchline soils (~167 cubic yards). Upon completion of in situ grouting, the OFASB would be backfilled and compacted to grade, and an engineered cap as described in alternative S2 would be constructed over the OFASB to minimize surface infiltration and reduce the potential for contaminant migration. These alternatives (S3A/S3B) would reduce the risks associated with direct radiation exposure and minimize, through grouting the most contaminated soils, future potential migration

of contaminants to the groundwater with minimal exposure to remediation workers.

Alternative S3A includes the removal and chipping of the vegetation followed by incineration at the SRS Consolidated Incinerator Facility (CIF). Existing SRS institutional controls would remain in effect. Following remediation the unit would be maintained for a present value cost of $2,100,000.

Alternative S3B includes the removal of the vegetation followed by transport and disposal off unit. Existing SRS institutional controls

would remain in effect. Following remediation the unit would be maintained for a present value cost of $1,800,000.

Alternative S4A/B - Ex Situ Grout Soils to 2 Feet & Incinerate Vegetation at CIF or Dispose of Vegetation Off Unit

This alternative involves the excavation and ex situ grouting of the OFASB and effluent ditchline. The OFASB would be excavated to a maximum depth of 2 feet. The excavated soils would be mixed with the solidification/stabilization reagents at predetermined ratios, and the soils would be placed back into the basin. When all of the OFASB soils are treated, the process would be repeated an effluent ditchline soils. Upon completion of ex situ grouting, the treated soils would be placed in the OFASB, the OFASB would be backfilled and compacted to grade, and an engineered cap as described in alternative S2 would then be constructed over the OFASB to minimize surface infiltration and reduce the potential for contaminant migration. These alternatives (S4A/S4B) would reduce the risks associated with direct radiation exposure and minimize, through grouting the most contaminated soils, future potential migration of contaminants to the groundwater but since the significantly contaminated soils would

require excavation prior to treatment exposure to remediation workers could occur.

Alternative S4A includes the removal and chipping of the vegetation followed by incineration at the SRS CIF. Existing SRS institutional controls would remain in effect. Following remediation the unit would be maintained for a present value cost of $2,300,000.

Alternative S4B includes the removal of the vegetation followed by transport and disposal at the SRS Burial Grounds which have trenches that are permitted to accept debris. Existing SRS institutional controls would

remain in effect. Following remediation, the unit would be maintained for a present value cost of $1,900,000.

Alternative S5 - Dispose of 2 Feet of Soils at Envirocare, Incinerate Vegetation at CIF, and Cap

This alternative involves the excavation and off-site disposal of the top 2 feet of the OFASB (4,500 cubic yards) and effluent ditchline soils (167 cubic yards). A backhoe would be used to excavate the OFASB soils. The backhoe would start at one end of the ditchline and basin and would gradually progress along the edges and toward the middle of the ditchline and basin until all of the soil within 2 feet is removed. Excavated soil would then be placed directly onto lined trucks for transport from the waste unit. From the OFASB, the excavated soils would either be transported directly to the Envirocare facility in Clive, Utah, or transferred to a railcar for final transport to the Envirocare facility. Upon completion of the excavation, and off-site disposal activities, the OFASB would be backfilled and compacted to grade, and an engineered cap as described in alternative S2 would then be constructed over the OFASB to minimize surface infiltration and reduce the potential for contaminant migration. This

alternative would reduce the risks associated with direct radiation exposure and minimum through off unit disposal, future potential migration of contaminants to the groundwater but since the significantly contaminated soils would require excavation prior to disposal, exposure to remediation workers could occur. Also, since transportation would be required off the SRS, the potential for exposure to the public exists.

This alternative also includes the removal of the vegetation followed by incineration at the SRS CIF. Existing SRS institutional controls would remain in effect. A present value cost of $9,000,000 is estimated for this alternative.

VII.B Description of the Considered Alternatives for the OFASB Operable Unit Groundwater

Four alternatives were evaluated for remedial

action of the OFASB operable unit groundwater. Each alternative is described below.

Alternative GW1 - No Action

This alternative is the same as the no action described in alternative S1. Because no action would be taken and the OFASB would remain in its present condition there would be no reduction of risk. The present value estimate to perform both the no action for soils/vegetation and groundwater would be $280,000 due to performance of five year reviews since waste is left in place.

Alternative GW2A - Groundwater Extraction, Treatment with Reverse Osmosis and Ion Exchange, Disposal of Residuals, and Reinjection

This alternative consists of setting up a system of 11 extraction wells on 100 foot nodes to hydraulically contain the contaminated water table aquifer plume. The groundwater would

be extracted from the ground and sent to a reverse osmosis unit which would separate the stream into a concentrated retentate stream (the part of the groundwater feed stream that is retained) containing the radionuclides and metal and a permeate stream (the part of the groundwater feed stream that passes through the membrane) which contains treated water. The permeate stream would next pass through an ion exchange unit designed to remove nitrate from the water. The treated water from the ion exchange unit would then be piped to a system of injection wells located up gradient from the extraction wells.

The treated water, which still contains tritium, would then be reinjected into the water table aquifer to allow additional time for natural decay to reduce the level of tritium in the groundwater. The retentate from the reverse osmosis unit and the regenerated liquid from the ion exchange unit would then be collected

and disposed.

Three methods for disposal have been found to be acceptable. All three involve solidifying the waste in a cement-based matrix for final disposition. The Saltstone facility would provide the lowest cost method for treating the waste stream, however, this facility is designed to accept waste from the ITP process only. If this facility can be modified, then the Saltstone facility represents the preferred method for disposal of the concentrated liquid waste. If modifications cannot be made, then the E-Area Vaults or the Envirocare facility can be used. This alternative would reduce risks associated with exposure due to ingestion, of contaminated groundwater through treatment.

Assuming use of the Saltstone facility and that the groundwater aquifer would be maintained, the present value cost for this alternative is $17,800,000.

Alternative GW2B - Groundwater Extraction, Treatment with Reverse Osmosis, Disposal of Residuals, and Reinjection

This alternative is nearly identical to the previous alternative (GW2A) except a dual ion exchange system is used in place of the reverse osmosis and ion exchange system. In this alternative, the ion exchange system would contain both an anionic and a cationic unit. For this application, one unit is designed to remove the radionuclides and metals while the other is designed to remove nitrate. The regeneration of one unit is normally done using an acid wash while the other uses a basic wash. An added advantage of this system is that the two waste streams can be used to neutralize each other before the waste is shipped for disposal. This alternative would reduce risks associated with exposure due to ingestion of groundwater through treatment.

Assuming use of the Saltstone facility and the groundwater aquifer would be maintained the present value cost for this alternative is $13,200,000.

Alternative GW3 - Groundwater Controls Using Alternate Concentration Limits/ Mixing Zone

This alternative will involve the installation of a monitoring well network between the basin and the down gradient stream and initiation of periodic monitoring. The application for a groundwater mixing zone has been approved by the appropriate regulatory agencies. This approval is based on data from monitoring wells around the OFASB and groundwater modeling. This alternative will demonstrate that remedial goal objectives will be met and MCLs will not be exceeded beyond the groundwater mixing zone. Implementation of this alternative involves installation and monitoring of groundwater wells as described in the groundwater mixing zone application.

This alternative will reduce the risks associated with groundwater ingestion by ensuring that through natural groundwater mixing zone processes the nearest groundwater receptor is not exposed to groundwater contaminated above MCLs. Access controls are in place through establishment of institutional controls to prevent exposure to the groundwater plume.

Since five year reviews of the remedy are required, the estimated present value for these reviews, installation of monitoring wells, and monitoring is $1,300,000.

VIII. Summary of Comparative Analysis of the Alternatives

Description of Nine Evaluation Criteria

Each of the remedial alternatives was evaluated using the nine criteria established by the National Oil and Hazardous Substances Contingency Plan (NCP). The criteria were derived from the statutory requirements of CERCLA Section 121. The NCP [40 CFR § 300.430 (e)(9)] sets forth nine evaluation criteria that provide the basis for evaluating alternatives and selecting a remedy. The criteria are:

- overall protection of human health and

the environment,
- compliance with ARARs,
- long-term effectiveness and permanence,
- reduction at toxicity, mobility, or volume through treatment,
- short-term effectiveness,
- implementability,
- cost,
- state acceptance, and
- community acceptance.

In selecting the preferred alternative, the above mentioned criteria were used to evaluate the alternatives developed in the Corrective Measures Study/Feasibility Study for the Old

F-Area Seepage Basin (U) (WSRC, 1996a). Seven of the criteria are used to evaluate all the alternatives, based on human health and environmental protection, cost, and feasibility issues. The preferred alternative is further evaluated based on the final two criteria: state acceptance and community acceptance. Brief descriptions of all nine criteria are given below.

Overall Protection of Human Health and the Environment - The remedial alternatives are assessed to determine the degree to which each alternative eliminates, reduces, or controls threats to human health and the environment through treatment engineering methods, or institutional controls.

All the soil/vegetation alternatives (with the exception of the no action alternative) would reduce the risks associated with direct radiation exposure, however, the in situ grouting, ex situ grouting, and off unit disposal options would further minimize the potential migration of contaminants to the groundwater. The groundwater alternatives (with the exception of the no action alternative) would reduce the risks associated with groundwater ingestion.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) - ARARs are Federal and state environmental regulations that establish standards which remedial actions must meet. These are three types of ARARs: (1) chemical-specific, (2) location-specific, and (3) action-specific.

Chemical-specific ARARs we usually health

or risk-based levels or which, when applied to unit-specific conditions, result in the establishment of numerical values. Often these numerical values are promulgated in Federal or state regulations.

Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in specific locations. Some

examples of specific locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats.

Action-specific ARARs are usually technology- or remedial activity-based requirements or limitations on actions taken with respect to hazardous substances or unit specific conditions. The requirements are triggered by the particular remedial activities that are selected to accomplish a remedy.

The remedial activities are assessed to determine whether they attain ARARs or provide grounds for invoking one of the five waivers for ARARs. These waivers are:

- the remedial action is an interim measure and will become a part of a total remedial action that will attain the ARAR,
- compliance will result in greater risk to human health and the environment than other alternatives,
- compliance is technically impracticable from an engineering perspective,
- the alternative remedial action will attain an equivalent standard of performance through use of another method or approach,
- the state has not consistently applied the promulgated requirement in similar circumstances or at other remedial action in the state.

In addition to ARARs, compliance with other criteria, guidance, and proposed standards that

are not legally binding, but may provide useful information or recommended procedures should be reviewed as To-Be-Considered when setting remedial objectives.

All the alternatives (with the exception of the no action alternative) for both soil/vegetation and groundwater will comply with ARARs. The mixing zone alternative will achieve MCLs at the compliance point as established in the

approved groundwater mixing zone application. Aquifer restoration will occur through natural groundwater mixing processes in approximately 200 years based on modeling conducted in the approved groundwater mixing zone application.

Long-Term Effectiveness and Permanence - The remedial alternatives are assessed based on their ability to maintain reliable protection of human health and the environment after implementation.

The grouting (in situ and ex situ) and off unit disposal alternatives provide more effectiveness than the capping alternative since the waste is solidified below grade or removed from the unit. The off unit disposal alternative provides the most effectiveness through removal of the source and disposal at an off unit location. The pump and treat groundwater alternatives would permanently remove most contaminants but would not improve the groundwater risks associated with tritium over the groundwater mixing zone alternative.

Reduction of Toxicity, Mobility, or Volume Through Treatment - The remedial alternatives are assessed based on the degree to which they employ treatment that reduces toxicity (the harmful nature of the contaminants), mobility (ability of the contaminants to move through the environment), or volume of contaminants associated with the unit.

The in situ and ex situ grouting alternatives for the soil would reduce contaminant mobility through treatment. The pump and treat alternatives for the groundwater would reduce the volume of contaminated groundwater through treatment.

Short-Term Effectiveness - The remedial

alternatives are assessed considering factors relevant to implementation of the remedial action, including risks to the community during implementation, impacts on workers, potential

environmental impacts (e.g., air emissions), and the time until protection is achieved.

In situ grouting and capping for the soil would provide the least potential for exposure to the worker while off unit disposal would pose the highest potential for exposure to the public since waste would be transported outside of the SRS. Groundwater pump and treat alternatives will provide the highest potential for exposure to workers through future disposal needs of the treatment medium (reverse osmosis, ion exchange).

Implementability - The remedial alternatives are assessed by considering the difficulty of implementing the alternative including technical feasibility, constructability, reliability of technology, ease of undertaking additional remedial actions (if required), monitoring considerations, administrative feasibility (regulatory requirements), and availability of services and materials.

All alternatives are easily and readily available for application at the OFASB. Separate regulatory acceptance of the groundwater mixing zone alternative is required prior to its initiation.

Cost - The evaluation of remedial alternatives must include capital and operational, and maintenance costs. Present value costs are estimated within +50/-30 percent per EPA guidance. The cost estimates given with each alternative are prepared from information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, find project scope, final project schedule, and other variable factors. As a result, the final project costs may vary from the estimates

presented herein.

The most costly alternative for the soil is off unit disposal followed by the grouting (in situ

and ex situ) and capping alternatives which have similar order of magnitude costs. The pump and treat alternatives for the groundwater are significantly (an order of magnitude) more costly than the groundwater mixing zone alternative. The no action alternative requires the least cost.

State - In accordance with the FFA, the State is required to comment/approve on the RFI/RI Report, the Baseline Risk Assessment, the Corrective Measures Study/Feasibility Study, and the Statement of Basis/Proposed Plan.

State acceptance of previous document as listed above has been obtained. Also, State acceptance of the groundwater mixing zone application was required.

Community Acceptance - The community acceptance of the preferred alternative is assessed by giving the public an opportunity to comment an the remedy selection process. A public comment period was held and public comments concerning the, proposed remedy are addressed in the Responsiveness Summary of the Record of Decision.

No comments through the formal public comment period or through scoping with the CAB that would cause deviation from the selected remedy were provided.

Detailed Evaluation

The remedial action alternatives discussed in Sections VII.A and VII.B have been evaluated using the nine criteria just described. Tables 4 and 5 present a summary of the evaluation of the soil/vegetation and groundwater remedial alternatives.

IX. The Selected Remedy

Based on the risks identified in the Baseline Risk Assessment, the OFASB unit pose a

Significant risk to human health. Significant carcinogenic risks to the potential future worker are driven by exposure from direct radiation from the basin soils contaminated with cesium-137 to a depth of 2 feet (~4.500 cubic yards) and effluent ditchline soils to a depth of 2 feet (~167 cubic yards). Groundwater monitoring data indicates that iodine-129, nitrate, strontium-90, and tritium exceed MCLS and uranium exceeds proposed MCLs. Although radium his been decreasing over time, it has exceeded MCLS and therefore, radium will be monitored.

The preferred alternative for the OFASB pipeline and pipeline soils is institutional controls. This alternative will restrict this land to future industrial use and limit access to the soil which might expose future workers to low concentrations of hazardous constituents through use of administrative and access controls.

Based on risk characterization, risk evaluations, and a detailed analysis of retained alternatives (Tables 4 and 5) the preferred alternative for remediating the OFASB soils/vegetation is S3B: In Situ Grout Soils to 2 Feet & Dispose of Vegetation Off Unit which will eliminate direct radiation risk and potential future impacts to the groundwater. The preferred alternative for remediating the OFASB groundwater is GW3: Groundwater Controls Using Alternate Concentration Limits/Mixing Zone which will monitor existing groundwater constituents to assess impacts to potential receptors based on the approved groundwater mixing zone application (demonstration). This mixing zone alternative will meet remedial action objectives. MZCLs will be achieved throughout the groundwater aquifer and MCLs will be achieved at the compliance point as described in the approved groundwater mixing zone application.

The OFASB is located in an area which has been recommended for industrial use by the

CAB and so designated by the U.S. DOE.

Institutional controls at the OFASB Operable Unit will be consistent with recommendations made in the "Savannah River Site Future Use Report Stakeholder Recommendations for SRS Land and Facilities", January 1996 which include the recommendation that "residential uses of SRS land should be prohibited." Current and future institutional controls which will include access controls (e.g. fencing, security, land use restrictions, etc.) will ensure that these recommendations are maintained. Under this land use policy alternatives S3B and GW3 (which include institutional controls) will be protective of human health and the environment.

Due to the presence of buried waste material and planned groundwater monitoring controls, institutional controls have been chosen to augment the preferred alternative for the OFASB source control operable unit including the pipeline and pipeline soils. Implementation of institutional controls will require both short- and long-term actions. For the short-term, signs will be posted at te waste unit which indicate that this area was used for disposal of waste material and contains buried waste. In addition, existing SRS access controls will be used to maintain the use of this site for industrial use only. Additionally, administrative controls such as site use and site clearance permits as well as access controls such as filling or grouting of pipeline manholes to prevent potential worker exposure will be employed.

In the long-term, it the property is ever transferred to non-federal ownership, the U.S. Government will create a deed for the new property owner which will contain information in compliance with Section 120(h) of CERCLA. The deed shall include notification disclosing former waste management and disposal activities as well as remedial actions taken on the site, and any continuing groundwater monitoring commitments.

The deed notification would, in perpetuity,

notify any potential purchaser that the property has been used for the management and disposal of radioactive materials and hazardous substances. The deed would also include deed restrictions precluding residential use of the property. However, the need for these deed restrictions could be reevaluated at the time of transfer in the event that contamination no longer poses an unacceptable risk under residential use.

In addition, if the property is ever transferred to non-federal ownership, a survey plat of the area would be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

Along with the institutional controls identified above, implementation of the soils/vegetation alternative (S3B) will involve the removal of contaminated vegetation and off unit disposal followed by the removal of contaminated soils in the effluent ditchline and placement in the basin, and in situ grouting the top 2 feet of contaminated soils in the basin (~4,500 cubic yards) and effluent ditchline soils (~167 cubic yards). An engineered cap (low permeability) would then be constructed over the basin area (Figure 3) to minimize surface infiltration and reduce the potential for contaminant migration. In situ grouting will follow placement of the ditchline soils (Figure 4). Grout application may involve soil mixing or tilling and mixing, however; the actual application method and stabilization admixture to be used in remediation will be specified in the remedial design.

Along with the institutional controls identified above, implementation of the groundwater alternative (GW3) will involve the placement of compliance boundary monitoring wells between the basin and the down gradient stream and periodic monitoring of these compliance wells against the MCLs. This alternative will meet remedial action objectives. MZCLs will be achieved throughout the groundwater aquifer and MCLs will be achieved at the compliance point as described in the approved groundwater mixing zone application. All monitoring, compliance, and reporting requirements to satisfy the groundwater mixing zone demonstration should be met in accordance with Section 5 of the

approved groundwater mixing application
(WSRC-RP-97-39, Rev. 1).

Costs (capital, O&M and total present worth)
for the selected remedy for the soil/vegetation
are

$1,300,000 (capital)
$ 500,000 (O&M)
$1,800,000 (total present worth)

and for the groundwater are

$ 200,000 (capital)
$1,100,000 (O&M)
$1,300,000 (total present worth).

Total present worth costs are estimated to be
approximately $3,100,000 for both the
soil/vegetation and groundwater media.

This proposal is consistent with EPA guidance
and is an effective use of risk management
principles.

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X. Statutory Determinations

Based on the OFASB RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report and the Baseline Risk Assessment, the OFASB poses no significant risk to the environment but poses significant risk to human health. Therefore, treatment and capping is necessary for the OFASB soils (basin and ditchline), institutional controls are necessary for the OFASB pipeline and pipeline soils, and monitoring of the existing groundwater constituents (based on the groundwater mixing zone application) to assess impacts to potential receptors for OFASB groundwater. The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The size and location of the waste unit and the levels of the contaminants preclude a remedy in which contaminants could be excavated and treated effectively.

In situ grouting/capping and the groundwater mixing zone application provide for a significant reduction in the risks associated with direct radiation potential future impacts to the groundwater, and groundwater ingestion. Throughout implementation the selected remedy all ARARs will have been complied with through use of treatment technologies on the soils, removal and off unit disposal of the vegetation, and application at the groundwater mixing zone.

Since the soil is grouted below grade, long term weathering and the potential for leaching of contaminants is minimized. Worker and public safety is maximized through minimizing handling of contaminated media. This selected remedy provides the most cost effective: option considering the OFASB is located in an identified industrial zone.

This remedy utilizes permanent solutions and alternative treatment technologies and satisfies the statutory preference for remedies that employ treatment (in situ grouting) that reduces toxicity, mobility, or volume as a principal element.

XI. Explanation of Significant Changes

The Statement of Basis/Proposed Plan and the draft RCRA permit modification provided for involvement with the community through a document review process and a public comment period. Comments that were received during the 45-day public comment period are addressed in Appendix A of this Record of Decision and are available with the final RCRA permit.

There were no significant changes to the selected remedy as a result of public comments. Approval of the groundwater mixing zone application was accelerated in order to obtain approval of the groundwater mixing zone application prior to approval of this Record of Decision. This groundwater mixing zone application demonstrates the appropriateness of aquifer restoration during passive remedial action.

In selecting the remedy in this Record of Decision, a Savannah River Site bulk disposal alternative was not evaluated in the feasibility study but is currently being developed and evaluated for radiologically contaminated soil/debris as a soils consolidation facility (SCF).

Should the SCF concept become a Savannah River Site remedial option for radiologically contaminated soils prior to implementation of the selected OFASB remedy, then the bulk disposal SCF alternative will be evaluated for the OFASB. This evaluation will fully

consider the nine criteria established by the NCP in determining if the SCF alternative is an appropriate remedy for the OFASB and if the

SCF remedy is determined appropriate for the OFASB, the change in remedy will cause no significant loss of monetary resources.

Should use of the SCF concept be deemed appropriate at the OFASB, this Record of Decision would require modification.

XII. Responsiveness Summary

There were ten comments received during the public comment period. The Responsiveness Summary (see Appendix A) of this Record of Decision addresses these comments.

XIII. Post-ROD Document Schedule

The post-ROD document schedule is listed below and is illustrated in Figure 5.

Soil/Groundwater

1. Corrective Measure/Remedial Design Workplan (CM/RDW) Revision 0 for the OFASB will be submitted for EPA and SCDHEC review 86 calendar days after issuance of the ROD.
2. EPA and SCDHEC review of the OFASB CM/RDW Revision 0 will last 45 calendar days.
3. SRS revision of the OFASB CM/RDW will be completed 30 calendar days after receipt of all regulatory comments.
4. EPA and SCDHEC final review and approval of the OFASB CM/RDW Revision 1 will last 30 calendar days.
5. Remedial Design Report/Remedial Action Workplan (RDR/RAWP) Revision 0 for the OFASB will be submitted 266 calendar days after issuance of the ROD.
6. EPA and SCDHEC review of the OFASB RDR/RDWP Revision 0 will last 90 calendar days.
7. SRS revision of the OFASB RDR/RAWP

will be completed 60 calendar days after receipt of all regulatory comments.

8. EPA and SCDHEC final review and approval of the OFASB RDR/RAWP Revision 1 will last 30 calendar days.
9. OFASB Remedial Action Start on the soils and groundwater will begin following EPA and SCDHEC approval of the RDR/RAWP.
10. OFASB Post Construction Report (PCR) Revision 0 will be submitted to EPA and SCDHEC 83 calendar days after completion of the remedial action.
11. EPA and SCDHEC review of the OFASB PCR will last 90 calendar days.
12. SRS revision of the OFASB PCR will be completed 60 calendar days after receipt of all regulatory comments.
13. EPA and SCDHEC final review and approval of the Revision 1 PCR will last 30 calendar days.

Vegetation

1. OFASB Vegetation Remedial Action Start will begin within 15 months after issuance of the ROD.

All vegetation within the basin and ditch line area are considered impacted by contaminant. uptake and will be removed. Vegetation sampling and analysis will be performed to characterize the vegetation as a waste to identify appropriate treatment options. Removal of contaminated trees will include removal of roots and all trees will be treated off-unit. Vegetation removal will be performed in a manner so as to minimize land disturbance and therefore the potential for soil erosion. All land disturbances will be addressed in an approved soil erosion control plan which will minimize to the extent possible, the potential for release of contaminated soil to the surrounding areas.

Contaminated vegetation will be cut, sectioned, and packaged for transport at the waste unit. Appropriate procedures will be used to ensure radiation exposure during all operations is as

low as reasonably achievable (ALARA). If necessary, wind breaks and radiological huts will be employed to reduce the risk from wind blown contamination. In addition, site procedures do not allow activity in contamination areas when wind velocity reaches 10 miles per hour. Handling of trees and larger vegetation will be performed remotely, whenever possible, which may include the use of cranes or other mechanical equipment used in the logging industry.

Treatment of contaminated vegetation will not be implemented at the waste unit. It is anticipated that contaminated vegetation will be disposed at an off unit facility. Off site shipment and treatment of contaminated vegetation will comply with the "offsite rule" under CERCLA. After completion of the final remedial action, including remediation of the basin soils, a Post Construction Report will be submitted which will include the volume and disposition of all vegetation removed from the unit.

XIV. References

DOE (U.S. Department of Energy), 1994. Public Involvement, A Plan for Savannah River Site. Savannah River Operations Office, Aiken South Carolina.

FFA, 1993. Federal Facility Agreement for the Savannah River Site, Administrative Docket No. 89-05-FF, (Effective Date: August 16, 1993).

WSRC, (Westinghouse Savannah River Company) 1995a. Baseline Risk Assessment for the Old F-Area Seepage Basin (U). WSRC-RP-94-1174. Rev. 1, Westinghouse Savannah River Company, Aiken, South Carolina (1995a).

WSRC, 1995b. Data Summary Report for the Old F-Area Seepage Basin (U). WSRC-RP-94-943, Rev. 0, Westinghouse Savannah River Company, Aiken, South Carolina (1995b).

WSRC, 1995c. RFI/RI Report for the Old F-

Area Seepage Basin (U). WSRC-RP-94-942, Rev. 1. Westinghouse Savannah River Company, Aiken, South Carolina (1995c).

WSRC, 1996a. Corrective Measures Study/Feasibility Study for the Old F-Area Seepage Basin (U). WSRC-RP-95-385, Rev. 1, Westinghouse Savannah River Company, Aiken South Carolina (1996).

WSRC, 1996b. Statement of Basis/Proposed Plan for the Old F-Area Seepage Basin (904-49G) (U), WSRC-RP-95-1557, Rev. 1, Westinghouse Savannah River Company, Aiken, South Carolina

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APPENDIX A

RESPONSIVENESS SUMMARY

Record of Decision for the Old F-Area Seepage Basin (904-49G) Savannah River Site
WSRC-RP-96-872
Revision 1.1 Final
March 1997

Responsiveness Summary

The 45-day public comment period for the Statement of Basis/Proposed Plan for Old F-Area Seepage Basin (904-49G) began on September 17, 1996 and ended on October 31, 1996. A public meeting was held on October 15, 1996. Specific comments and responses are found below. The comments are italicized and the responses are bolded.

Public Comments

Comment 1: Scenario for Current Land Use-Direct Radiation

It appears that the occupancy factor for the visitor is too high. The Exposure Frequency (events/year) and Exposure Duration (years) are probably unrealistically conservative. If realistic values were used then the risk value would

probably be less than 1.0E-06. In that event, this scenario would drop from the list of significant risks. The other part of the equation that drives the risk value upward is the use of the highest detectable value (Tables 3-11 through 3-20) in the calculation of risk. Again this unrealistically conservative, driving the conclusion toward taking action when none may be warranted.

Response 1: We believe the occupancy factor for the current on-unit visitor, which is defined as an SRS researcher/sampler, is reasonable. The researcher/sampler is only exposed for 6 days per year for 5 years, which is a reasonable estimate for an SREL worker or ER sampler performing environmental studies at the OFASB. The EPA standard default worker occupancy factors are 250 days per year for 25 years.

The "use of the highest detectable value in the calculation of risk" is done according to EPA and SCDHEC guidance. The regulatory guidance is that we calculate a 95% Upper Confidence Limit (95% UCL) on the average detected value and compare the 95% UCL or the maximum detected value, whichever is lower. The lower of the two values is selected as the "Reasonable Maximum Exposure" concentration. The 95% UCL can actually exceed the maximum detected value if there is a small sample size, or if there is great variation in detected values, which will result in using the maximum detect since it is the lower value.

Comment 2: Future Land Use-Noncarcinogenic Hazards

In the general use of the highest detectable value in calculating the risk is not justified; a more realistic risk should be calculated.

The ingestion of groundwater (adult and child) scenarios list several nonradioactive inorganic analyzes that derive the Hazard index above unity. These include manganese, arsenic, lead, and nitrate. The Plan describes that inorganic analytes are compared to their appropriate background levels and are to be eliminated if their maximum detected concentration onsite is less than twice

their mean background concentration. The comparison of the maximum detected concentration to the mean detected concentration is like comparing apples and oranges. The comparison should be of the mean detected concentration to the mean background concentration to avoid incorrectly identifying an analyte with high variability in the environment as being of concern. If the range of background samples were compared to the range of basin samples, one could find that the maximum background sample would be in excess of the basin sample.

The identification of manganese as a chemical of concern is not supported by the record of discharges to the basin. Arsenic is identified elsewhere as a legacy of the farming activities in the area (components of arsenic were used as pesticides).

If these were detected from the risk analysis, then the only child pathway for Aquifer Unit IIB remains above a HI of 1.0.

Given that residential use of this land is not recommended by the Citizens Advisory Board, then this pathway does not constitute a risk worth remediating. A similar justification is applicable to the "ingestion of basin soil and homegrown vegetable (mercury)" pathways.

Response 2: The maximum detected value becomes the Reasonable Maximum Exposure (RME) point concentration if it is lower than the 95UCL (see response #1 above). Use of the current data screening protocol could possibly eliminate naturally-occurring inorganic constituents, such as manganese, arsenic, and lead. Nitrates are related to SRS processes and would not be eliminated.

The second point about ingestion of groundwater using maximum detected values to derive an HI above unity and the use of 2X background comparison was covered in the response to comment #1 above. Current regulatory guidance prescribes the use of background comparisons.

As stated above (response #1), manganese and arsenic are likely to be naturally-occurring, but they passed through the Contaminant Of Potential Concern (COPC screening process as applied in 1994 when this Baseline Risk Assessment (BRA) was prepared. The new RCRA Facility Investigation/Remedial Investigation (RFI/RI)/BRA Scoping Process that is now being developed will all for use of an uncertainty analysis to consider natural abundance, anthropogenic sources, and likely future land uses in considering the application of any COPC in the risk assessment process.

The use of the RFI/RI/BRA Scoping Process would allow SRS to potentially screen out future residential land use in areas that are designated for future industrial or nuclear industrial uses. However, for this waste unit, use of this screening protocol would not change the conclusion on the appropriate remedy.

Comment 3: Future Use Scenarios-Ingestion of Groundwater-Radioactivity/Beryllium

The ingestion of groundwater by future residents lists potassium-40 as the major contributor of risk (82% of the total risk). Potassium-40 occurs naturally and is not a contaminant added by the operations of the Savannah River Site. The screening criteria for potassium-40 must be flawed (too low). Potassium should not appear in any of the risk calculations. Additionally, lead-212 and radium-226 occur naturally; however, they may also be contributed from SRS activities. Comparison to a valid set of background samples and use of appropriate comparison values (not maximum sample concentration to average background concentration) should reveal whether their presence is due to SRS activities. Strontium-90 could be present due to either fallout or SRS activities.

However, given that residential use is not recommended the risk does not justify cleanup actions.

The presence of beryllium in the on-unit worker scenario is puzzling. To my knowledge beryllium was not a component of the materials discharged to the basin.

Response 3: The K-40, which is naturally-occurring, could possibly be eliminated using the current COPC screening process or the RFI/RI/BRA Scoping Process that is being developed. See background comparison responses above (response #1 and #2). Beryllium is a naturally-occurring metal that occasionally shows up at SRS waste units. However, for this waste unit, use of this screening protocol would not change the conclusion on the appropriate remedy.

Comment 4: Future Use Scenario-Inhalation of Soil-Radioactivity

Worker occupancy factors are probably too high, residential use is not recommended by the CAB, risk could be eliminated with a covering (2 feet of clean soil).

Response 4: The Future Industrial Worker scenario is the standard default exposure scenario. The 250 days per year exposure over 25 years is a suggested default assumption in EPA guidance. SRS, EPA, and SCDHEC agreed to use the standard worker scenario in all SRS Baseline Risk Assessments. Other worker exposures, such as the researcher/scenario, are also evaluated in BRAs. The result of the inhalation of soil (radioactivity) pathway results actually helps the risk manager decide that an action to limit that exposure is warranted, such as the application of a 2 ft. layer of clean soil over the closed basin. Although the residential scenario was not selected as the preferred land use, additional action (grouting and a low permeability cap) is required to protect the groundwater aquifer from future impacts from the radiologically contaminated soils present at this waste unit.

Comment 5: Future Use Scenario-Ingestion of Soil/Vegetables-Radioactivity

A covering of clean soil would eliminate the worker pathway, residential use is not recommended by the CAB.

Response 5: Shielding through use of 2 to 3 feet of soil is effective in eliminating the direct radiation exposure hazards associated with the worker. Although the residential scenario was not selected as the preferred land use, additional action (grouting and a low permeability cap) is required to protect the groundwater aquifer from future impacts from the radiologically contaminated soils present at this waste unit.

Comment 6: Recommendation

The most cost-effective approach would be to excavate the ditchline soils to a depth of 2 feet and place the soil in the basin; remove the vegetation growing in the ditch and basin, chip and place in the basin; place clean soil in the ditch and

basin; then grade to minimize erosion, apply topsoil and plant ground cover to control erosion.

Response 6: Grouting of the top layer of contaminated soils at this waste unit eliminates the need for a more protective cap (i.e. with grouting a cap with only a 10E-5 cm/sec hydraulic conductivity is required to protect the groundwater verses the requirement of a 10E-6 cm/sec hydraulic conductivity cap without grouting). Grouting is also more permanent since the solidified soil would not be exposed to weathering and requires no long-term maintenance. Also, with the use of a 10E-5 cm/sec cap, maintenance is easier and less costly (primarily due to the availability of 10E-5 cm/sec soil at SRS).

Capping the vegetation was evaluated in the Corrective Measures Study/Feasibility Study for this waste unit. Since grouting is the primary treatment only a 10E-5 cm/sec cap is needed. Also, extra handling and storage of the vegetation would be required while the grouting process is being conducted causing increased costs and environmental management concerns. The grouting process is expected to take several months to complete.

Ditchline soils are planned to be moved into the basin and clean soil in the ditch and basin are planned to return the ditch to natural grade and to provide shielding to workers in the basin. The cap will be constructed to promote surface water runoff and a vegetative cover will be prepared to provided added evapotranspiration benefits in minimizing infiltration of surface water into the basin area.

Public Meeting Comments

The following comments were taken from the October 15, 1996 OFASB Public Meeting transcript.

Comment 7: Why isn't the proposed soils consolidation facility being considered to permanently take care of the situation with the limited depth of contamination since with the soils consolidation facility would not have to permanently take care of the waste unit or maintain the cap or soil cover after excavation and transportation to the soils consolidation facility? (paraphrased from the public meeting transcript during the presentation of the proposed remedy for this waste unit)

Response 7: This waste unit consists of soil contamination to a depth of about 26 feet below the basin bottom. Therefore, there is a significant quantity of soil that may require excavation and transport to the pre-conceptual soil consolidation facility (~58,000 cubic yards in place volume).

The Corrective Measures Study/Feasibility Study considered a number and range of alternatives for remediation of the source unit. However, the soil consolidation facility has been considered for this waste unit in the Proposed Plan but without a site, design, or available capacity at the present time or short term is not considered feasible at this time. (The use of a soils consolidation

facility would not necessarily provide additional protectiveness to human health or the environment.) The selected remedy identified in this ROD meets the requirements under CERCLA and the NCP. Therefore, it was determined that if this soil consolidation facility comes on line and that the soils from this waste unit are acceptable to this soil consolidation facility, then; the action at this waste unit may be reevaluated to consider the soil consolidation facility.

Comment 8: What kind of risk modeling and prioritization based on the associated risks have been studied and reviewed for this waste unit? (paraphrased from the public meeting transcript during the presentation of the proposed remedy for this waste unit)

Response 8: The groundwater at this waste unit has been contaminated from the basin operations. Modeling was performed to determine if current contaminant concentrations in the basin and ditchline soils serve as a continuing source to groundwater contamination above primary environmental standards. This modeling identified that contaminant concentration in the top two feet of the basin and ditchline soils could cause future impacts to the groundwater aquifer This is the primary basis for treating this soil layer using stabilization/solidification techniques.

Comment 9: The risk has been identified as a risk to the workers that are going to be working in the vicinity of that area (the waste unit). Just how significant is the risk in terms of radiation exposure to the workers that are close to those areas? And how do you compare that risk which is probably quite small, to the risk that will be essentially taken by the workers that will go in to do the remediation of this site? Heavy equipment disturbing contaminated soil, getting radiation exposure, those activities, how do you balance the two to say it would probably be better to just push clean dirt over the top of it and not disturb the soil, not to do anything that does that? Because apparently it's not a risk to the public sector, it's only a risk to the worker, as opposed to actually going in and actively doing things to disturb the soil, to do the grouting in place, and those type of activities; how does the other side of the equation get weighed in when you make a decision that this is an area that we need to go and remediate? (from the public meeting transcript during the formal comment period for this waste unit)

Response 9: Existing institutional controls in the area of this waste unit prevent access and therefore radiation exposure to workers in the vicinity of this waste unit. No risks are identified for the current worker based on a visitor/sampler scenario (see response 1). The future industrial worker risks are significant based on the EPA standard default scenario (see response 4). These risks along with the risks to the remediation worker are evaluated qualitatively in the detailed analysis of alternatives, specifically the short term effectiveness criteria. It is this evaluation that drives the preference of in situ treatment technologies over ex situ treatment technologies.

The selected remedy identifies a minimal amount of movement of contaminated soil (~167 cubic yards from the ditchline to be placed in the basin). Following placement of the ditchline soils in the bottom of the basis a layer of clean soil will be placed over the contaminated soil to provide shielding from radioactive contaminants. After the clean soil is placed (~3 feet) the top 2 foot layer of contaminated basin soil and the ditchline soil will be grouted followed by backfilling the basin to grade and placement of a low permeability cap over the basin area.

Comment 10: Mike Rourak: My name is Mike Rourak and my question is directed directly to Mr. Brian Hennessey's earlier discussion [unintelligible] Silverton Road property for example. In the Future Use Manual that was sent out to some of us about the disposal of close to a million acres of property for DOE, in your deed restrictions there're things that we cannot do. And we're going to need a little bit before we can respond back to Washington. Those of us who received the manual, we almost are going to need to know what those deed restrictions are because if we cannot have a subdivision then there's no need to bid the price accordingly or say that's what we want to use it for. If we cannot graze cattle there like we do in Tennessee at [unintelligible] or something or grow crops because we cannot put a well in for contamination, then we are left with only looking at for the pine trees.

So being federal, you own this property. Even with deed restrictions you've got to give us either a Phase I, II or III audit. In this case, it's the seller who has to provide this liability, not necessarily. The buyer's neglect of liability to due diligence. So it would really help if we knew what deed restrictions would be there to a more extent and also what we can use the land for. If I want to use it for applying 50 - - under the Code of Federal Regulations 503, if I want to use it for bio solid disposal, can I do so? Because it's adjacent to your other property. So the deed restrictions that you brought up were of immense concern about responding back to the future use and the disposal of roughly 849,000 acres nationwide for - to be put back into - I understand from Washington, they would like to put it back mainly into public use to get the taxes off of it. Maybe not so much for the government but for the local entities who lose the tax base. Thank you. (from the public meeting transcript)

Response 10: The SRS Future Use Project Report was distributed to inform citizens of the planned future uses of SRS. The recommendations that were presented in the report may change over time and will be discussed with the stakeholders. Deed restrictions for federal property are not determined until the land is transferred to non-federal control. At the time of property transfer, the need for deed restrictions will be evaluated. Due to natural attenuation, decay, etc., the conditions at specific areas may not warrant any deed restrictions. All legal requirements will be met at the time of property transfer.

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 09/30/1997
Operable Unit: 17
ROD ID: EPA/541/R-97/204

Media: Soil,groundwater.

Contaminant: Americium, antimony, cesium, cobalt, curium, europium, plutonium, potassium, strontium, uranium, aluminum, cadmium, chromium, lead, nickel, vanadium, actinium, thallium, bismuth, potassium, beryllium, arsenic, thallium.

Abstract: The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. SRS is a secured U.S. Government facility with no permanent residents. The site is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company. The L-Area Oil & Chemical Basin (LAOCB) and L-Area Acid Caustic Basin (LAACB) are located in the south central portion of the SRS. Both basins are less than 1 acre in size.SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. Chemical and radioactive wastes are by-products of nuclear material production processes. Hazardous substances are currently present in the environment at SRS. The LAOCB and LAACB were historically used as unlined earthen basins for disposal of liquid waste. The LAOCB was used from 1961 until 1979 and the LAACB was used from 1955 until 1968. Both are located in an area of SRS designated for industrial use.The chemical and radioactive wastes have been treated, stored, and in some cases, disposed at SRS. Past disposal practices have resulted in soil and groundwater contamination. The SRS was included on the National Priorities List (NPL) in 1989. Initial assessments have been

completed for the basins; however, they are currently listed as requiring further evaluation.

Remedy: This remedy addresses contamination in the L-Area Oil & Chemical Basin (LAOCB) and L-Area Acid/Caustic Basin (LAACB) within the Savannah River Site. The remedy for LAOCB is in-situ stabilization and disposal in the LAOCB for cleanup of the LAOCB pipeline; and in-situ stabilization and capping of the LAOCB for cleanup of the LAOCB soil. The remedy for the LAACB is no further action.

Text: Full-text ROD document follows on next page.

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RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

L-Area Oil and Chemical Basin (904-83G) and L-Area Acid Caustic Basin (904-79G)

WSRC-RP-97-143
Revision, 1 July 1997

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U.S. Department of Energy Under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

L-Area Oil & Chemical Basin (904-83G) and L-Area Acid/Caustic Basin (904-79G)

Savannah River Site

Aiken, South Carolina

The L-Area Oil & Chemical Basin (LAOCB) and L-Area Acid/Caustic Basin (LAACB) source Operable Unit (OU) is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Unit/Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS).

Statement of Basis and Purpose

This decision document presents the selected remedial alternative for the LAOCB/LAACB located at the SRS south of Aiken, South Carolina. The selected alternative was developed in accordance with CERCLA, as amended, RCRA, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this specific RCRA/CERCLA unit.

Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

The preferred alternatives for the LAOCB source OU are Alternative P-3: In-situ Stabilization and Disposal in the LAOCB for remediating the LAOCB pipeline, and Alternative S-4: In-situ Stabilization and Capping of the LAOCB for remediating the LAOCB soil. These alternatives will meet remedial action objectives by eliminating the potential ingestion of soils and produce grown in soils, and reduce/minimize direct radiation exposure and potential future impacts to groundwater. The capped area will be maintained and Institutional Controls will remain in place as long as the waste remains a threat to human health or the environment.

The preferred alternative for the LAACB is No Action. The LAACB will be backfilled with native soil and vegetation will be established in a similar fashion to the clean closure of the F-, H-, K-, and P-Acid/Caustic Basins (WSRC, 1995a).

Groundwater south of L Reactor has been impacted by several source OUs including the LAOCB. The groundwater has been identified as a separate OU, as discussed in Section IV of this ROD, and will be addressed in a separate groundwater ROD.

Implementation of the preferred alternatives will require both near- and long-term actions which will be protective of human health and the environment. For the near-term, signs will be posted at the LAOCB which indicate that this area was used for the disposal of radioactive and hazardous substances. In addition, existing SRS access controls will be used to maintain the use of this site for industrial activities only. Near-term actions at the LAACB will consist of backfilling and seeding to establish vegetation and posting to indicate that this area was used for the disposal of hazardous substances.

In the long-term, if the property is ever transferred to non-Federal ownership, the U.S. Government will create a deed for the new property owner which would contain information in compliance with Section 120(h) of CERCLA. The deed would include a notification disclosing former waste management and disposal activities as well as remedial actions taken on the site, and any continuing groundwater monitoring commitments. The deed notification would, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of radioactive and hazardous substances.

The deed would also include deed restrictions precluding residential use of the property. However, the need for these restrictions may be reevaluated in the event that contamination no longer poses an unacceptable risk under residential use. In addition, if the site is ever transferred to non-Federal ownership, a survey plat of the area will be prepared, certified by a professional land surveyor, and recorded with the appropriate Barnwell County recording agency (the LAOCB/LAACB OU is located in northern Barnwell County).

The post-ROD document, the Corrective Measures/Remedial Design Work Plan (CM/RD WP), will be submitted to the U.S. Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC) within approximately one month after the issuance of the ROD. The CM/RD WP will contain a summary description of the scope of work for the remedial action design, implementation/submittal schedule for subsequent post-ROD documents, and an anticipated field activities start date. The regulatory review period, SRS revision period, and final regulatory review and approval period will be 45 days, 30 days, and 30 days, respectively.

The SCDHEC has modified the SRS RCRA permit to incorporate the selected remedy.

Statutory Determination

Based on the LAOCB/LAACB RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report and the Baseline Risk Assessment (BRA), the LAOCB source OU poses significant risk to human health and the environment. Therefore, a determination has been made that in-situ solidification/stabilization (S/S) of the pipeline, excavation and placement of pipeline in the LAOCB, and in-situ S/S and capping of the LAOCB is protective of human health and environment for the contamination remaining in the LAOCB pipeline and LAOCB soil. In-situ S/S and capping will result in the protection of unit groundwater through the stabilization of unit constituents of concern (COCs), and will be protective of on-unit human and ecological receptors by shielding radiation exposure and preventing the assimilation of unit COCs. The selected remedy is protective of human health and the environment, complies With Federal and State of South Carolina requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technology to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

Based on the LAOCB/LAACB RFI/RI Report and the BRA, the LAACB source OU poses no significant risk to human health and the environment. Therefore, a determination has been made that a No Action alternative is appropriate for the LAACB. The No Action alternative will be protective of human health and the environment.

Section 300.430 (f)(4)(ii) of the NCP requires that a five year review of the ROD be performed if hazardous substances, pollutants, or contaminants remain in the waste unit. The SRS RCRA permit is reviewed every five years, and was most recently renewed on September 5, 1995. Because this remedy will result in hazardous substances remaining on-site above health-based levels. The three Parties [U.S. Department of Energy (DOE), SCDHEC, and EPA] have determined that a Five Year Review of the ROD for the LAOCB/LAACB will be performed to ensure continued protection of human health and the environment.

<IMG SRC 97204A>

DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

L-Area Oil and Chemical Basin (904-83G) and L-Area Acid Caustic Basin (904-79G)

WSRC-RP-97-143
Revision. 1
July 1997

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U.S. Department of Energy Under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

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LIST OF ACRONYMS AND ABBREVIATIONS

%	percent
ANS	American National Standard
ARARs	Applicable or relevant and appropriate requirements
BRA	Baseline Risk Assessment
CAB	Citizens Advisory Board
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act

Ci	Curies
CM/RDR/RAWP	Corrective Measures/Remedial Design Report/Remedial Action Work Plan
CM/RDWP	Corrective Measures/Remedial Design Work Plan
CMS	Corrective Measures Study
COC	Constituent of Concern
COPC	Constituent of Potential Concern
CrVI	chromium VI
CSM	conceptual site model
DOE	U.S. Department of Energy
dpm	disintegrations per minute
DQO	Data Quality Objectives
EPA	U.S. Environmental Protection Agency
ERD	Environmental Restoration Department
FFA	Federal Facility Agreement
FS	Feasibility Study
ft	feet
GOU	Groundwater Operable Unit
HI	Hazard index
HQ	Hazard quotient
LAACB	L-Area Acid/Caustic Basin
LAOCB	L-Area Oil and Chemical Basin
MEK	methyl ethyl ketone
mg/kg	milligrams per kilograms
msl	mean sea level
NCP	National Oil and Hazardous Substances Contingency Plan
NEPA	National Environmental Policy Act
NESHAPS	National Emissions Standards for Hazardous Air Pollutants
NPL	CERCLA National Priorities List
NTS	Nevada Test Site
OSHA	Occupational Safety and Health Administration
OU	operable unit
PCB	polychlorinated biphenyls
pCi/g	picoCuries per grain
PP	Proposed Plan
RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RG	Remedial Goal
RI	CERCLA Remedial Investigation
ROD	Record of Decision
S/S	stabilization/solidification
SB	Statement of Basis
SCDHEC	South Carolina Department of Health and Environmental Control

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

SCHWMR	South Carolina Hazardous Waste Management Regulations
SDCF	soil/debris consolidation facility
SRS	Savannah River Site
SVOC	semivolatile organic compound
TBC	To Be Considered
TCLP	Toxicity Characteristic Leaching Procedure
UMTRCA	Uranium Mill Tailings Radiation Control Act
USC	unit specific constituent
VOC	volatile organic compounds
WSRC	Westinghouse Savannah River Company

Savanrmh River Site
CITIZENS ADVISORY BOARD

Recommendation No. 37
May 13, 1997

L-AREA OIL & CHEMICAL BASIN AND L-AREA ACID/CAUSTIC BASIN

Background

The L-Area Oil & Chemical Basin and L-Area Acid/Caustic Basin are within 400 feet of L-Area. They were used as unlined earthen basins for disposal of liquid waste. The L-Area Oil & Chemical Basin (LAOCB) was used from 1961 to 1979 and the L-Area Acid/Caustic Basin (LAACB) was used from 1955 to 1968. Both are located in an area of SRS designated for Industrial Use by the CAB 1 and other Stakeholders 2. The stakeholders recommended and the DOE-SR plans on DOE maintaining control of all of SRS indefinitely 1,2. The LAOCB covers about 0.5 acre, is 12 feet deep and the contamination is confined to approximately the top 2 feet of the soil in the basin bottom. Although some volatile organics and tritiated water probably moved deeper, complete characterization of groundwater contamination has not been done.

Analysis of the risks indicate concern for a future hypothetical onsite resident or onsite industrial worker in the immediate vicinity of the LAOCB only 3. These risks are associated largely with direct radiation from Co-60 and Cs-137 3. However, there are also risks via ingestion and inhalation pathways. The LAOCB pipelines (about 1000 ft.) contain radioactive materials which could reach the soil after the pipe disintegrates 3. Because the pipeline is buried under four feet of soil, there is no risk to

the occasional visitor. There are no risks associated with the LAACB.

The preferred alternative 3 is a good engineering solution for remedial action. It includes in-situ stabilization, backfilling and capping for the LAOCB, in-situ stabilization of the radionuclides in the pipe, and removal of the pipe and its disposal in the LAOCB. Total costs (not including expenditures for reports and regulatory approval) are estimated at $4.6 million for the preferred alternative. The risk analysis indicates that no remedial action is needed for the LAACB 3.

Recommendation

- The preferred alternative negotiated by DOE, EPA, and DHEC be implemented. 3
  This alternative includes in-situ grout stabilization, backfill and capping and may reduce the future remediation costs for the groundwater.

1. CAB Recommendations 2, Industrial/Residential Land Use Guidelines for CERCLA Near Term Decision-making, and 8, Nine Part Recommendation on the future uses of the Savannah River Site.

2. Savannah River Site Future Use Project Report - Stakeholder Recommendations for SRS Land Facilities, published by the U.S. Department of Energy Savannah River Operations Office, January 1996.

3. Statement of Basis/Proposed Plan for the L-Area Oil & Chemical Basin and L-Area Acid/Caustic Basin, February 1997.

Savannah River Site
CITIZENS ADVISORY BOARD

Minority Report
Submitted Regarding
Recommendation No. 37
May 13, 1997

Two recommendation alternatives were presented to the full Board on May 13, 1997, regarding remedial activities at the L-Area Oil & Chemical Basin. Three Board members were in favor of the following alternative:

Because there is no significant risk under the current L-Area industrial operations, because there is some risk to workers implementing the preferred clean up action, because the area is designated as industrial 1,2, because DOE-SR intends to maintain control of the SRS for the indefinite future 1,2,

because the dominant radiological hazard is associated with radionuclides with half lives of 30 years
or less, because groundwater remediation is to be considered later for the whole L-Area, and because
the SRS budget continues to decline, the SRS Citizens Advisory Board recommends that:

- The LAOCB be only backfilled with clean dirt at this time. This will provide direct radiation shielding and eliminate possible inhalation and ingestion of contamination by humans. It will also significantly reduce exposure of wildlife to contaminated soil. Costs should be less than the $1.4 million estimated for backfilling and capping.

- Money saved by implementing this recommended action instead of the preferred action should be used to mitigate risks at higher risk sites.

- Deed restrictions be placed on the land records now to avoid potential conflicts during possible future land disposal action by the Federal Government.

- Groundwater remediation be considered as part of the general L-Area groundwater assessment. If necessary, the LAOCB should be capped with a low permeability barrier later.

Board members in favor of this alternative stated they were concerned that although the L-Area Oil &
Chemical Basin is listed as the second highest risk in the Federal Facility Agreement which addresses
he Environmental Restoration Program, the basin is not the second highest risk at SRS. Comments
were that in light of budget reductions, funding for this activity may be more appropriately allocated
to other SRS programs which pose higher risks.

1. CAB Recommendations 2, Industrial/Residential Land Use Guidelines for CERCLA Near Term Decision-making, and 8, Nine Part Recommendation
on the future uses of the Savannah River Site.

2. Savannah River Site Future Use Project Report - Stakeholder Recommendations for SRS Land Facilities, published by the U.S. Department of Energy
Savannah River Operations Office, January 1996.

3. Statement of Basis/Proposed Plan for the L-Area Oil & Chemical Basin and L-Area Acid/Caustic Basin, February 1997.

I. SAVANNAH RIVER SITE AND OPERABLE UNIT NAME, LOCATION, DESCRIPTION, AND PROCESS HISTORY

Savannah River Site Location, Description, and Process History

The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of western South Carolina. SRS is a secured U.S. Government facility with no permanent residents, and is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina (Figure 1).

SRS is owned by the U.S. Department of Energy (DOE). Management and operating services are currently provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense and the space program. Chemical and radioactive wastes are by-products of nuclear material production processes.

Operable Unit Name, Location, Description, and Process History

The Federal Facility Agreement (FFA) for the SRS lists the L-Area Oil and Chemical Basin/Acid Caustic Basin (LAOCB/LAACB), 904-83G and 904-79G, as a Resource Conservation and Recovery Act/ Comprehensive Environmental Response, Compensation and Liability Act (RCRA/CERCLA) unit requiring further evaluation, using an investigation/assessment process that integrates and combines the RCRA Facility Investigation (RFI) process with the CERCLA Remedial Investigation (RI) to determine the actual or potential impact to human health and the enviromnenl. The LAOCB and LAACB are located south of L Area in an area of low to moderate relief (Figure 2). They are situated on the southern flank of a hill approximately 300 feet (ft) south of the L-Area perimeter fence and 1,250 ft north of L Lake. The area lies at an elevation of approximately 235 ft above mean sea level (msl), and 45. It above the elevation of L Lake. Surface water runoff in L Area drains southward to L Lake via overland flow and small intermittent stream channels and drainage ditches.

Direct precipitation (rain, snow, ice, etc.) is currently the only source for basin water. The LAOCB and LAACB both act as intermittent, wet-weather ponds. The LAOCB contains water at most times while the LAACB is more frequently dry. Overflow from the LAOCB would drain southward to L Lake as described above. Overflow is not probable because the capacity of the basin is approximately four times the volume of water attributable to annual precipitation. Wastewater has never been reported to

have

Figure 1. Location of the Savannah River Site and major SRS Facilities

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Figure 2. Topographic Map of the LAOCB/LAACB and Surrounding Area

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overflowed from the LAOCB. The LAACB was designed to discharge basin water through an overflow pipe located at the southern end of the basin. A discharge ditch was also constructed to receive water from
the overflow pipe. The overflow pipe is positioned to operate only at very high water levels to prevent
overtopping the basin berm.

LAOCB

The LAOCB was designed and constructed as an unlined seepage basin in 1961 for the purpose of disposing of small volumes of wastes that were not appropriate for discharge to local streams, regular seepage basins, or the 200-Area waste management system. The LAOCB measures 182 ft long by 108 ft wide at the berm with an overall area of 0.45 acres and an average depth of 12 ft, The LAOCB received waste via a bermed concrete drainage pad that was located outside the basin perimeter fence, and from a gravity flow underground pipeline (6-inch diameter steel) originating at the maintenance Hot Shop (Figure 3). The pipeline from the Hot Shop was originally constructed to extend to the L-Area Reactor Seepage Basin for an approximate total length of 750 ft. The pipeline was installed prior to the excavation of the LAOCB. When the LAOCB was constructed, all pipeline drainage was diverted to the LAOCB. The approximately 275 ft of pipeline between the LAOCB and the Reactor Seepage Basin was plugged off at each end and taken out of use. This section of the pipeline is not part of the LAOCB/LAACB OU and will be addressed as part of the L-Reactor Seepage Basin (see Section IV). In addition, a second pipeline (2-inch diameter steel), located just south of the main pipeline, extends approximately 450 ft from the Hot Shop to the LAOCB.

The exact quantity of wastewater discharged to the basin is not documented and the following summary on chemical composition of discharges is based on process knowledge. Liquid wastes consisting of small volumes of slightly radioactive oil and chemical wastewater were sent to the LAOCB from throughout SRS, but came primarily from the reactor areas. Wastes were transported to the drainage pad in tank trucks, metal drums, skid tanks, and other containers. The Hot Shop (Building 717-G) discharged decontamination wastewater containing radionuclides, detergents, and spent degreasing solvents through the pipeline to the basin. Historical records indicate that wastes from all sources contributed approximately 2.2 curies (Ci) of alpha emitters and 270 Ci of nonvolatile beta emitters including 0.1 Ci of strontium-90 (90 Sr) and 0.4 Ci of cesium-137 (137 Cs) (Fenimore et al., 1988).

The basin remained active until 1979 when all discharge to the basin ceased, and has remained open from 1979 to present. The LAOCB is currently surrounded by a chain link fence, posted as a radiological contamination area, and contains low-lying vegetation indigenous to the area that has grown back since removal in 1993 (Figure 4).

Figure 3. Unit Layout and RFI/RI Sampling Locations of the LAOCB/LAACB

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Figure 4. Aerial Photograph of LAOCB

<IMG SRC 97204E>

LAACB

Acid/caustic basins were constructed in F, H, K, L, P, and R Areas between 1952 and 1954 as unlined basins. These basins received dilute sulfuric acid and sodium hydroxide solutions used to regenerate ion-exchange units in the water purification processes at the reactor and separations areas in the center of the SRS. Other wastes discharged to the basins included water rinses from the ion exchange units both before and after regeneration, steam condensate from the heaters in the sodium hydroxide storage tanks and water treatment building, and any rain that collected in the storage tank's spill containment enclosures. The

basins allowed mixing and neutralization of the dilute solutions before discharge to nearby streams.

The LAACB was constructed in 1954 and received wastewater from the L-Area water treatment plant facility via a pipeline (vitrified clay) that extends approximately 1,100 ft from the water treatment facility to the LAACB (Figure 5). The LAACB and pipeline are considered a part of this operable-unit (OU) and are addressed in this Record of Decision (ROD). The LAACB measures 50 ft by 50 ft with an area of 0.057 acres and an average depth of 7 ft. A berm surrounding the basin diverts overland flow away from the basin. As discussed for the LAOCB, the exact quantity of wastewater disposed of is not documented, but is known to consist primarily of dilute sulfuric acid and sodium hydroxide solutions.

The LAACB received waste from 1955 to 1968 at which time all discharge to the basin ceased, and has remained open from 1968 to present. The LAACB is currently surrounded by a barbed-wire fence, is posted as a RCRA/CERCLA unit, and contains low-lying vegetation indigenous to the area.

II. SITE AND OPERABLE UNIT COMPLIANCE HISTORY

SRS Operational History

The primary mission of SRS was to produce tritium (3 H), Plutonium-239 (239 Pu), and other special nuclear materials for our nation's defense programs. Production of nuclear materials for the defense programs was discontinued in 1988. SRS has provided nuclear materials for the space program, as well as for medical, industrial, and research efforts up to the present. Chemical and radioactive wastes are by-products of nuclear material production processes. These wastes have been treated, stored, and in some cases, disposed at SRS. Past disposal practices have resulted in soil and groundwater contamination.

Figure 5. Unit Layout and RFI/RI Sampling Locations of the LAACB Pipeline

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SRS Compliance History

Waste materials handled at SRS are regulated and managed under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities have required Federal operating or post-closure permits under RCRA. SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control (SCDHEC); the permit was most recently renewed on September 5, 1995. Part IV of the permit mandates that SRS establish and implement an RFI Program to fulfill the requirements specified in Section 3004(u) of the Federal permit.

On December 21, 1989, SRS was included on the National Priorities List (NPL). This inclusion created a need to integrate the established RFI Program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA, DOE has negotiated a Federal Facility Agreement (FFA) (WSRC, 1993a) with the U.S. Environmental Protection Agency (EPA) and SCDHEC to coordinate remedial activities at SRS into one comprehensive strategy which fulfills these dual regulatory requirements.

Operable Unit Compliance History

LAOCB

As previously stated, the LAOCB is listed in the FFA as a RCRA/CERCLA unit requiring further evaluation to determine the actual or potential impact to human health and the environment. An RFI/RI characterization and Baseline Risk Assessment (BRA) were conducted for the unit between 1993 and 1995. The results of the RFI/RI and BRA were presented in the RFI/RI and BRA reports. The RFI/RI and BRA reports were submitted in accordance with the FFA and the approved implementation schedule, and were approved by the EPA and SCDHEC in February 1996. The Corrective Measures Study/Feasibility Study (CMS/FS) and Statement of Basis/Proposed Plan (SB/PP) were submitted in accordance with the FFA and the approved implementation schedule, and were approved by EPA and SCDHEC in March 1997.

LAACB

As previously stated, the LAACB is listed in the FFA as a RCRA/CERCLA unit requiring further evaluation to determine the actual or potential impact to human health and the environment. An RFI/RI field characterization was conducted and documented for the LAACB at the same time as the LAOCB. The RFI/RI and BRA reports were submitted in accordance with the FFA and regulatory approved implementation schedule, and were approved by the EPA and SCDHEC in February 1996. The CMS/FS

and SB/PP were submitted in accordance with the FFA and the approved implementation schedule, and were approved by EPA and SCDHEC in March 1997.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Both RCRA and CERCLA require the public be given an opportunity to review and comment on the draft permit modification and proposed remedial alternative. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial Alternatives for addressing the LAOCB/LAACB soils and groundwater. The Administrative Record File must be established at or near the facility at issue. The SRS Public Involvement Plan (DOE, 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial Alternatives. The SRS Public Involvement Plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act, 1969 (NEPA). SCHWMR R.61-79.124 and Section 117(a) of CERCLA, as amended, require the advertisement of the draft permit modification and notice of any proposed remedial action and provide the public an opportunity to participate in the selection of the remedial action. The Statement of Basis/Proposed Plan for the L-Area Oil and Chemical Basin and L-Area Acid/Caustic Basin (WSRC, 1997a), a part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the LAOCB/LAACB.

The FFA Administrative Record File, which contains the information pertaining to the selection of the response action, is available at the EPA office and at the following locations:

U.S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

Reese Library
Augusta State University
2500 Walton Way
Augusta, Georgia 30910
(706) 737-1744

Asa H. Gordon Library
Savannah State University
Tompkins Road
Savannah, Georgia 31404
(912) 356-2183

Prior to the submittal of the CMS/FS for the LAOCB/LAACB, the SRS Environmental Restoration Department (ERD) presented a focused feasibility scoping of remedial actions for the LAOCB/LAACB to the Environmental Remediation and Waste Management Subcommitee of the SRS Citizens Advisory Board. This feasibilitv scoping was deemed necessary because the high-risk associated with LAOCB requires that a remedial action be performed in a timely manner, and because of the technology limitations of the remedial alternatives for the mixed radioactive and hazardous wastes identified in the soil inside the basin.

The public was notified of the public comment period through mailing's of the SRS Environmental Bulletin, a newsletter sent to approximately 3500 citizens in South Carolina and Georgia, through notices

in the
Aiken Standard, the Allendale Citizen Leader, the Augusta Chronicle, the Barnwell People-Sentinel, and
The State newspapers. The public comment period was also announced on local radio stations.

The 45-day public comment period began on April 4, 1997 and ended on May 18, 1997. A public comment meeting was held on May 7, 1997. A Responsiveness Summary was prepared to address comments received during the public comment period. The Responsiveness Summary is provided in Appendix A of the ROD. It will also be available in the final RCRA Permit.

IV. SCOPE AND ROLE OF THE OPERABLE UNIT WITHIN THE SITE STRATEGY

RCRA/CERCLA Programs at SRS

RCRA/CERCLA units (including the LAOCB/LAACB) at SRS are subject to a multi-stage remedial investigation process that integrates the requirements of RCRA and CERCLA as outlined in the RFI/RI
Program Plan (WSRC, 1993b). The RCRA/CERCLA processes are summarized on Figure 6. Figure 6 illustrates the investigation and characterization of potentially impacted environmental media (such as soil,

Figure 6. RCRA/CERCLA Logic and Documentation

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Figure 6. (continued) RCRA/CERCLA Logic and Documentation

<IMG SRC 97204H>

groundwater, and surface water) comprising the waste site and surrounding areas; the evaluation of risk to human health and the local ecological community, the screening of possible remedial actions to identify the selected technology which will protect human health and the environment, implementation of the selected alternative, documentation that the remediation has been performed competently; and evaluation of the effectiveness of the technology. The steps of this process are iterative in nature, and include decision points which involve concurrence between the DOE (as owner/manager), the EPA and SCDHEC (as regulatory oversight), and the public. The RCRA/CERCLA process as applied to the LAOCB/LAACB is outlined below.

RFI/RI Work Plan

Based on the data reviewed and collected during the unit preliminary screening and process knowledge, a conceptual site model (CSM) was developed to: determine the source, primary contaminated media, migration pathways, exposure pathways, and potential human and ecological receptors. Section V provides the unit-specific CSM for the LAOCB/LAACB OU, and a summary of the characteristics of the primary and secondary sources and release mechanisms for the units as determined in the RIF/RI.

Development of the CSM facilitates the initial step of determining the nature and extent of unit contamination through the identification of data gaps using the Data Quality Objectives (DQO) process. DQOs are useful in identifying data needs associated with the sources and exposure media and in developing a sampling and analytical plan which describes the procedures for collecting sufficient data of known and defensible quality. The unit disposal and monitoring history indicated that the LAOCB/LAACB and associated pipelines are a probable contamination source that may represent unacceptable risk to human health and the environment. Multiple data needs were identified to reduce the uncertainty associated with the contamination of the LAOCB/LAACB to include the nature and extent of contamination in: (1) basin vegetation, surface water, and soils, (2) soils adjacent to the basins, (3) soils along the pipelines, and (4) groundwater in the vicinity of the basins. Consequently, to make key remedial decisions it was necessary to develop a work plan to satisfy these data needs to determine the

associated
risk to human and ecological receptors. The approved RFI/RI work plan for the LAOCB/LAACB (WSRC,
1993) outlined the specific characterization activities that were necessary to meet the DQOs for the
LAOCB/LAACB.

Unit/Site Characterization (RFI/RI)

The primary need for the RFI/RI is to establish unit-specific constituents (USCs) that pose potential risk
through various exposure routes and determine their distribution in source media associated with the unit.
One of the principle requirements for determining USCs is to establish unit-specific background
concentrations. Once established, the maximum values of detected constituents at the unit are screened
against two-times mean background concentrations to identify constituents that exceed background. These
data are used to further define the Constituents of Potential Concern (COPCs) and Constituents of Concern
(COCs) during the risk assessment. In addition, these data provide the contaminant profile and mass which
is necessary to determine potential contaminant migration to off-unit receptors.

The data needs for the LAOCB/LAACB RFI/RI were satisfied through the following characterization activities:

- sampling/analysis of basin surface water/sediment and subsurface soil (secondary source)
- sampling/analysis of basin perimeter surface/subsurface soil (secondary source)
- sampling/analysis of subsurface soil along pipelines (secondary source)
- sampling/analysis of basin vegetation (exposure pathway)
- sampling/analysis of groundwater (exposure pathway)
- air monitoring during sampling activities (exposure pathway)
- sampling/analysis of background vegetation, soil, and groundwater
- radiation survey of the ends of the LAOCB pipelines (secondary source)

Streamlined investigation activities and the development of innovative sampling devices to minimize worker exposure during the collection of radioactive environmental media were utilized during the RFI/RI for the LAOCB/LAACB. Blanks and duplicate samples were collected during the RFI/RI at defined frequencies and analyzed by independent, certified laboratories to provide defensible data. The results of the RFI/RI of the LAOCB/LAACB are reported and discussed in Section V.

Baseline Risk Assessment

The intent of the BRA is to develop risk information necessary to assist in the decision-making process for remedial sites. Risk from the unit/site is quantified, based on unit specific data, for current and future human and ecological receptors through multiple exposure routes as identified in the CSM. Carcinogenic risk at or above 1.0 x 10-6 (one excess human cancer in a population of one million) are considered

significant. In addition, if a hazard index (HI) is greater than 1.0 for noncarcinogenic constituents, there is concern that adverse health effects may occur.

The overall objectives of the BRA conducted for the LAOCB/LAACB were met as summarized below:

- identified the unit-specific COPCs (primarily radionuclides) and quantified the risk they pose to applicable human and ecological receptors (unacceptable risk to human health);

- determined that the LAACB does not pose a significant risk to human receptors;

- determined that the LAOCB poses an unacceptable risk to human receptors;

- determined that the LAOCB and LAACB do not pose unacceptable risk to ecological receptors;

- determined that the LAOCB and LAACB and the surrounding areas do not provide habitat for any threatened, endangered, or sensitive plant or animal species that may be impacted by unit contaminants;

- established human health COCs for the LAOCB (primarily radionuclides) that pose unacceptable risk and determined the remedial goal (RG) concentrations of chemical and radiological constituents that can remain in-situ and will be adequately protective of human health and the environment;

- established the data necessary to compare potential human health and environmental impacts of remedial actions applicable to the LAOCB and other radioactive seepage basins at SRS to include stabilization/solidification, vitrification, and removal.

A summary of the results of the BRA for the LAOCB/LAACB are presented in Section VI.

CMS/FS

The results of the RFI/RI and BRA provide the basis for establishing unit-specific remedial action objectives in the CMS/FS. Remedial action objectives for the LAOCB (including its pipelines) were developed to address: unit-specific contaminants, media of concern, potential exposure pathways, and RGs.
The remedial action objectives are based on the nature and extent of contamination, threatened resources, human and environmental risk information, and the potential for human and enviromental exposure. In addition, the preliminary remediation goals for the LAOCB and its pipelines were developed based upon Applicable or Relevant and Appropriate Requirements (ARARs) or other information from the RFI/RI Report and the BRA.

The methodologies used to identify and screen relevant technologies for the remediation of the waste unit followed an established process developed by the EPA. The goal of this remedy selection process is to select corrective measurestremedial actions that are protective of human health and the environment, that

maintain protection over time, and that minimize contaminant (or waste) mobility, toxicity, or volume

through treatment, when possible [CERCLA 300.430 (a)(1)(1)]. The selection of a response action for the waste unit proceeded in a series of steps as defined in the NCP of November 20, 1985 (50 FR 47973) and outlined in Figure 7. In addition, the remedial alternatives were further evaluated for the LAOCB (including, its pipelines) by following nine selection criteria established by the NCP:

- Overall Protection of Human Health and the Environment
- Compliance with Applicable or Relevant and Appropriate Requirements
- Long-Term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume Through Treatment
- Short-Term Effectiveness
- Implementability
- Cost
- State Acceptance
- Community Acceptance

The results of the CMS/FS conducted for the LAOCB/LAACB are summarized in Section VII, and a summary of the comparative analysis of the alternatives is provided in Section VIII.

SB/PP

The culmination of the response action selection process is the Statement of Basis/Proposed Plan (SB/PP). The purpose of the SB/PP is to facilitate public participation in the remedy selection process through the solicitation of public review and comment on all the remedial alternatives described. The SB/PP presents the lead agency's preliminary recommendation(s) concerning how best to undertake a remedial action at a particular waste unit. The SB/PP describes all remedial options that were considered in detail in the CMS/FS, and explicitly identifies the preferred alternative for a remedial action at a waste unit and the preference rationale.

The SB/PP directs the public to the RFI/RI, BRA, and CMS/FS reports as the primary sources of detailed, site specific information, and information on the remedial alternatives analyzed, and provides information on how the public can be involved in the remedy selection process. The public is notified of a public comment period through mailing of the SRS Environmental Bulletin, the Aiken Standard, the Allendale Citizen Leader, the Barnwell People Sentinel, The State, and Augusta Chronicle newspapers, and

through
announcements on local radio stations. In addition, DOE platforms a public meeting during the public

Figure 7. Response Action Selection Process

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comment period to receive and discuss questions and comments from the public on the preferred remedial
alternative.

ROD

The ROD documents the remedial action plan for a unit and consists of three basic components: a Declaration, the Decision Summary, and the Responsiveness Summary. The purpose of the Declaration is
to certify that the remedy selection process was carried out in accordance with the requirements of
CERCLA and, to the extent practicable, the NCP. The Decision Summary is a technical and information
document that provides the public with a consolidated source of information about the history, characteristics, and risks posed by a unit, followed by a summary/evaluation of the cleanup alternatives
considered that led to the selected remedy. The Responsiveness Summary presents comments received
during the public comment period (April 4 through May 18, 1997) on the SB/PP, and a response to each

comment or criticism, submitted in writing or orally. The Responsiveness Summary for the LAOCB/LAACB is provided in Appendix A and an explanation of significant changes resulting from public comment is provided in Section XI.

SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control (SCDHEC) which is renewed every five (5) years. The permit was most recently renewed on September 5, 1995. Part IV of the permit mandates that SRS establish and implement an RFI Program to fulfill the requirements specified in Section 3004(u) of the Federal permit. The LAOCB and LAACB are Solid Waste Management Units (SWMUs) listed on the SRS RCRA Permit because the units received hazardous substances. Thus, the remedial decision for these SWMUs requires a RCRA Permit Modification. Specific comments and responses received during the April 4, 1997 - May 18, 1997 public comment period on the proposed remedial action and the associated draft RCRA permit modification are included in the Responsiveness Summary of this ROD (Appendix A) and with the final RCRA Permit. The final RCRA Permit and the ROD document the final decision for this operable unit.

Post-ROD Documentation

The post-ROD documentation consists primarily of the design documents that are required prior to initiating a remedial action. Specific post-ROD documents include, the corrective measure/remedial design workplan, the corrective measure/remedial design report, the corrective measure/remedial action workplan, and the post-construction report. A discussion of the schedules that apply to these documents is provided in the SB/PP and Section XIII of this ROD.

Southern L-Area Remedial Strategy

The RFI/RI process provides a method of managing the steps to ultimate remediation of a specific waste unit. It is often preferable to group waste unit components and actions to expedite characterization and remediation of the components that pose the most significant risks. These groupings are typically designated as OUs. A "source control OU" may consist of a number of potential sources of

contamination,
and usually indicates that there is a preference toward collective characterization and ultimate remediation
of these sources. A "groundwater OU" usually consists of a specific area of groundwater contamination
and proposed actions related to its characterization and ultimate remediation, and/or the timing of these
actions.

The LAOCB and LAACB have been grouped into a source control OU that is located within the Steel Creek Watershed (Figure 8). Several source control and groundwater OUs within this watershed will be
evaluated to determine future impacts, if any, to associated streams and wetlands. It is the intent of SRS,
EPA, and the SCDHEC to manage these sources of contamination to minimize impact to the watershed.
To effectively manage the impact to the Steel Creek Watershed (groundwater, streams, and wetlands), a
comprehensive characterization and regulatory process plan for the waste units in the vicinity of the
LAOCB/LAACB OU was developed. This characterization and regulatory process plan provides a programmatic method of promoting continuous characterization, risk assessment, remedial assessment, and
remedial action.

The waste units included in the remedial process plan consist of the LAOCB/LAACB OU, the L-Area Hot
Shop, and the L-Reactor Seepage Basin. The LAOCB and L-Area Hot Shop received mixed radioactive and hazardous waste, the L-Reactor Seepage Basin received radioactive waste, and the LAACB received
characteristic hazardous waste. Because the waste units are located in close proximity and have known and
probable groundwater contamination, they represent a complex characterization, remediation and regulatory challenge. The plan consists of a phased approach for the characterization, documentation, and
remediation of these waste units. The location of these waste units and overall components of the
comprehensive plan are described in Appendix A of the RFI/RI Report (WSRC, 1996a).

During the characterization process of the LAOCB/LAACB OU, it was recognized that the highest concentrations of contaminants and the contaminants with the highest potential risk were primarily

Figure 8. Steel Creek Watershed and associated Operable Units

<IMG SRC 97204J>

restricted to surficial soils, subsurface soils, and surface water within the LAOCB. In addition, it was recognized that the LAOCB represents a significant source of contamination to unit groundwater. The characterization of the LAOCB/LAACB OU and its associated RFI/RI and BRA documentation provide sufficient information to move forward with a remedial action of this source control OU. Therefore, the CMS/FS, SB/PP, and this ROD are focused on this source control OU.

Groundwater contamination associated with the LAOCB was found to consist primarily of tritium and solvents. However, it was recognized that the extent of the groundwater contamination had not been completely characterized during the RFI/RI. In addition, groundwater contamination is also likely associated with the L-Area Hot Shop and the L-Area Reactor Seepage Basin. Groundwater contamination associated with the Hot Shop is not documented, but soil gas data suggest that chlorinated organic solvents have been released to the soil in the area and may have impacted the local groundwater. Groundwater contamination associated with the L-Area Reactor Seepage Basin is known to consist of tritium (historical groundwater monitoring).

A comprehensive groundwater OU was created as the L-Area Southern Groundwater OU because of the uncertainty associated with the nature and extent of the known and suspected groundwater plumes in the vicinity of the LAOCB/LAACB OU, L-Area Hot Shop, and L-Area Reactor Seepage Basin. Because any remedial actions directed toward the groundwater could cause further commingling of contaminant plumes, a phased remedial investigation of the groundwater plumes will be conducted as part of the integrator OU strategy. The phased process would continue until all the components of the source control,

vadose zone,
and groundwater OUs are characterized and documented.

V. OPERABLE UNIT CHARACTERISTICS

CSMs were developed for the LAOCB and LAACB that identify the primary sources, primary contaminated media, migration pathways, exposure pathways, and potential receptors for each unit. The
CSMs for the LAOCB, and LAACB are presented in Figures 9 and 10, respectively, and are based on the
data that are presented in the RCRA/CERCLA documentation for these units. The Data Summary Report
(WSRC, 1995b), RFI/RI Report (WSRC, 1996a), and Baseline Risk Assessment (WSRC, 1996b) contain detailed analytical data for all of the environmental media samples taken in the characterization of the
LAOCB/LAACB. These documents are available in the Administrative Record (See Section III).

As previously stated in Section IV, it has been recognized that the highest potential risk is primarily
restricted to soil and surface water within the LAOCB. In addition, the extent of the groundwater

Figure 9. Conceptual Site Model for the LAOCB

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Figure 10. Conceptual Site Model for the LAACB

<IMG SRC 97204L>

contamination has not been completely characterized during the RFI/RI, and further investigation is necessary to proceed with a risk assessment and CMS/FS for unit groundwater. Therefore, the following discussion of the OU will be focused on the primary and secondary sources of the LAOCB and LAACB, and will not include a description of the characteristics of the unit groundwater.

L-Area Oil & Chemical Basin

LAOCB Primary Sources and Release Mechanisms

The primary sources were radioactive wastewater discharged to the LAOCB from the Hot Shop via the LAOCB pipelines and other SRS areas via the concrete drainage pad (see Figure 9). Residual wastewater is no longer present in the LAOCB, and its presence in the pipelines is unlikely because all piping was constructed as gravity feed, and no wastewater has been discharged through the piping for approximately 30 years. Radioactive contamination on the internal surfaces of the LAOCB pipelines is documented [approximately 300,000 disintegrations per minute (dpm) as measured at the discharge end in the LAOCB], and there is a high probability of radioactive contamination of the concrete drainage pad and associated piping based on process knowledge.

The primary release mechanisms are deposition inside the basin, deposition outside the basin from overflow, deposition onto the pipeline and drainage pad surfaces, and leakage of the pipelines (see Figure 9). The most significant of these release mechanisms are the release of unit contaminants to the surface soil in the basin bottom and pipeline leaks to the subsurface soils along the LAOCB pipelines. In addition, there are no documented occurrences of basin overflow, and surface mdiation surveys indicate the basin did not overflow.

LAOCB Secondary Sources and Release Mechanisms

Secondary sources include sludge/organic sediment and subsurface soil in the LAOCB, surface water in the basin that accumulates from precipitation, surface and subsurface soil around the basin, concrete and steel pipe, and subsurface soil along the pipeline (see Figure 9). A detailed sampling and analysis plan was prepared and implemented to investigate these secondary sources and a complete description of the sampling methods and protocols are provided in the RFM Report (WSRC, 1996a).

Sludge/organic sediment and subsurface soil were collected from five locations within the LAOCB (see Figure 3) using a remote vibracore sampling device to reduce cross contamination of samples and

minimize worker exposure. The sampling of the basin sludge indicates that the sludge is approximately six inches thick. Based on the analysis of samples collected from the five locations within the basin, the sludge and organic sediment within the LAOCB is highly contaminated with radionuclides. Twenty-four radionuclides and gross alpha and non-volatile beta were detected above screening levels in the LAOCB sludge (Table 1). The major man-made radionuclides with respect to activity within the basin sludge are: americium-241 (241 Am), 137 Cs, cobalt-60 (60 Co), curium-244 (244 Cm), europium-152 (152 Eu), 154 Eu, 155 Eu, promethium-147 (147 Pm), 238 Pu, 239 Pu, 90 Sr, uranium-234 (234 U), 235 U, 238 U, and 3 H. A review of the data also indicates the primary fission products are 137 Cs, 90 Sr, 152 Eu, 154 Eu, and 155 Eu, the primary activation product is 60 Co, and the primary alpha-emitters are 238 Pu, 239 Pu, and 238 U. In addition, the data indicate that tritium contributes at least one third of total activity within the basin sludge with a maximum of 15,498 pCi/g. The subsurface soil underlying the basin sludge is also highly contaminated with radionuclides as described for the sludge. The average activity for the basin sludge and subsoils (to a depth of 1.5 ft) is 3833.3 pCi/g for the major radionuclides (i.e., 241 Am, 137 Cs, 60 Co, 152 Eu, 154 Eu, 154 Eu, 238 Pu, 239 Pu, 90 Sr, 235 U, 238 U, and 3 H). Based on the activities of the soil samples coltected during this

investigation, the total radionuclide activity within the basin (including the sludge and subsoils to a depth of 1.5 ft) is estimated at approximately 4.2 Ci.

The concentrations of radionuclides in the LAOCB subsoils tend to decrease rapidly with depth. An analysis of the attenuation of the maximum gross alpha and non-volatile beta activities indicates that radionuclide concentrations (other than 3 H) should reach background activity levels within approximately two feet from the top of the sludge. Linear regression of the gross alpha values (log) versus sample depth demonstrates that the maximum observed gross alpha values will decrease to activities less than detectable levels at a depth of approximately 1.5 ft from the top of the sludge (Figure 11). Linear regression of the gross non-volatile beta values (log) versus sample depth demonstrates that the maximum observed gross non-volatile beta values will decrease to activities less than detectable levels at a depth of approximately 2.0 ft from the top of the sludge (Figure 11). The radionuclide concentrations are highly correlative (as expected) with the gross alpha and gross non-volatile beta values for the samples. Because the rapid reduction of activities is logarithmically correlated with depth, any intervals deeper than 1.25 ft would represent additional activities of only a fraction of one percent. A review of the 3 H activities of the basin sludge and subsoils indicates that 3 H activities also decrease rapidly with depth. As previously stated, the maximum 3 H activity within the basin sludge is 15,498 pCi/g, however, the maximum 3 H activity at one foot below the basin sludge is 137.9 pCi/g. A comparison of 3 H ratios to the major radionuclides within the basin suggests that the 3 H has reached equilibrium conditions with respect to depth.

Table 1
Summary of Detected Radionuclides
LAOCB Soil and Sediment

Analyte	2 X Average Background Value	Frequency of Detects Above 2 X Average Background	Highest Detection
RADIOISOTOPES (pCi/g)			
Actinium-228	1.25	9/12	11.86
Americium-241	1.25	9/12	804.65
Antimony-125	0.34	12/12	7.44
Bismuth-214	0.91	9/12	9.30
Cerium-144	0.91	8/12	6.98
Cesium-134	0.11	12/12	2.09
Cesium-137	0.11	12/12	1154.20
Cobalt-60	0.11	12/12	5241.80
Curium-244	---	+ 12/12	339.72
Europium-152	0.34	12/12	297.67
Europium-154	0.34	12/12	109.30
Europium-155	0.57	8/12	4.88
Lead-212	---	+ 12/12	2.79
Lead-214	0.84	6/12	4.75
Plutonium-238	---	+ 10/10	60.15
Plutonium-239	---	+ 10/10	236.51
Potassium-40	1.59	6/12	15.81
Promethium-147	---	+ 9/9	93.98
Strontium-90	---	+ 11/11	2706.60
Thallium-208	1.14	5/12	18.60
Tritium	---	+ 11/11	15498.27
Thorium-234	---	+ 12/12	713.56
Uranium-234	---	+ 10/10	2019.90
Uranium-235	---	+ 12/12	44.07
Uranium-238	---	+ 12/12	2203.30
Gross Alpha	2 20	10/12	13098.60
Non-Volatile Beta	2 50	12/12	22625.90

Legend:
Frequency: 5/12 = Detects above 2 X average background values/total number of samples analyzed.
+ No site-specific background value exists for analyte. Frequency reported is detects/total number of samples analyzed.
--- No value available.
RBCs - EPA Risk Based Concentrations (1E-06)
2 The screening levels of 20 and 50 pCi/g for gross alpha and non-volatile beta, respectively, are based on site-specific background samples and the presence of naturally occurring radionuclides

Figure 11. Gross Alpha and Non-Volatile Beta Concentrations vs. Depth

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The rapid decrease in contaminant concentrations with relatively shallow depth is due principally to the presence of dense, kaolinitic clay and iron oxide cemented sediments that underlie the basin and the surrounding area. This stratigraphic horizon (which is correlatable in the vicinity of the unit) is termed the "hardpan" and is described in detail in the RFI/RI Report (WSRC, 1996a). Figure 12 illustrates the location of the hardpan relative to the basin and other strata in the vicinity. The moisture content and hydraulic conductivity of the hardpan beneath the basin appear to be low enough to significantly retard migration of radionuclides and other contaminants. The sampling of the subsoils below the basin indicates that the free moisture content of these soils is very low (visual examination suggested that the free moisture content was probably less than 5 percent). The basin contained approximately 1.5 ft of standing water at the time of sampling. The moisture content of the subsoils below the sludge versus the hydraulic conditions of the basin suggests that the hydraulic conductivity of the subsoils/hardpan is very low.

Four volatile organic compounds (VOCs) were detected in the LAOCB sludge and subsoil at concentrations exceeding screening levels. All VOCs but methyl ethyl ketone (MEK) were determined to be false positives. Reported MEK concentrations are near the screening, level and well below risk based concentrations (RBCs). The LAOCB sludge contains petroleum hydrocarbons with a median observed concentration of 11.34 mg/kg, and a maximum observed concentration of 7186 mg/kg.

Seventeen metals were detected in the LAOCB sludge and subsoil at concentrations exceeding screening levels. Relatively high concentrations of Cr, Be, Cu, Cd, Pb, and Zn are attributed to

decontamination of
stainless steel, galvanized metals, and brass. All 17 metals, except Ba, Co, Cu, Hg, and Zn, exceed RBCs
in at least one sample.

Surface water was collected from two locations in the basin (see Figure 3). Seven radionuclides were
reported in the LAOCB surface water. 137 Cs, 60 Co, and 90 Sr were detected at concentrations exceeding
RBCs and are believed to originate from the LAOCB sludge/organic sediment. 3 H activity in the surface
water is very low considering the 3 H activity in the sludge. Reported concentrations of 214 Bi, 208 Ti, and 40 K
in the surface water are probably of natural origin. Based on the 1994 sampling and analysis results, there
are no significant concentrations of VOCs present in the surface water in the LAOCB. Nine metals are
reported for the surface water samples collected within the LAOCB, of which only Mn is reported at
concentrations exceeding screening limits. No screening limits are available for Ca, Fe, or K.

Vegetation samples were collected from within the LAOCB security fence to determine the potential
uptake of unit contaminants. For comparative purposes, samples of similar vegetation were also collected
from an unimpacted background reference location. Seven radionuclides were detected in the samples

Figure 12. Cross-Section of LAOCB and Surrounding Soils

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analyzed. Mean 137 Cs concentrations are significantly higher at the LAOCB than at the reference area for similar vegetation types with the highest concentrations detected in vegetation collected nearest the water (black willow, rush, and sedge). In addition, mean concentrations in vegetation are much higher than the mean concentration of 137 Cs in SRS soils (0.15 pCi/g) estimated by Fay and Pickett (1987). Elevated levels of 137 Cs detected in the vegetation at the LAOCB are unit-related. Mean 60 Co concentrations in vegetation at the LAOCB are higher than the trace levels which normally occur in plants and are also likely to be unit-related. Sixteen metals are reported in the vegetation samples collected in the LAOCB. All detected metal concentrations from samples collected from the LAOCB are either at or below those observed in the reference area, are within acceptable background ranges for the SRS, and/or are ecologically insignificant. In conclusion, the vegetation within the LAOCB security fence is contaminated with radionuclides from the basin. An ecological risk assessment was performed for selected media within the LAOCB security fence and the results are discussed in Section VI.

There is no man-made radionuclide contamination of soils outside and adjacent to the LAOCB security fence. The detected radionuclides are determined to be strictly naturally occurring. Six VOCs and one semi-volatile organic compound (SVOC) are reported at concentrations exceeding screening limits In soil samples from locations adjacent to the LAOCB. However, most detections are determined to be suspect with respect to laboratory data quality, and do not exhibit any apparent trends in vertical or lateral distribution. Eighteen metals are reported in the soil samples collected adjacent to the LAOCB. Cr, V, Al, As, and Fe were the only metals reported above screening limits with more than 25 percent frequency. The reported metals were determined to be naturally occurring and not a result of unit operations. No pesticides, polychlorinated biphenols (PCBs), dioxins, or furans are reported in any of the soil samples collected adjacent to the LAOCB.

Soil samples were collected at nine locations along the LAOCB pipelines (see Figure 3). Samples were collected to a maximum depth of approximately 10 feet below land surface along the pipelines to evaluate potential leaks which may have occurred during operation. The analytical results indicated elevated concentrations of naturally occurring radionuclides (e.g., 40 K and 204 TI) and metals (e.g., Be

and TI), and constituents resulting from fanning activities prior to SRS (i.e., As). However, no man-made radionuclide contamination of soils along the LAOCB pipeline was detected. Several VOCs were detected at concentrations exceeding screening levels, however, all but MEK were determined to be laboratory artifacts. No SVOCs are reported at concentrations exceeding screening levels, and no pesticides or PCBs are reported in any of the soil samples collected along the LAOCB pipeline. Metal concentrations reported for samples collected along the LAOCB pipeline are consistent with those reported for the soils adjacent to the LAOCB described above. Although the analytical results do not indicate significant impact to

subsurface soils along the LAOCB pipelines, it is anticipated that residual radionuclides, organics, and metals from leaks in the pipeline may be present in the subsurface soils that were not encountered during the RFI/RI sampling activities.

Secondary release mechanisms associated with these sources include volatilization from soil and basin water, fugitive dust generation from exposed surface soil, biotic uptake, and leaching to groundwater. The most significant of these secondary release mechanisms are the current release of unit contaminants to the air through fugitive dust generation and leaching to unit groundwater. The quantified risks associated with these and other exposure routes are summarized in Section VI.

Summary of LAOCB Primary and Secondary Sources

The characterization of the primary and secondary sources associated with the LAOCB, indicates that soil in the LAOCB is highly contaminated with radionuclides. The concentrations of the radionuclides in the LAOCB sediment tend to decrease rapidly with depth, and generally reach background levels within approximately two feet from the top of the sediment in the basin. Seven of the radionuclides detected in the LAOCB soil are also detected above screening levels in the basin surface water. The man-made

radionuclides detected in soils at the site are restricted to the LAOCB and are attributed directly to unit operations. Metals concentrations in the LAOCB soil are generally above screening limits and are relatively high, when compared to the LAACB soil and soils from the remainder of the OU. The occurrence of several of the metals detected above screening levels are attributed to unit operations. Petroleum hydrocarbons are present in high concentrations in the LAOCB soil and are attributed to unit operations. Ecological sampling of the basin indicated that 137 Cs and 60 Co were the principal radionuclides detected in vegetation samples from the LAOCB. These radionuclides have the potential to pose risk to ecological receptors exposed to contaminated media directly or through the food chain, such as animals which consume either contaminated vegetation or other animals with bioaccumulated residues of these radionuclides in their tissues. Based on these data, it is apparent that the media inside the LAOCB have been significantly impacted by unit operations, and a remedial action is appropriate.

The results of the soil investigation along the LAOCB pipelines indicate that these soils have not been impacted by unit operations, however, radioactive contamination of the internal surface of the LAOCB pipelines has been documented to be approximately 300,000 dpm. The pipelines are relatively shallow (buried less than four feet below land surface) and exposed at one point in a drainage ditch near the Hot Shop. Both pipelines are constructed of iron pipe and are subject to natural corrosion processes. Based upon the known radiological contamination associated with the interior of the LAOCB pipelines, and the

probability the pipe will eventually corrode to the point of allowing the release of fixed/transferable contamination to the environment, a remedial action to eliminate the potential release of radioactive contamination from the pipelines is appropriate. In addition, since the concrete drainage pad and associated piping of the staging area on the north end of the LAOCB are likely contaminated with

fixed
and/or transferable radioactive contamination, these components should be remediated at the same time as
the basin remediation.

L-Area Acid/Caustic Basin

LAACB Primary Sources and Release Mechanisms

Acid/caustic wastewater discharged from the L-Area water treatment plant via the LAACB pipeline was
the primary source. Residual wastewater is no longer present in the LAACB, and its presence in the
pipeline is unlikely because all piping was constructed as gravity feed, and no wastewater has been
discharged through the piping for approximately 30 years.

The primary release mechanisms associated with these sources are deposition inside the basin, deposition
outside the basin from overflow, infiltration and percolation, and leakage of the pipeline (see Figure 10).
The most significant of these release mechanisms are the release of unit contaminants to surface soil inside
the basin and from the leakage of wastewater from the pipeline to the subsurface soil along the LAACB
pipeline.

LAACB Secondary Sources and Release Mechanisms

Secondary sources include organic sediment and subsurface soil in the LAACB, surface water in the basin
that occasionally accumulates from precipitation, and surface and subsurface soil around the basin and in
the effluent ditch south of the basin. Subsurface soil is the only secondary source associated with the
LAACB pipeline since it is buried approximately six feet below land surface. A detailed sampling and
analysis plan was pirepared and implemented to investigate thew secondary sources and a complete
description of the sampling methods and protocol are provided in the RFI/RI Report (WSRC, 1996a). No
surface water was present in the LAACB during the RFI/RI, and consequently, no analytical results are
available.

Organic sediment and surface/subsurface soil were collected from two locations within the LAACB (see
Figure 3). Radionuclides, VOCs, and SVOCs were not reported above screening values in the LAACB

sediment and subsurface soil. Some LAACB sediment samples were reported with oil and grease. Petroleum hydrocarbons were reported in low concentrations in one sample. Sodium concentrations exceed screening limits in 90 percent of the samples analyzed and are attributed to the discharge of caustic soda (NaOH) solutions to the basin. In addition, reported pH measurements are alkaline (11.24 to 11-50) as would be expected for soils in contact with caustic solutions.

Surface and subsurface soil were collected from four locations adjacent to the LAACB (see Figure 3). Radionuclide analyses of these samples did not indicate the presence of man-made radionuclides. Based on these results, there is no radionuclide contamination of soils adjacent to the LAACB. Acetone and carbon disulfide were the only VOCs reported at concentrations exceeding screening values. However, all occurrences of these two VOCs were determined to be laboratory artifacts. Bis(2-ethylhexyl)phthalate was the only SVOC detected above screening limits. All detections were near the detection limit and exhibit no apparent trends in distribution. No pesticide/PCBs are reported above screening, limits in soils adjacent to the LAACB. No furans and no significant dioxin contamination were reported for soil samples. Based on these results, there is no organic compound contamination of soils adjacent to the LAACB. Zn, Sb, As, Pb, Mn, K, and V were the only metals reported at concentrations above screening limits, with Zn being the only metal reported to exceed screening levels in more than 25 percent of samples analyzed. The occurrence of metals is consistent with metals detected in the soils adjacent the LAOCB, and LAOCB pipeline, and their presence is not attributed to unit operations. Soil pH measurements generally range from 5.73 to 7.29 (typical for SRS soils). Lower pH values (2.01 to 2.12) were reported for soils on the east side of the basin, however, follow-up sampling indicated that these low values were due to analytical error and there is no unit impact to soils on the east side of the basin.

Sixteen metals were detected in the vegetation samples collected in the LAACB. Of the 16 metals that were analyzed and detected at the basin and that have a significant potential for toxicity, only Cd levels may be unit-related and elevated above reference levels. Cd concentrations in soils of the LAACB are not elevated with respect to unit specific soil background. The presence of Cd in unit vegetation at

concentrations above the reference area vegetation concentrations may be a function of soil differences between the waste unit and the reference area or the natural range of Cd in vegetation, and not due to unit specific contamination. In addition, if the Cd present in vegetation at the unit was unit related, the ecological impact of this vegetation would be very low because the vegetation of the unit would represent a very small percentage of the diet of any potential ecological receptors, and the intake of Cd by any potential ecological receptors would be negligible. All other detected metal concentrations from vegetation samples collected from the LAACB are either at or below those observed in the reference area, within acceptable background ranges for SRS, and/or ecologically insignificant.

No radionuclide, VOC, or SVOC contamination is indicated in soils alone the LAACB pipeline and effluent drainage ditch. PCB-1254 and octachlorodibenzo p-dioxin isomers were reported at very low concentrations and are considered insignificant. Nineteen metals were reported above screening levels along the pipeline and drainage ditch. Cr, Pb, Se, Mn, V, and Zn are the only metals detected above screening limits in more than 35 percent of samples analyzed. With the exception of Pb, Mn, and V, all reported concentrations of the metals are below RBCs. LAACB pipeline and drainage ditch soil sample pH measurements typically range from 5 to 7.

Secondary release mechanisms associated with these sources include volatilization from soil and basin water, fugitive dust generation from exposed surface soil, biotic uptake, and leaching to groundwater. The most significant of these secondary release mechanisms are the current release of unit contaminants to the air through fugitive dust generation and leaching to unit groundwater. The quantified risks associated with these and other exposure routes are summarized in Section VI.

Summary of LAACB Primary and Secondary Sources

With the exception of consistently elevated Na concentrations in the LAACB surface/subsurface soil and the elevated Cd levels in LAACB vegetation, the envirorunental media associated with the LAACB have not been impacted by unit operations. No man-made radionuclides, organic compounds, or metais were consistently identified in unit soils at concentrations above screening levels that would indicate contamination from unit operations.

VI. SUMMARY OF OPERABLE UNIT RISKS

As part of the investigation/assessment process for the LAOCB/LAACB waste unit, a BRA was performed using data generated during the asses ment phase. Detailed information regarding the development of COPCs, the fate and transport of contaminants, and the risk assessment can be found in the RFI/RI Report (WSRC, 1996a) and the Baseline Risk Assessment (WSRC, 1996b).

An exposure assessment was performed to provide an indication of the potential exposures which could occur based on the chemical concentrations detected during unit-specific sampling activities. The current land use scenario is an inactive industrial site. The only current exposure scenario identified for the LAOCB/LAACB was for on-unit visitors, who may perform environmental research such as groundwater sampling on a limited and intermittent basis at the LAOCB/LAACB. Conservative future exposure

scenarios identified for the LAOCB/LAACB included future on-unit industrial workers and future on-unit resident adults and children. The future residential scenario includes homegrown produce as an exposure point, which is not considered under the current on-unit visitor or future industrial worker scenarios. Risks and hazards from exposures under the three land use scenarios at LAACB and LAOCB are presented in Tables 2 and 3, respectively. The unit-specific risks for the LAACB and LAOCB are further explained below.

L-Area Acid/Caustic Basin

The media evaluated in the BRA include soil inside the LAACB, soil adjacent to the LAACB, soil along the LAACB pipeline, and soil along the LAACB overflow drainage ditch. The BRA concluded that the LAACB, adjacent area, overflow drainage ditch, and associated pipeline represent low to non-existent risk (less than 1 x 10 -6 and HIs less than 1.0) under the current and future on-unit worker scenarios. For the future on-unit resident, all estimated nonradiological cancer risks were less than 1 x 10 -6 except for two pathways, ingestion of soils 0-2 ft adjacent to the LAACB and ingestion of soils 0-4 ft at the LAACB pipeline. These risks are very low (approximately 3 x 10 -6), and are attributed solely to arsenic and one dioxin that are not unit related. Therefore, a No Action alternative is proposed for the LAACB. The No Action alternative will be protective of human health and the environment.

The LAACB will be backfilled with native soil and vegetation will be established in a similar fashion to the clean closure of the F-, H-, K-, and P-Acid/Caustic Basins (WSRC, 1995a). Final grade will be sloped to promote drainage and conform with surrounding terrain. The No Action alternative will be protective of human health and the environment, and no post ROD documentation or reviews will be necessary.

L-Area Oil A Chemical Basin

The media evaluated in the BRA include soil inside the LAOCB, surface water inside the LAOCB, and soil adjacent to the LAOCB. Exposure to basin soils represents the greatest risk at the LAOCB. Direct radiation exposure is the primary risk pathway. The primary contributors to this risk are 60 Co and 137 Cs. Results of the BRA are summarized below.

Table 2. Current and Future On-Unit Risks - LAACB

LAACB Exposure Point	Nonradiological Current On-Unit	Nonradiological	Nonradiological Current On-Unit

Nonradiological Exposure Route	Visitor Risk	Risk Drivers	Visitor Hazard	Hazard Drivers
Soil (0-4 ft inside LAACB)				
dermal	NA		NA	
ingestion	NA		NA	
inhalation	NA		NA	
Soil (0-2 ft outside LAACB)				
dermal	2.4E-10	OCDD 95%, As 5%	3.9E-5	OCDD 56%, Pb 22%, Sb 10%
ingestion	1.0E-9	As 88%, OCDD 12%	2.8E-4	Pb 47%, Sb 22%, TI 17%
inhalation	1.2E-10	As 100%	3.8E-5	Mn 98%, Pb 2%
Soil (0-4 ft LAACB Pipeline)				
dermal	NA		NA	
ingestion	NA		NA	
inhalation	NA		NA	
Soil (0-12 ft LAACB Pipeline)				
dermal	NA		NA	
ingestion	NA		NA	
inhalation	NA		NA	

Soil was the only media with exposure pathways which were quantified.
NA - Not applicable for this receptor.
NC - Could not quantify due to limited toxicity information.
Values for inhalation of dust and volatiles in air are estimated from COPC concentrations in soil.

Table 2. (continued) Current and Future On-Unit Risks - LAACB

LAACB Exposure Point	Nonradiologic Future On-Unit	Nonradiological	Nonradiological Future On-Unit	Nonradiological

Exposure Route	Worker Risk	Risk Drivers	Worker Hazard	Hazard Drivers
Soil (0-4 ft inside LAACB)				
dermal	NA		NA	
ingestion	NC		2.0E-2	Pb 100%
inhalation	NA		7.2E-5	Pb 100%
Soil (0-2 ft outside LAACB)				
dermal	NA		NA	
ingestion	3.2E-7	As 88%, OCDD 12%	1.8E-2	Pb 47%, Sb 22%, TI 17%, As 8%
inhalation	3.8E-8	As 100%	2.4E-3	Mn 98%, Pb 2%
Soil (0-4 ft LAACB Pipeline)				
dermal	NA		NA	
ingestion	3.4E-7	As 100%	1.5E-2	Pb 61%, Sb 25%, As 12%
inhalation	5.1E-8	As 100%	1.5E-3	Mn 97%, Pb 3%
Soil (0-12 ft LAACB Pipeline)				
dermal	NA		NA	
ingestion	7.9E-8	OCDD 100%	1.5E-2	Pb 39%, Sb 19%, V 17%, 11g 14%
inhalation	4.2E-10	OCDD 100%	1.5E-3	Mn 95%,11g 3%, Pb 2%

Soil was the only media with exposure pathways which were quantified.
NA - Not applicable for this receptor.
NC - Could not quantify due to limited toxicity information.
Values for inhalation of dust and volatiles in air are estimated from COPC concentrations in soil.

Table 2. (continued) Current and Future On-Unit Risks - LAACB

LAACB	Nonradiological		Nonradiological	

Exposure Point Exposure Route	Future On-Unit Resident Risk	Nonradiological Risk Drivers	Future On-Unit Nonradiological Resident Hazard Hazard Drivers	
			Adult	Child
Soil (0-4 ft inside LAACB)				
dermal	NC		3.6E-3	6.9E-3
Pb 100%				
ingestion	NC		1.5E-1	5E-1
Pb 100%				
inhalation	NC		1.3E-4	4.2E-4
Pb 100%				
Soil (0-2 ft outside LAACB)				
dermal	2.6E-7	OCDD 95%, As 5%	6.9E-3	1.3E-2
OCDD 56%, Pb 22%, Sb 10%				
ingestion	2.9E-6	As 88%, OCDD 12%	1.3E-1	4.6E-1
Pb 47%, Sb 22%, TI 17%, As 8%				
inhalation	8.5E-8	As 100%	4.4E-3	1.4E-2
Mn 98%, Pb 2%				
Soil (0-4 ft LAACB Pipeline)				
dermal	1.6E-8	As 100%	2.5E-3	2.7E-3
Pb 65%, Sb 26%, Mn 6%, As 3%				
ingestion	3.0E-6	As 100%	1.1E-1	3.8E-1
Pb 61%, Sb 25%, As 12%				
inhalation	1.1E-7	As 100%	2.7E-3	8.6E-3
Mn 97%, Pb 3%				
Soil (0-12 ft LAACB Pipeline)				
dermal	4.9E-7	OCDD 100%	1.0E-2	2.0E-2
OCDD 73%, Pb 11%				
ingestion	7.0E-7	OCDD 100%	1.2E-1	4.0E-1
Pb 39%, Sb 19%, V 17%, 11g 14%				
inhalation	9.3E-10	OCDD 100%	2.8E-3	8.6E-3
Mn 95%, 11g 3%, Pb 2%				
Ingestion of Produce (0-4 ft inside LAACB)				
leafy	NC		3.5E-3	5.3E-3
Pb 100%				
tuberous	NC		1.2E-2	1.8E-2
Pb 100%				
fruit	NC		6.1E-2	9.1E-2
Pb 100%				
Ingestion of Produce (0-2 ft outside LAACB)				
leafy	4.1E-7	As 100%	1.0E-2	1.6E-2
Mn 65%, As 17% Pb 14%				
tuberous	3.9E-7	As 100%	1.9E-2	2.9E-2
Mn 61%, Pb 27%, As 9%				
fruit	6.9E-7	As 100%	3.6E-2	5.4E-2

Pb 71%, Mn 19%, As 9%

Soil was the only media with exposure pathways which were quantified.
NA - Not applicable for this receptor.
NC - Could not quantify due to limited toxicity information.
Values for inhalation of dust and volatiles in air are estimated from COPC concentrations in soil.

Table 3. Current and Future On-Unit Risks - LAOCB

LAOCB Exposure Point Exposure Route	Radiological Current On-Unit Visitor Risk	Radiologicil Risk Drivers
Soil (0-2 ft inside LAOCB)		
direct external	2.7E-6	Co-60 91%, Cs-137 5%, Eu-152 3%, Eu-154 1%
ingestion	NA	
inhalation	NA	
Soil (0-2 ft outside LAOCB)		
direct external	NA	
ingestion	NA	
inhalation	NA	
Soil (0-4 ft LAOCB Pipeline)		
direct external	NA	
ingestion	NA	
inhalation	NA	
Soil (0-12 ft LAOCB Pipeline)		
direct external	NA	
ingestion	NA	
inhalation	NA	

LAOCB Exposure Point Exposure Route	Nonrediological Current On-Unit Visitor Risk	Nonradiological Risk Drivers	Nonradiological Current On-Unit Visitor Hazard	Nonradiological Hazard Drivers

Soil (0-2 ft inside LAOCB)			
dermal	NA		NA
ingestion	NA		NA
inhalation	NA		NA
Soil (0-2 ft outside LAOCB)			
dermal	3.7E-11	As 59%, OCDD 41%	5.6E-5
CrVI 72%, Pb 12%, V 6%, TI 5%			
ingestion	1.7E-9	As 99%, OCDD 1%	3.1E-4
Pb 33%, CrVI 20%, V 17%,			
As 14%, TI 14%			
inhalation	5.4E-9	CrVI 95%, As 5%	3.0E-5
Mn 98%, Pb 2%			
Soil (0-4 ft LAOCB Pipeline)			
dermal	NA		NA
ingestion	NA		NA
inhalation	NA		NA
Soil (0-12 ft LAOCB Pipeline)			
dermal	NA		NA
ingestion	NA		NA
inhalation	NA		NA

Soil was the only media with exposure pathways which were quantified.
NA - Not applicable for this receptor.
NC - Could not quantify due to limited toxicity information.
Values for inhalation of dust and volatiles in air are estimated from COPC concentrations in soil.

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Table 3. (continued) Current and Future On-Unit Risks - LAOCB

LAOCB Exposure Point / Exposure Route	Radiological Future On-Unit Worker Risk	Radiological Risk Drivers
Soil (0-2 ft inside LAOCB)		
direct external	2.4E-2	Co-60 84%, Cs-137 11%, Eu-154 4%, Eu-154 1%

ingestion	1.5E-4	Am-241 39%, Sr-90 15%, Pu-239 11%, U-238 9%, Cm-244 7%, U-234 7%, Cs 137 5%, Co-60 5%
inhalation	7.8E-6	Tc-97%, U-234 1%, U-238 1%
Soil (0-2 ft outside LAOCB)		
direct external	NA	
ingestion	NA	
inhalation	NA	
Soil (0-4 ft LAOCB Pipeline)		
direct external	NA	
ingestion	NA	
inhalation	NA	
Soil (0-12 ft LAOCB Pipeline)		
direct external	2.7E-6	K-40 77%, TI-208 23%
ingestion	8.9E-9	K-40 100%
inhalation	7.8E-6	Tc-99 97%, U-234 1%, U-238 1%

LAOCB Exposure Point Exposure Route	Nonradiological Future On-Unit Worker Risk	Nonradiological Risk Drivers	Nonradiological Future On-Unit Worker Hazard	Nonradiological Hazard Drivers
Soil (0-2 ft inside LAOCB)				
dermal	NA		NA	
ingestion	4.8E-6	Be 100%	6.6E-1	CrVI 78%, Pb 17%, Al 2%, NI 1%
inhalation	1.6E-4	CrVI 95%, As 5%	6.8E-3	Mn 93%, Pb 7%
Soil (0-2 ft outside LAOCB)				
dermal	NA		NA	
ingestion	5.2E-7	As 99%, OCDD 1%	2.0E-2	Pb 33%, CrVI 20%, V 17%, As 14%, TI 14%, Mn 1%
inhalation	1.7E-6	CrVI 95%, As 5%	1.9E-3	Mn 98%, Pb 2%
Soil (0-4 ft LAOCB Pipeline)				
dermal	NA		NA	
ingestion	2.4E-6	Be 77%, As 23%	3.6E-1	TI 90%, Pb 6%, Al 2%, As 1%
inhalation	1.1E-7	As 72%, Be 17%, Cd 12%	2.1E-3	Mn 95%, Pb 5%
Soil (0-12 ft LAOCB Pipeline)				
dermal	NA		NA	
ingestion	1.5E-6	As 50%, Be 50%	1.5E-1	TI 82%, Pb 9%, Al 3%, As 3%
inhalation	1.2E-7	As 88%, Be 6%, Cd 5%	1.3E-3	Mn 95%, Pb 5%

Soil was the only media with exposure pathways which were quantified.
NA - Not applicable for this receptor.
NC - Could not quantify due to limited toxicity information.
Values for inhalation of dust and volatiles in air are estimated from COPC concentrations in soil.

Table 3. (continued) Current and Future On-Unit Risks - LAOCB

LAOCB Exposure Point / Exposure Route	Radiological Future On-Unit Resident Risk	Radiological Risk Drivers
Soil (0-2 ft inside LAOCB)		
direct external	1.8E-1	Co-60 83%, Cs-12%, Eu-152 4%, Eu-154 1%
ingestion	6.0E-4	Am-241 40%, Sr-90 14%, Pu-239 11%, U-238 9%, Cm-244 7%, U-234 7%, Cs-137 5%, Co-60 4%
inhalation	8.9E-6	Tc-99 97%, U-234 1%, U-238 1%
Soil (0-2 ft outside LAOCB)		
direct external	NA	
ingestion	NA	
inhalation	NA	
Soil (0-4 ft LAOCB Pipeline)		
direct external	NA	
ingestion	NA	
inhalation	NA	
Soil (0-12 ft LAOCB Pipeline)		
direct external	2.3E-5	K-40 82, TI-208 18%
ingestion	3.6E-8	K-40 100%
inhalation	3.4E-14	K-40 100%
Ingestion of Produce (0-2 ft inside LAOCB)		
leafy	9.2E-4	Sr-90 96%, Cs-137 3%, U-238 1%
tuberous	2.9E-3	Sr-90 96%, Cs-137 2%, U-234 1%, U-238 1%
fruit	1.5E-3	Sr-90 69%, Cs-137 30%

Table 3. (continued) Current and Future On-Unit Risks - LAOCB

LAOCB Exposure Point Nonradiological Exposure Route	NonRadiological Future On-Unit Resident Risk	Nonradiological Risk Drivers	Nonradiological Future On-Unit Resident Hazard Adult	Child	Hazard Drivers
Soil (0-2 ft inside LAOCB)					
dermal	1.1E-6	Be 100%	9.7E-1	1.9E+0	CrVI 97%, Pb 2%
ingestion	4.3E-5	Be 100%	4.9E+0	1.7E+1	CrVI 78%, Pb 17%, Al 2%
inhalation	3.6E-4	CrVI 100%	1.3E-2	4E-2	Mn 93%, Pb 7%
Soil (0-2 ft outside LAOCB)					
dermal	4.0E-8	As 59%, OCDD 41%	1.0E-2	1.9E-2	CrVI 72%, Ph 12%, V 6%, TI 5%
ingestion	4.6E-6	As 99%, OCDD 1%	1.5E-1	5.1E-1	Pb 33%, CrVI 20%, V 17%, As 14%, TI 14%, Mn 1%
inhalation	3.8E-6	CrVI 95%, As 5%	3.5E-3	1-1E-2	Mn 98%, Ph 2%
Soil (0-4 ft LAOCB Pipeline)					
dermal	4.4E-7	Be 94%, As 6%	6.5E-2	1.3E-1	TI 90%, Pb 6%, Al 1%, Cd 1%
ingestion	2.2E-5	Be 77%, As 23%	2.7E+0	9.3E+0	TI 90%, Pb 6%, Al 2%, As 1%
inhalation	2.4E-7	As 72%, Be 17%, Cd 12%	3.9E-3	1.2E-2	Mn 95%, Pb 5%
Soil (0-12 ft LAOCB Pipeline)					
dermal	2.1E-7	Be 83%, As 17%	2.6E-2	5.1E-2	TI 84%, Pb 9%, Al 3%, Cd 2%
ingestion	1.4E-3	As 50%, Be 50%	1.1E+0	3.8E+0	TI 82%, Pb 9%, Al 3%, As 3%
inhalation	2.7E-7	As 88%, Be 6%, Cd 5%	2.5E-3	7.7E-3	Mn 95%, Pb 5%
Ingestion of Produce (0-2 ft inside LAOCB)					
leafy	1.8E-6	Be 100%	2.4E-1	3.6E-1	CrVI 50%, Cd 18%, Ni 14%
tuberous	1.7E-6	Be 100%	6.7E-1	1.0E+0	CrVI

66%, Cd 11%, Pb 10%
fruit 3.0E-6 Be 100% 1.4E+0 2.1E+0 CrVI
57%, Pb 26%, Cd 10%

Ingestion of Produce
(0-2 ft outside LAOCB)
leafy 7.5E-7 As 100% 1.0E-2 1.6E-2 Mn
44%, As 32%, Pb 11%
tuberous 7.1E-7 As 100% 1.9E-2 2.8E-2 Mn
42%, Ph 22%, CrVI 18%,
As
17%, TI 1%
fruit 1.3E-6 As 100% 3.7E-2 5.5E-2 Pb
55%, CrVI 16%, As 15%, Mn
12%
, TI 1%

Soil was the only media with exposure pathways which were quantified.
NA - Not applicable ror this receptor.
NC - Could not quantity due to limited toxicity Information.
Values for inhalation of dust and volatiles in air are estimated from COPC concentrations in soil.

Current Land Use - Carcinogenic Risks (LAOCB)

Under the current land use scenario, human health risks were characterized for the current on-unit visitor (see Table 2). The highest estimated radiological cancer risk for any pathway was 3 x 10 -6 from direct radiation exposure to soils (primarily 60 Co) from the LAOCB soil. This risk level is low and within the risk range for NPL sites. All of the estimated nonradiological cancer risks were less than 1.0 x 10 -6.

Current Land Use - Noncarcinogenic Hazards (LAOCB)

Under the current land use scenario, noncarcinogenic hazards were characterized for the current on-unit visitor. The BRA (WSRC, 1996b) shows that potential adverse noncarcinogenic health effects are not likely to occur, because none of the hazard indices exceed a value of 1.0 (see Table 2).

Future Land Use - Carcinogenic Risks (LAOCB)

For the future on-unit worker, cancer risk from radiological constituents exceeded the 1×10^{-6} risk level for soil ingestion and direct radiation. The highest risk was 2×10^{-2} for direct radiation from LAOCB soils due principally to 60 Co and 137 Cs (see Table 2). Cancer risks for nonradiological carcinogens were all below 1×10^{-6}, except for ingestion and inhalation of the LAOCB soil. The risk from soil ingestion was 4.8×10^{-6} (primarily Be) and the risk from soil inhalation was 1.6×10^{-4} (primarily CrVI).

For the future on-unit resident, cancer risks from radiological exposure exceeded the risk threshold for exposure to LAOCB soils from direct radiation, ingestion, and ingestion of produce grown in LAOCB soils. Risks are estimated at approximately 2×10^{-2} (primarily 60 Co and 137 Cs) for direct radiation exposure, 5×10^{-3} (primarily 90 Sr and 137 Cs) for exposure from ingestion of produce grown in LAOCB soils, and 6×10^{-4} (primarily 241 Am, 90 Sr, and 239 Pu) for exposure from LAOCB soil ingestion. Cancer risks for nonradiological carcinogens exceeded 1×10^{-6}. The risk of 4×10^{-4} from inhalation of LAOCB soils is due primarily to CrVI, the risk of 4.3×10^{-5} from ingestion of LAOCB soils is due to Be, and the risk of 3.0×10^{-6} from ingestion of produce inside the basin is due to Be.

Future Land Use - Noncarcinopenic Hazards (LAOCB)

For the future on-unit worker, the HIs were less than 1.0 for all constituents and exposure pathways.

For the future on-unit resident, the HIs exceeded 1.0 for soils at the LAOC13 and pipeline. The highest HIs for these pathways were for the ingestion of soils, 20 at the LAOCB (primarily from CrVI) and 9 at the pipeline (primarily from TI).

Ecological Risk Assessment Results for the LAOCB/LAACB OU

The ecological risk assessment evaluated the likelihood of occurrence for adverse ecological effects from exposure to chemicals associated with the LAOCB/LAACB OU. The ecological setting of the unit is not unique. There are no known endangered, threatened, or special concern species on the units, nor are the species that inhabit the unit rare in the region or considered to be of special societal value. The area of the unit is small and the habitat is low in diversity and productivity.

Based on characterization of the environmental setting and identification of potential receptor organisms, a CSM was developed to determine the complete exposure pathways through which ecological receptors could be exposed to COPCs. The focused evaluation addressed small mammals inhabiting the unit (represented by the cotton mouse) and amphibians inhabiting the LAACB (represented by the spring peeper frog). The ultimate assessment endpoint was the biodiversity and health of the ecological community encompassing the unit.

Interpretation of the ecological significance of the unit-related contamination at the LAOCB/LAACB indicated that there was no likelihood of unit-related radiological or nonradiological constituents causing significant impacts to the community of species in the vicinity of the unit. No constituents of potential concern identified in the soil at the LAOCB or LAACB we estimated to pose significant ecological risk based on their toxicity at the concentration at which they are present.

COCs and Human Health Risk-Based RGs

The LAOCB soil poses a potential threat to human health through exposure to sixteen primary COCs (>1 x 10 -4 risk) and five secondary COCs (1 x 1 -4 to 1 x 10 -4 risk), and the LAOCB pipeline soil poses a potential threat to human health through exposure to four primary COCs and two secondary COCs. The primary and secondary COCs for the LAOCB soil and LAOCB pipeline soil are presented in Table 4.

RGs were developed for the primary COCs (primarily radionuclides) which represent greater than 99 percent of the total unit risk. RGs are human health risk-based calculations performed on COCs which are primary contributors of potential risk and/or adverse effects for the future resident scenario. Because the

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hypothetical future scenarios usually yield the most conservative RG, future resident and on-unit worker RGs are presented in Table 4 for the primary COCs identified for the LAOCB soil and LAOCB pipeline soil.

Exposure to direct radiation from radiological constituents in soils/sediments at the LAOCB posed an estimated carcinogenic risk to the hypothetical future resident greater than all other evaluated exposure pathways. The primary contributors to the risk are 60 Co and 137 Cs.

The greatest risk to the hypothetical future resident at the LAOCB pipelines was estimated to be by the incidental ingestion of contaminated soils adjacent to the LAOCB pipelines. These risks are attributed to metals that occur naturally or are from farming activities pnor to SRS. These metals are typically reported at concentrations above risk based concentrations in SRS soils.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

Site-Specific Considerations

Site-specific considerations, based on the conclusions of the BRA and RFI/RI, which indicate significant risk to the future on-unit worker and firture on-unit resident include:

1) LAOCB soils represent the greatest risk at the unit. Specifically, radionuclides represent greater than 99 percent of the total unit risk. Direct radiation exposure is the primary risk pathway and results in a 2 x 10 -2 (i.e., 1 in 50 people would develop cancer due to exposure in an industrial

setting) risk for a hypothetical future worker and 2 x 10 -1 (1 in 5 people would develop cancer due to exposure in a residential setting) risk for a hypothetical future resident. 137 Cs (12%) and 60 Co (83%) are the primary risk drivers for the direct radiation pathway. The half-lives of 60 Co and 137 Cs are 5.2 years and 30.2 years, respectively.

2) Carcinogenic and noncaminogenic risks posed by the pipeline Soils are due to naturally occurring metals and radionuclides that are typical of SRS soils.

3) Radioactive contamination of the internal surface of the LAOCB pipeline has been documented to be approximately 300,000 dpm. Although this contamination does not currently represent a risk to

human health and the environment, future deterioration of the steel walls of the pipeline could potentially release contaminants to the environment and result in an unacceptable risk.

4) The LAACB, LAACB pipeline, and the area adjacent to the LAOCB are estimated to contribute low to nonexistent risk; therefore, No Action for these components of this operable unit is appropriate.

5) The LAOCB is underlain with a compact layer of dense clay (hardpan) and iron-cemented sediments which has limited migration of contaminants to the shallow soils (approximately 0-2 ft) below the LAOCB bottom.

6) The extent of groundwater contamination has not been completely defined, therefore, further characterization is required downgradient of identified tritium and VOC plumes.

7) The LAOCB and LAACB are in an area which has been recommended as an industrial zone by the Citizens Advisory Board and the Savannah River Site Future Use Project Report (DOE, 1996), precluding future residential use.

8) The existing monitoring wells around the LAOCB (LCO-1, -2, -3, and -4) were constructed in

1981
prior to the establishment of standard monitoring well construction specifications. All four wells have 30 foot screens that breach the "hardpan" clay horizon that has effectively minimized the migration of contaminants from the basin to the water table aquifer. Consequently, these wells potentially provide a conduit for the migration of unit COCs to the water table aquifer in the vicinity of the basin. The selected remedy should include abandonment/replacement of these wells, and state approval of these actions will be requested prior to field implementation.

VII. REMEDIAL ACTION OBJECTIVES AND DESCRIPTION OF CONSIDERED ALTERNATIVES FOR THE LAOCB/LAACB SOURCE CONTROL OPERABLE UNIT

Remedial Action Objectives

Remedial action objectives specify unit-specific contaminants, media of concern, potential exposure pathways, and remediation goals. The remedial action objectives are based on the nature and extent of contamination, threatened resources, and the potential for human and environmental exposure. Initially, preliminary remediation goals are developed based upon ARARs, or other information from the RFI/RI Report and the BRA. These goals should be modified, as necessary, as more information concerning the

unit and potential remedial technologies becomes available. Final remediation goals will be determined when the remedy is selected and shall establish acceptable exposure levels that are protective of human health and the environment.

ARARs are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal, State, or local environmental law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at

a
CERCLA site. Three types of ARARs (action-, chemical-, and location-specific) have been developed to simplify identification and compliance with environmental requirements. Action-specific requirements set controls on the design, performance, and other aspects of implementation of specific remedial activities. Chemical-specific requirements are media-specific and health-based concentration limits developed for site-specific levels of constituents in specific media. Location-specific ARARs must considir Federal, State, and local requirements that reflect the physiographical and environmental characteristics of the unit or the immediate area. There were no action-specific, location-specific, or chemical-specific ARARs relevant to establishing remedial action objectives for the LAOCB/LAACB source unit.

The RFM and BRA indicate that the secondary sources (i.e. LAOCB soil) associated with the LAOCB pose significant carcinogenic risk (approximately 2 x 10 -1) to human health. Threatened, endangered, or sensitive species are not found at the LAOCB/LAACB and the unit does not offer attractive or unique cover or forage opportunities for wildlife. Thus, ecological receptors are not at significant risk from the LAOCB/LAACB OU. In addition, although limited risk is associated with the LAOCB pipeline soils (approximately 2 x 10 -5), radioactivity detected inside the LAOCB pipelines does pose potential future risks associated with this source. The RFM and BRA further indicate that risk and hazard to future residents for the LAACB and its pipeline are at or below 1 x 10 -6 and 1.0, respectively. Therefore, No Action is warranted at the LAACB or the LAACB pipeline. Based on these conclusions, the CMS/FS was conducted to consider possible actions which could reduce the risks associated with the LAOCB soils and LAOCB pipeline. Since No Action is appropriate for the LAACB, no evaluation of alternatives in the CMS/FS was warranted for the LAACB.

Based on the risks posed by the radionuclides in the LAOCB soil, the general remedial action objectives for the LAOCB/LAACB OU are as follows:

1) to reduce risks to human health and the environment associated with:

   a) external exposure to radiological constituents

b) inhalation of radiological constituents

c) ingestion of soil or produce grown in soil with radiological constituents, and

d) prevent or mitigate the leaching and migration of COCs to unit groundwater

2) Achieve RGs established for unit soils

The predominant risk drivers at the LAOCB/LAACB OU are radionuclides in the LAOCB soils, Table 3 summarizes the risk posed by LAOCB soil, and illustrates that a majority of the risk is attributed to direct exterrial radiation from 60 Co and 137 Cs, ingestion of 241 Am, 90 Sr, and 239 Pu, and inhalation of 99 Tc. Radionuclides are unique contaminants with a limited selection of remedial responses/technologies. Consequently, a preliminary list of treatment technologies that are potentially applicable to contamination associated with radioactive basins at SRS was developed at the Remediation Technology Roundtable, conducted on January 17 and 18, 1995 (WSRC, 1995c). The Remediation Technology Roundtable consisted of a panel of technical experts assembled to initiate critical, objective dialogue concerning potentially feasible remedial technologies and general response actions that could be used at radioactive waste sites such as the LAOCB. Technical merits and limitations of each technology and general response action were discussed in the open forum. The results of this forum indicate that the preferred remedial responses/technologies are stabilization and containment. The results of this forum, coupled with current guidance, provided the basis for screening and identifying technologies applicable to radioactive contaminants, and facilitated the selection of a preferred remedial alternative for the LAOCB in the CMS/FS and SB/PP.

RGs were developed for the primary COCs (see Table 4) which represent greater than 99% of the total unit risk. These target risk based concentrations are for the industrial receptor based on the land-use determination for the area, and arc the acceptable levels of COCs for unit soils that will not pose unacceptable risk to human health and the environment. In generaL RGs for radionuclides (activity base) in soil can only be achieved through off-unit removal/disposal alternatives. Although the preferred stabilization or containment alternatives will not achieve activity based RGs, these Alternatives meet the

remedial action objectives of eliminating the risks posed by dkect external radiation, ingestion, and inhalation of radionuclides and preventing or mitigating the leaching and migration of COCs to unit groundwater.

LAOCB Alternatives

The primary sources associated with the LAOCB (i.e., residual wastewater inside the LAOCB pipeline and piping associated with the drainage pad) are described in Section V. Residual wastewater is no longer present in the LAOCB, and its presence in the pipeline is unlikely because all piping was constructed as gravity feed, and no wastewater has been discharged through the piping for approximately 30 years. Consequently, remedial alternatives were not developed specifically for these sources.

The secondary sources pose a majority of the unit risk and include the LAOCB soil and LAOCB pipeline. The CMS/FS included detailed analyses for four LAOCB pipeline and six LAOCB soil alternatives which are described below. Included with the secondary source alternatives are remedial activities to address the contaminated vegetation in the LAOCB, the contaminated concrete and associated piping of the drainage pad on the north end of the LAOCB, and the existing monitoring wells around the basin that are potential contaminant migration conduits. Since primary and secondary COCs for the LAOCB soil and LAOCB pipeline soil are radionuclides and metals with very similar physical and chemical properties, the remedial alternatives identified in the CMS/FS are applicable to all unit primary and secondary COCs. These Alternatives do not include discussion of the soil/debris consolidation facility (SDCF), a bulk disposal option currently under evaluation for the disposal of radiologically contaminated soils/debris at the SRS. If built, the SDCF would be located at the SRS and would accommodate low level radioactive soil and debris from many waste units at the SRS. The feasibility of constructing a SDCF is currently being evaluated and it is not known if disposal at the SDCF will be a viable option in the future. Therefore this

disposal option
was not considered during the CMS/FS. If, after the ROD has been issued, DOE, EPA, SCDHEC, and stakeholders decide the LAOCB soil or pipeline should be disposed of at the SDCF, the ROD would be
revised at that time.

Secondary Source Alternatives (LAOCB)

Alternative S-1. No Action

Under this alternative, no action would be taken at the LAOCB soils. EPA policy and regulations require
consideration of the No Action alternative to serve as a basis against which other alternatives can be
compared. Because No Action would be taken and the LAOCB soils would remain in their present condition, there are minimal costs related to normal SRS maintenance activities. The only reduction of
risks resultino from the No Action alternative would be due to natural radioactive decay. Natural decay of
60 Co and 137 Cs, which pose 95% of the risk in the primary risk pathway (external radiation to hypothetical
future resident), would reduce the external radiation risk by nearly 100% and 88%, respectively, over

approximately 90 years. Since five year reviews of the remedy are required for 30 years, the total present
value estimate for these reviews for the next 30 years is $280,000.

Alternative S-2. Backfill and Cap the LAOCB

This alternative involves the placement of clean backfill in the LAOCB followed by construction of a cap
over the LAOCB. Initially, the waste unit would be prepared by abandoning the existing monitoring wells
around the basin and clearing any vegetation, fencing, and other physical obstructions immediately
surrounding the LAOCB area. In addition, the contaminated soils, vegetation, and debris on the walls of
the basin and the staging area on the north end of the basin would be pushed into the bottom of the basin.
The basin would then be backfilled and compacted to grade. After sufficient compaction, an

engineered
cap would be constructed over the LAOCB to minimize surface infiltration and thereby reduce the potential for contaminant migration. A low permeability engineered cap would be sufficient to minimize
infiltration, intrusion, and surface erosion. The cover design would be approved by the EPA and SCDHEC
prior to construction. The cap would cover an area of approximately 0.5 acres (21,780 square feet). The
capped area will be maintained and Institutional Controls will remain in place as long as the waste remains
a threat to human health or the environment. Based on the known half-lives of the predominant radiological risk drivers (i.e., 60 Co and 137 Cs), 60 Co will have gone through approximately 20 half-lives and
137 Cs will have gone through approximately 3.5 half-lives over a 100 year duration.

A properly engineered cap would function as a physical barrier to prevent direct human exposure to soil-
borne contamination and thus be protective of human health and the environment. Capping is a performance-based engineering approach since it does not reduce the total mass of COCs and cannot
achieve RGs. Three feet of soil cover is required to reduce the annual effective dose associated with
continuous exposure to the 137 Cs and 60 Co in the basin by over 99% and to within regulatory and DOE
limits. In addition, a properly maintained cap would minimize infiltration and subsequent leaching of
contamination from unsaturated soil to the groundwater. Under this remedial alternative, remedial action
objectives would be satisfied by: (1) limiting infiltration into the area and thereby reducing the leaching of
primary and secondary COCs to unit groundwater, and (2) preventing human or ecological access and
thereby reducing risks to human health and the environment. The total presefit value estimate for this
alternative is $1,430,000. These costs include operation and maintenance of the cap for 30 years, and
review of remedy every five years for 30 years, as required by the NCP.

Alternative S-3. Backfill, Install Slurry Cut-Off Walls around the LAOCB, and Cap

This alternative involves the placement of clean backfill in the LAOCB followed by installation of a
vertical cut-off wall around the LAOCB cap area and construction of a cap over the LAOCB.

Initially, the waste unit would be prepared by abandoning the existing monitoring wells around the basin and clearing any vegetation, fencing, and other physical obstructions immediately surround in the LAOCB area. In addition, the contaminated soils, vegetation, and debris on the walls of the basin and the staging area on the north end of the basin would be pushed into the bottom of the basin. The basin would then be backfilled and compacted to grade. After sufficient compaction, a vertical cut-off wall (slurry wall) would be installed by excavating a trench around the LAOCB down to the hardpan clay layer located just below the bottom of the LAOCB, and filling with a low permeability soil-bentonite or cement-bentonite slurry. An engineered cap would be constructed over the LAOCB to minimize surface infiltration and reduce the potential for contaminant migration. Coupled with the hardpan clay layer located just below the bottom of the LAOCB, this slurry wall/cap would form a complete low-permeability containment unit.

The low permeability engineered cap would have the same characteristics as identified in Alternative S-2. The capped area will be maintained and Institutional Controls will remain in place as long as the waste remains a threat to human health or the environment.

Under this afternative, remedial action objectives would be satisfied by: (1) limiting infiltration into the area and thereby preventing the migration of primary and secondary COCs to groundwater, and (2) preventing human or ecological access and thereby reducing risks to human health and the environment. This alternative, assuming an approximate backfill/cap thickness of four feet, is estimated to reduce the radioactive dose (direct radiation exposure) received from 60 Co and 137 Cs at the LAOCB by nearly 100 percent. The total present value estimate for this alternative is $3,430,000. There costs include Operation and maintenance of the cap for 30 years, and review of remedy every five years for 30 years, as required by the NCP.

Alternative S-4. In-situ Solidification/Stabilization, Backfill, and Cap

This alternative involves the in-situ solidification/stabilization (S/S) of the top two feet of soil in the bottom of the LAOCB, placement of clean backfill in the LAOCB to grade, followed by construction of a cap over the LAOCB. Initially, the waste unit would be prepared by abandoning the existing monitoring wells around the basin and clearing any vegetation, fencing, and other physical obstructions immediately surrounding the LAOCB area. In addition, the contaminated soils, vegetation, and debris on the walls of

the basin and the staging area on the north end of the basin would be pushed into the bottom of the basin.
The soil and debris would then be solidified/stabilized to a depth of approximately two feet below the

current basin bottom. In-situ S/S would involve mixing the S/S reagents into the waste by some mechanical means such as a jet-grouting system or a long-reach backhoe fitted with a rotary tine. A treatability study has been conducted on LAOCB soils to identify S/S reagents that effectively immobilize unit-specific contaminants. A mixture of Portland Cement, bentonite, and sodium silicate was found to effectively immobilize LAOCB contaminants of concern and would be used to in-situ S/S LAOCB soils.
Following S/S, the remaining depression would be backfilled to grade and a low permeability engineered cap sufficient to minimize infiltration, intrusion, and surface erosion would be constructed over the basin.
The cover design would be approved by the EPA and SCDHEC prior to construction. The capped area will be maintained and Institutional Controls will remain in place as long as the waste remains a threat to human health or the environment.

In-situ S/S does not reduce the total mass of COCs and cannot in itself achieve RGs. However, it is a proven performance based engineering approach that reduces the mobility of primary and secondary COCs. Based on results of a literature search and a treatability study performed on LAOCB soils, the in-situ S/S reagents are considered effective at reducing the leachability of contaminants. Specifically, the various S/S reagent samples (with LAOCB soil) were subjected to toxicity characteristic leaching procedure (TCLP) and the extended American National Standard (ANS) 16.1 procedure to simulate leaching of contaminants over time. Analysis of the two leaching tests performed on LAOCB soil samples amended with S/S reagents demonstrated that all of the samples released 0.41% and 1.61% or less of gross alpha and gross beta, respectively (WSRC, 1996c).

Under this alternative, contamination in the basin would be immobilized and covered with clean soil and a cap. These actions would meet remedial action objectives by: (1) preventing infiltration into the area

through capping and immobilizing contaminants present in the basin via in-situ S/S, and thereby preventing migration of primary and secondary COCs to groundwater, and (2) preventing human or ecological access and thereby reducing risks to human health and the environment. In addition, assuming an approximate backfill/cap thickness of four feet, this alternative is estimated to reduce the radioactive dose (direct radiation exposure) received from 60 Co and 137 Cs at the LAOCB by nearly 100%. The total present value estimate for this alternative is $3,580,000. These costs include operation and maintenance of the cap for 30 years, and review of the remedy every five years for 30 years, as required by the NCP.

Alternative S-5. Ex-situ Stabilize, Backfill, & Cap

This alternative involves the ex-situ S/S of the top two feet of soil in the bottom of the LAOCB, placement back in the LAOCB, placement of clean backfill in the remaining depression, followed by construction of a cap over the LAOCB. Initially, the waste unit would be prepared by abandoning the existing monitoring

wells around the basin and clearing any vegetation, fencing, and other physical obstructions immediately surrounding the LAOCB area. Due to radiological control concerns with the excavation of the radioactive contamination in the basin, the soil would be stabilized prior to excavation for ex-situ S/S. The soil would be solidified/stabilized to a depth of approximately two feet below the current basin bottom as described for Alternative S-4. The top two feet of soil in the bottom of the basin would then be excavated and ex-situ S/S. Following placement of the treated basin soil back in the LAOCB, contaminated soils, vegetation, and debris on the walls of the basin and the staging area on the north end of the basin would be pushed into the bottom of the basin on top of the stabilized soil. The basin would be backfilled with clean soil and compacted to original grade. After sufficient compaction, an engineered cap would be constructed over the LAOCB. The treated soil and the engineered cap would minimize surface infiltration and reduce the

potential for contaminant migration. The low permeability engineered cap would have the same characteristics as identified in Alternative S-2. The capped area will be maintained and Institutional Controls will remain in place as long as the waste remains a threat to human health or the environment.

As discussed under Alternative S4, this alternative does not reduce the total mass of COCs and cannot in itself achieve RGs. However, it is a proven performance-based engineering approach that reduces the mobility of primary and secondary COCs. In addition, as discussed under Alternative S4, results of a literature search and a treatability study performed on LAOCB soils indicate S/S reagents are considered effective at reducing the mobility of primary and secondary COCs. Under this alternative, contamination in the basin would be excavated, immobilized, replaced in the LAOCB, and a cap constructed.

This alternative would meat remedial actioti objectives by: (1) preventing infiltration into the area through capping and immobilizing contamination present in the basin through ex-situ S/S, thereby preventing migration of primary and secondary COCs to groundwater, and (2) preventing human or ecological access and thereby reducing risks to human health and the environment. In addition, assuming an approximate backfill/cap thickness of four feet, this alternative is estimated to reduce the radioactive dose (direct radiation exposure) received from 60 Co and 137 Cs at the LAOCB by nearly 100%. The total present value estimate for this alternative is $4,370,000. These costs include operation and maintenance of the cap for 30 years, and the review of remedy every five years for 30 years, as required by the NCP.

Alternative S-6. Excavation & Off-Unit Disposal

This alternative involves the excavation and off-unit disposal of the top two feet of soil from the bottom of the LAOCB, and contaminated soils, vegetation, and debris on the walls of the basin and the staging area on the north end of the basin. Treatment (i.e., stabilization) of the LAOCB soils would first be conducted to ensure optimal waste handling characteristics. Following pretreatment, a backhoe or trackhoe would be

used to excavate contaminated material in the LAOCB to a depth of approximately two feet below the current basin bottom. Confirmation soil samples would be collected and analyzed periodically during excavation to verify that all soil exceeding concentration-based remediation goals was recovered. Following excavation, the soil may require further treatment for waste handling purposes and packaging and disposal requirements. The contaminated material would then be placed directly into lined haul trucks for transport from the waste unit to the disposal facility [Nevada Test Site (NTS) near Mercury, Nevada]. Upon completion of contaminated material removal, the LAOCB would be backfilled with clean soil and compacted to grade.

By removing the source of contamination, this alternative would eliminate all risks associated with the LA0CB, soils and meet the remedial action objectives by eliminating any risk of contaminant migration to groundwater and risk to human health and the environment. Since the source term is removed under this alternative, review of remedy every five years for 30 years would not be required. The total present value estimate for this alternative is $9,100,000.

Secondary Source Alternatives (LAOCB Pipeline)

Alternative P-1. No Action

Under this alternative, no action would be taken at the LAOCB pipeline. EPA policy and regulations require consideration of the No Action alternative to serve as a basis against which other alternatives can be compared. Because no action would be taken and the LAOCB pipeline would remain in its present condition, there are minimal costs related to normal SRS maintenance activities. Under the No Action alternative, there would be no reduction or mitigation of current or future risks associated with the pipelines. Since five year reviews of the remedy would be in conjunction with the reviews for the LAOCB soil remedy, the estimated cost for these reviews for the next 30 years is $0. The total present value estimate for this alternative is $0.

Alternative P-2. Capping

This alternative involves the construction of a low permeability cap over the LAOCB pipeline area

Initially, the waste unit would be prepared by clearing any vegetation, fencing, and other physical obstructions immediately surrounding the LAOCB pipeline area. After the area is prepared, an engineered cap would be constructed over the LAOCB pipeline to minimize surface infiltration and thereby reduce the potential for contaminant migration. The low permeability engineered cap would be designed to minimize infiltration, intrusion, and surface erosion. The cover design would be approved by the EPA and SCDREC prior to construction. The cap would cover an area of approximately 0.5 acres (21,780 square feet). The

capped area will be maintained and Institutional Controls will remain in place as long, as the waste remains a threat to human health or the environment.

This alternative would meet the remedial action objectives by: (1) minimizing infiltration into the pipeline area, thereby preventing migration of contaminants to groundwater, and (2) preventing intrusion to the pipeline area, thereby reducing risk to human health and the environment. Since five year reviews of the remedy would be in conjunction with the LAOCB soil, the additional estimated present value for these reviews for the next 30 years is $0. The total present value estimate for this alternative is $730,1000.

Alternative P-3. In-situ Soliclification/Stabitization and Disposal in the LAOCB

This alternative involves the in-situ S/S, excavation, and on-unit disposal of the LAOCB pipeline and associated soils in the LAOCB. The pipelines would first be filled with grout to minimize the potential release of residual contaminants from inside the pipelines during excavation. A backhoe or trackhoe would then be used to excavate the LAOCB pipeline. The pipelines would be cut into manageable sections for the purpose of moving and minimizing required disposal space. Confirmation soil samples would be collected and analyzed periodically during excavation to verify that all soil exceeding concentration-based remediation goals was recovered. The pipeline sections and associated soils would be placed

directly into
the LAOCB and subsequently solidified/stabilized to create a monolith and further reduce the mobility of
pipeline contaminants. When pipeline and soil removal and disposal are completed, the LAOCB pipeline
area would be backfilled with clean soil and compacted to grade.

Because the source of contamination would be removed under this alternative, remedial action objectives
would be met by eliminating any risk to groundwater, human health, or the environnent caused by the
LAOCB pipeline area. Since five year reviews of the remedy would be in conjunction with the LAOCB
soil, the additional estimated present value for these reviews for the next 30 years is $0. The total present
value estimate for this alternative is $990,000.

Alternative P-4. In-situ Solidification/Stabilization and Dismisal at the Nevada Test Site

This alternative involves the in-situ S/S, excavation, and off-unit disposal of the LAOCB pipeline and
associated soils. The pipelines would first be filled with grout to minimize the potential release of residual
contaminants from inside the pipelines during excavation. A backhoe or trackhoe would be used to
excavate the LAOCB pipeline. The pipeline sections would then be cut into manageable sections for the
purpose of moving and minimizing required disposal space. Confirmation soil samples would be collected
and analyzed periodically during excavation to verify that all soil exceeding concentration-based
remediation goals was recovered. The pipelines and associated soil would then be placed directly into

lined haul trucks for transpori ftom the waste unit to the disposal facility (NTS near Mercury, Nevada).
Upon the completion of the excavation of contaminated pipeline and soil, the LAOCB pipeline area would
be backfilled with clean soil and compacted to grade.

Because the source of contamination would be removed under this alternative, remedial action

objectives
would be met by eliminating any risk to groundwater, human health, or the environment caused by the
LAOCB pipeline area. Since five year reviews of the remedy would be in conjunction with the LAOCB
soil, the additional estimated present value for these reviews for the next 30 years is $0. The total present
value estimate for this alternative is $4,630,000.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF THE ALTERNATIVES

Each of the remedial alternatives was evaluated using the nine criteria established by the NCP. The criteria
were derived from the statutory requirements of CERCLA Section 121. The criteria are:

- overall protection of human health and the environment,
- compliance with ARARs,
- long-term cffectiveness and permanence,
- reduction of toxicity, mobility, or volume through treatment,
- short-term effectiveness,
- implementability,
- cost,
- state acceptance, and
- community acceptance.

In selecting the preferred alternative, the above criteria were used to evaluate the alternatives developed in
the focused CMS/FS (WSRC, 1997b). Seven of the criteria were used to evaluate all the Alternatives,
based on human health and environmental protection, cost, feasibility, and implementabillity issues. The
preferred alternative was further evaluated based on the final two criteria: state acceptance and community
acceptance.

Tables 5 and 6 present the evaluation of the soil and pipeline remedial alternatives, respectively.
Summaries of the comparative analysis of alternatives are provided below.

<IMG SRC 97204P>

<IMG SRC 97204Q>

<IMG SRC 97204R>

<IMG SRC 97204S>

<IMG SRC 97204T>

<IMG SRC 97204U>

<IMG SRC 97204V>

<IMG SRC 97204W>

<IMG SRC 97204X>

LAOCB Soil Alternatives

Overall Protection of Human Health and the Environment (LAOCB Soil)

The No Action alternative would not be protective of human health and the environment. The existence of the clay layer (hardpan) beneath the Basin adequately retards the migration of COCs through the vadose zone, however, it provides no means of verifying whether contaminants would impact groundwater in the future.

Remaining alternatives being considered would all be protective of human health and the environment. With the exception of Alternative S-6 (Disposal at NTS), all other alternatives would involve capping, which would: (1) act as a barrier that would deter human access to contaminated media; (2) minimize infiltration and leaching of contaminants from soil to groundwater; (3) act as shielding to reduce radiation exposure to hypothetical receptors to within acceptable levels; and (4) serve as redundant protective feature for those alternatives that involve treatment as a primary means of remediating contaminated soil.

Compliance with ARARs (LAOCB Soil)

The chemical-specific ARARs associated with the LAOCB include concentration-based standards for Ra and Th in surface and subsurface soil specified in Uranium Mill Tailings Radiation Control Act (UMTRCA). No detectable activities of 226/228 Ra, 230 Th, or 232 Th were present in the basin soil. 234 Th (a daughter of 238 U) was present in significant activities in the basin soil.

EPA regulation 40 CFR 192 and DOE Order 5400.5 are considered relevant and appropriate and to-

be-
considered information, respectively. The EPA standard specifies an allowable annual effective dose to
any member of the public resulting from nuclear power plant operations. The allowable effective dose rate
is 25 mrem/year. The DOE Order specifies an allowable annual effective dose to any member of the public
resulting from all DOE operations of 100 mrem/year. With the exception of the No Action alternative
(Alternative S-1), an evaluation of remaining alternatives using very conservative assumptions indicates
that implementation of the alternatives would meet the allowable effective dose rates under 40 CFR 192
and DOE Order 5400.5.

Action-specific ARARs identified for the evaluated alternatives are generally similar, however, no ARARs
are identified for the No Action alternative. All remaining alternatives require National Emissions
Standards for Hazardous Air Pollutants (NESHAPs) air modeling, county erosion control plans, and OSHA

health and safery plans. RCRA capping performance standards are required for all alternatives except No
Action and off-unit disposal. Alternative S-6 requires transportation of radioactive materials within SRS
boundaries and off site to the NTS facility, which would require adherence to DOE Order 5480.3 and 49
CFR 172 throuch 203.

Long-Term Effectiveness and Permanence (LAOCB Soil)

Long-term effectiveness and permanence can be measured in broad terms by (1) the magnitude of residual
risks associated with the waste unit, and (2) the adequacy of controls after implementation of the remedial
alternative. Of the alternatives being considered, the No Action alternative is the least effective alternative
in terms of the magnitude of residual risks after implementation since it would leave all contaminated
media in place without the benefit of treatment. Alternatives S-2 and S-3, which involve the-capping of all

contaminated media and vertical barriers, would significantly reduce the magnitude of residual risks over No Action since they would minimize infiltration reaching the waste, however, Alternatives S-2 (Capping) and S-3 (Capping and Slurry Wall) do not involve any form of treatment that would permenanty reduce the magnitude of residual risk. With the exception of No Action (Alternative S-1) and Alternative S-6 (Disposal at NTS), all other alternatives involve capping and treatment of contaminated media. Alternative S-6 involves off-unit disposal of all contaminated soil above concentration-based remediation goals but does not involve capping. Alternatives S-4 (In-situ VS), S-5 (Ex-situ S/S) and S-6 (Disposal at NTS) offer a greater reduction in the magnitude of residual risks than would Alternatives S-2 (Capping) and S-3 (Capping and Slurry Wall).

Alternatives S4 (In-situ S/S) and S-5 (Ex-situ S/S) involve some form of treatment that would permanently reduce the magnitude of on-unit residual risks by reducing contaminant mobility and/or volume. Alternative S-6 involves no form of treatment to reduce the magnitude of residual risk associated with contaminated media, however, this alternative involves the disposal of contaminated soil at the NTS facility and would effectively remove all residual risk at the unit.

With respect to contaminated soil, Alternative S-6 (Disposal at NTS) offers the greatest reduction in residual risk since it would permanently remove all contaminated soil at concentrations above concentration-based remediation goals from the LAOCB waste unit. Residual concentrations left in soil would not pose a significant risk to human health or the environment. Alternatives S4 (In-situ S/S) and S-5 (Ex-situ S/S) would immobilize soil-borne contaminants. The residual risks associated with Alternative S-5 would be slightly less than that of Alternative S4 because the treatment of all known soil-borne

contamination at the LAOCB waste unit would be verified by confirmation sampling under Alternative S-5, whereas treatment of all known soil-borne contamination would not he confirmed under Alternative S-4.

Existing SRS institutional controls would be adequate for the protection of human health as long as the institutional controls are maintained. In the absence of existing controls, the No Action alternative would not be protective of human health. Based upon the hypothetical scenario that institutional controls cannot be guaranteed and/or proposed caps could be allowed to fail, the need for controls to maintain protectiveness would decrease corresponcling to the extent to which contaminated rnedia are treated to permanently reduce the magnitude of residual risks. Consequently, the need for controls is greatest for alternatives that do not treat or remove any of the contaminated media (Alternatives S-1 - No Action, S-2 - Capping, and S-3 - Capping and Slurry Wall) followed by alterriatives that treat all known contaminated soil at the LAOCB waste unit (Alternatives S-4 - In-situ S/S and S-5 - Ex-situ S/S), Alternative S-6 (Disposal at NTS) would require the least controls of all alternatives being considered since it would involve the permanent removal of all contaminated soil known to exceed concentration-based remediation goals. With the exception of restrictions on groundwater use, no controls would be required for the LAOCB waste unit under Alternative S-6.

Reduction of Toxicity, Mobility, or Volume (LAOCB Soil)

Alternatives S-1 (No Action), S-2 (Capping), S-3 (Capping and Slurry Walls), and S-6 (Disposal at NTS) offer no form of active treatment and, therefore, do not satisfy the NCP preference for remedial alternatives that offer a reduction in contaminant toxicity, mobility, or volume. AH other alternatives being considered offer some form of active treatment that would permanently reduce contaminant toxicity, mobility, or (contaminated media) volume. The treatment technology being considered for treating LAOCB contaminated soil is stabilization/solidification by grouting (soil only), which reduces contaminant mobility.

Short-Term Effectiveness (LAOCB Soil)

The short-term risks to remedial workers increases with the volume of contaminated media directly handled or processed and project duration. Handling (e.g., excavating, moving) and/or processing (e.g., treating) contaminated media increases the risk of remedial worker exposure to radiation effects. In addition, remedial workers are exposed to potential construction-related risks (e.g., falls, cuts, heavy equipment operation) which increase with corresponding increases in project duration, however, potential short-term risks to remedial workers should be manageable for all alternatives being considered.

With

strict adherence to project health and safety plans, it should be possible to maintain short-term risks of all considered alternatives within acceptable limits.

The potential risk to remedial workers would be lowest for the No Action Alternative, followed by Alternative S-2 (Capping) which invqlvcs no or very limited handling or processing of contaminated media. The No Action alternative requires no time in the field, whereas the estimated time to complete Alternative S-2 (Capping) is four months once fieldwork begins. Alternative S-6 (Disposal at NTS) would not require an extensive timeframe to complete the remediation beyond that of Alternative S-2.

The alternatives posing the greatest potential risks to remedial worken would be Alternatives S-5 (Ex-situ S/S) and S-6 (Disposal at NTS) because they involve the direct handling and processing of the greatest volume of contaminated media. Standby time would be anticipated for these alternatives to address health and safety is sues since these alternatives would involve extensive handling and/or processing of contaminated soil. Work stoppages would significantly impact the time needed to complete these alternatives. After mobilization to the field, the estimated time to complete Alternatives S-5 and S-6 is two months.

All alternatives being considered would pose negligible or very low risks to the community. Under Alteratives S-1 (No Action), S-2 (Capping), S-3 (Capping and Slurry Walls), S-4 (In-situ S/S), and S-5 (Ex-situ S/S), the risks posed to the community would be negligible since they would not include off-unit transport of contaminated media. Alternative S-6 involves transport of contaminated soil to the NTS facility near Mercury, Nevada, 2,200 miles from the LAOCB waste unit, and involves more risk than the other alternatives.

Implementability (LAOCB Soil)

Alternative S-1 (No Action) would be the most implementable altmative being considered since it would
not involve any type of consmuction or remedial actions beyond existing institutional control however,
the No Action alternative could potentially arouse public concern since it would pose a potential threat to
the environment. Alternative S-2 (Capping) would involve the construction of a cap, but should be
relatively easy to implement. Alternative S-3 would involve the construction of slurry cut-off walls and a
Cap, both of which are readily constructed. Alternatives S-2 and S-3 should not elicit major public
concerns. Alternatives S-4 (in-situ S/S) and S-5 (Ex-situ S/S) should be implementable, however,
Alternative S-5 requires extensive waste handling and pre-excavation treatment of soil. Stabilization and
disposal are commonly applied technologies for remediating low-level or mixed wastes, and should not

elicit public concerns. Alternative S-6 (Disposal at NTS) would be readily implementable. Alternative S-6
also would require treatment of soil prior to excavation to ensure optimal waste handling characteristics.
Post-excavation treatment may be needed under Alternative S-6 for packaging and disposal requirements.
There may be potential public concern regarding the off-site awsportation of low-level or mixed wastes.

With the exception of Alternative S-6, future remedial alternatives, if warranted, would not be precluded
by implementing any of the Alternatives. Disposal of LAOCB wastes at the SRS Soil Consolidation
Facility, for instance, could be re-evaluated should the facility become operational in the future.

Cost (LAOCB Soil)

Total estimated present worth costs range between $280,000 for the No Action alternative to $9,100,000
for Alternative S-6 (Disposal at NTS). Alternative S-2 ($1,430,000) involves capping only. Alternative S-
3 ($3,430,000) involves slurry cut-off walls. Alternative S-4 ($3,580,000) involves in-situ

stabilization of
the contaminated soil. Alternative S-5 ($4,370,000) involves ex-situ stabilization of the contaminated soil.
Alternative S-6 ($9,100,000) involves off-unit disposal of all LAOCB contaminated soil to two feet.

With the exception of Alternatives S-1 and S-6, the estimated operation and maintenance costs of all
alternatives are approximately $430,000 for the long-term (30 years) maintenance of a cap and five year
remedy reviews. The estimated operation and maintenance for the NoAction alternative (Alternatives-1)
is $280,000 because it does not involve capping. Alternative S-6 would have no additional operation and
maintenance costs since it would permanently remove all contaminated soil from the LAOCB waste unit
and would not require five year remedy reviews. All cost estimates are provided for comparison purposes
only and are not intended to forecast actual budgetary expenditures.

State and Community Acceptance (LAOCB Soil)

Alternative S-1 does not provide short or long term protectiveness of human health and the environment
and consequendy has not met state and Federal regulatory acceptance. Alternatives S-2 and S-3 do provide
for reduced contaminant mobility, however, these alternatives do not provide a permanent reduction in
contaminant mobility and have not met state and Federal regulatory acceptance. Alterngives S-5 and S-6
do provide for a permanent reduction in contaminant mobility, however, both alternatives include
significant waste handling and/or transport and are estimated in excess of $4 million. Consequently,
neither Alternative S-5 or S-6 have met state and Federal acceptance or community acceptance.

The state and Federal regulatory agencies have accepted and approved Alternative S4 primarily because it
is the least expensive alternative that provides a permanent reduction in contaminant mobility and poses
minimal risk to remedial workers and the community. In addition, based on the public comments received
from the community and the Citizens Advisory Board, Alternative S-4 has met community

acceptance.

Comparative Analysis Summary (LAOCB Soil)

The results of the comparative analysis for the LAOCB soil indicate that with the exception of S-1 (No Action), all considered alternatives are comparable with respect to overall protectiveness of human health and environment, meeting chemical-specific and action-specific ARARs, and relative implementability (see Table 5). The primary balancing criteria are cost, long-term effectiveness and permanence, and reduction of toxicity, mobility, or volume. Alternatives S-5 and S-6, although effective in reducing the toxicity, mobility, or volume permanently, are estimated in excess of $4 million. In addition, both these alternatives include significant waste handling and/or transport which increase the potential for remedial worker and public exposure. Alternative S-3 has an estimated cost comparable to Alternative S-4, but its ability to reduce contaminant mobility and migration to groundwater over the long-term is not adequate. In addition, although the estimated cost of Alternative S-2 is significantly less than Alternative S-4, its ability to reduce contaminant mobility and migration to groundwater over the long-term is also not adequate.

LAOCB Pipeline Alternatives

Overall Protection of Human Health and the Environment (LAOCB Pipeline)

The No Action Alternative (P-1) would not be protective of human health and the environment. According to data gathered during the RFI/RI, the internal suface of the pipelines exhibit a relatively high radioactivity level (approximately 300,000 dpm cm internal surface), however, radioisotopes have not been detected in the pipeline soil or in groundwater from the pipeline areas. This suggests radionuclides have not migrated from the pipeline to unit soil and groundwater. The No Action Alternative does not prohibit access to the pipeline areas, and the potential exists for human or wildlife intiusion and subsequently exposure to the pipelines. Furthermore, based on the shallow depth of the pipeline (within three feet of the ground surface), its relatively high radioactivity level on the internal surface, the age (>30 years) and material of the pipe (steel which could degrade over time and release radioisotopes), Alternative P-1 (No Action) would not be protective of human health or the environment.

Remaining alternatives being considered would all be protective of human health and the ecological receptors. Alternative P-2 would not result in the mitigation of potential future radionuclide release to the environment due to corrosion of the steel walls of the pipelines, however, Alternative P-2 would involve capping, which would: (1) act as a barrier that would deter human access to contaminated media; (2) minimize infiltration and leaching of contaminants to unit soil and groundwater; and (3) act as shielding to reduce radiation exposure to hypothetical receptors to within acceptable levels. Alternatives P-3 and P-4 are protective of human health and the environment because they involve the excavation and disposal of the pipelines.

Compliance with ARARs (LAOCB Pipeline)

The potential chemical-specific ARARs associated with the pipelines include concentration-based standards specified in DOE Order 5400-5. DOE Order 5400.5 is considered TBC information only. The DOE Order specifies an allowable annual effective dose to any member of the public resulting from all DOE operations of 100 mrem/year. The pipelines were not sampled for specific isotopes, therefore it is unknown whether the radiation doses resulting from isotopes in the LAOCB pipelines meet the identified potential ARAR. Consequently, compliance with this potential ARAR cannot be evaluated for Alternative P-1. The remaining alternatives would comply with the potential chemical-specific ARAR through reduction of radiation dose (capping), treatment, or disposal.

Alternatives P-2, P-3, and P-4 would require compliance with several action-specific ARARs. Alternative P-2 involves construction of a cap and would therefore require compliance with RCRA cap performance standards. Alternatives P-3 and P-4 involve construction-type activities and would require NESHAPs air modeling and permitting, an erosion control plan, and an Occupational Health and Safety Administration (OSHA) worker health and safety plan. All alternatives could comply with the action-specific ARARs. No location-specific ARARs were identified under any of the alternatives.

Long-Term Effectiveness and Permanence (LAOCB Pipeline)

Long-term effectiveness and permanence can be measured in broad terms by: (1) the magnitude of residual risks associated with the waste unit; and (2) the adequacy of controls after implementadon of the remedial alternative. The alternative having the highest residual risks is Alternative P-1 because the pipelines would remain in place without treatment and institutional controls would not be guaranteed under this alternative. Alternative P-2 would have less residual risk than Alternative P-1 because it would involve capping the pipeline areas which would minimize migration of contamination and would restrict human and wildlife

access to the pipelines. Neither Alternatives P-1 or P-2 would prevent the potential release of contaminants to the environment upon the deterioration of the steel pipelines. Alternatives P-3 and P-4 would result in the least residual risk because they involve removing pipeline contamination from the area.

The adequacy of controls under Alternative P-1 cannot be ascertained since the continued maintenance under institutional controls would not be guaranteed. Alternative P-2 would include the construction of a cap over the pipeline areas which would require maintenance, but would limit the radiation exposure potential, decrease the potential for migration, and limit access to the pipelines. Alternatives P-3 and P4 involve the removal of pipeline contamination and would, therefore, not require any controls following remediation.

Reduction of Toxicity, Mobility, or Volume (LAOCB Pipeline)

Alternatives P-1 and P-2 offer no form of active treatment and, therefore, do not satisfy the NCP preference for remedial alternatives that offer a reduction in contaminant toxicity, mobility, or volume. However, Alternative P-2 offers capping which would reduce the mobility of contaminants by minimizing surface water infiltration, thereby reducing leaching of contaminants to unit groundwater. Alternatives P-3 and P-4

would offer treatment through grouting that would reduce contaminant mobility.

Short-Term Effectiveness (LAOCB Pipeline)

The short-term risks to remedial workers increases with project duration. Handling (e.g., excavating, moving) and/or processing (e.g., treating) contaminated media increase the risk of remedial worker exposure to radiation effects. In addition, remedial workers are exposed to potential construction-related risks (e.g., falls, cuts, heavy equipment operation) which increase with corresponding increases in project duration. Potential short-term risks to remedial workers should be manageable for all alternatives being considered. With strict adherence to project and safety plans, it should be possible to maintain short-term risks of all considered alternatives within acceptable limits.

The potential risk to remedial workers would be lowest for the No Action alternative, followed by Alternatives P-2, P-3, and P-4. Alternative P-2 (capping) would not involve any contact with the pipelines.
Alternatives P-3 and P-4 would involve in-situ S/S and excavation and disposal of the pipelines
Alternative P-4 involves more waste handling due to cutting and packaging of the pipeline for transport.
The risk to remedial workers would be medium under Alternative P-3 and high under Alternative P-4.
Alternative P-3 is estimated to take two months and Alternative P-4 three months.

All alternatives would pose negligible or low short-term risks to the community. The risks posed to the community from Alternatives P-1, P-2, and P-3, would be negligible since they would not include off-unit transport of contaminated media. Since Alternative P-4 involves transport of contaminated soil to the NTS facility near Mercury, Nevada, 2,200 miles from the LAOCB waste unit, this alternative involves more risk than the other alternatives.

Implementability (LAOCB Pipeline)

Alternative P-1 (No Action) would be the most implementable alternative being considered since it would not involve any type of construction or remedial actions beyond existing institutional controls. However, the No Action Alternative could potentially arouse public concern since it does not involve treatment or removal of the contamination. Alternative P-2 (Capping) would involve the construction of a cap, but should be relatively easy to implement. Alternative P-2 should not elicit major public concerns since a cap would provide a physical barrier between receptors and the pipelines, however, the geometry of the cap (approximately 450 ft long by 10 ft wide) would caust traffic control and maintenance problems under current and future land use scenarios. Alternatives P-3 (In-situ S/S and disposal in the LAOCB) and P-4 (In-situ S/S and disposal at NTS) could be readily implementable. S/S is a commonly applied technology for remediating low-level wastes and should not elicit public concerns. There may be potential public concern regarding the off-site transportation of low-level waste under Alternative P4.

Cost (LAOCB Pipeline)

Total estimated present worth costs range between $730,000 for Alternaive P-2 (Capping) to $4,630,000 for Alternative P-4 (In-situ S/S, excavation, and disposal at the NTS). The cost of Alternative P-1, No Action, would be included under the No Action alternative for the LAOCB soils (S-1). Alternative P-2 ($730,000) includes capping only. Alternative P-3 ($990,000) involves the grouting, excavation, and disposal of the pipelines in the LAOCB. Alternative P-4 ($4,630,000) would involve grouting, excavation, and disposal of the LAOCB pipelines at the NTS.

Alternatives P-1 and P-2 would require a remedy review every five years for 30 years because they do not result in unrestricted use of the pipeline area. The cost for remedy review would be included with that of the LAOCB soils, depending on the remedy selected for the LAOCB. Alternative P-2 includes the operation and maintenance costs of a cap.

State and Community Acceptance (LAOCB Pipeline)

Alternative P-1 does not provide short or long term protectiveness of human health and the environment and consequently has not met state and Federal regulatory acceptance. Alternative P-2 does provide for reduced contaminant mobility, however, this alternative does not provide a permanent reduction in contaminant mobility and has not met state and Federal regulatory acceptance. Alternative P-4 does provide for a permanent reduction in contaminant mobility, however, this alternative includes significant waste handling and/or transport and is estimated in excess of $4 million. Consequently, Alternative P-4 has not met state and Federal acceptance or community acceptance.

The state and Federal regulatory agencies have accepted and approved Alternative P-3 primarily because it is the least expensive Alternative that provides a permanent reduction in contaminant mobility and poses minimal risk to remedial workers and the community. In addition, based on the public comments received from the community and the Citizens Advisory Board, Alternative P-3 has met community acceptance.

Comparative Analysis Summary (LAOCB Pipeline)

The results of the comparative analysis for the LAOCB pipeline indicate that with the exception of S-1 (No Action), all considered alternatives are comparable with respect to overall protectiveness of human health and environment, meeting chemical-specific and action-specific ARARs, and relative implementablility (see Table 6). The primary deciding criteria are cost, long-term effectiveness and permanence, and reduction of toxicity, mobility, or volume. Alternative P-4, although effective in reducing the toxicity, mobility, or volume permanently, is estimated in excess of $4 million. In addition, this alternative would include significant waste transport which would increase the potential for public exposure. Alternative P-2 has an estimated cost comparable to Alternative P-3, however, its ability to reduce contaminant mobility and migration to groundwater over the long-term may not be adequate. Alternative P-3 provides a reduction in contaminant mobility through in-situ stabilization, removal, and further stabilization/disposal in the LAOCB, is more cost effective than Alternative P-4, and has met state and community acceptance.

IX. THE SELECTED REMEDY

Based on the risks identified in Section VI, the LAOCB soil poses significant risks to human

health and the
environment. Significant carcinogenic risks to the potential future worker or resident are driven by
exposure from direct radiation, ingestion of soil, and ingestion of produce grown in the LACCB soils
contaminated with radionuclides (primarily 60 Co and 137 Cs) to a depth of less than two feet. In addition,

significant noncarcinogenic risks are driven primarily by ingestion of basin soils contaminated with
chromium and lead. Based on characterization and risk evaluations, a remedial action is appropriate for the
LAOCB soil.

An evaluation of potential alternatives was performed in accordance with the NCP as summarized in
Section VIII. Based on this evaluation, the selected alternative for remediating the LAOCB soil is
Alternative S-4: In-situ Stabilization and Capping. This alternative will meet remedial action objectives
by permanently eliminating ingestion of soils and produce grown in soils, eliminating direct radiation
exposure, and providing a permanent reduction in contaminant mobility and potential future impacts to
groundwater. In addition, this alternative poses minimal risk to remedial workers and the community, is
the least expensive alternative that meets remedial action objectives, and has met state and Federal
regulatory and community acceptance.

Implementation of the selected LAOCB alternative (S-4) will involve in-situ S/S of the top two feet of soil
in the bottom of the LAOCB, the placement of clean soil in the LAOCB, followed by construction of a cap
over the LAOCB. Initially, the waste unit would be prepared by abandoning the existing monitoring wells
around the basin and clearing any vegetation, fencing, and other physical obstructions immediately
surrounding the LAOCB area. In addition, the contaminated soils, vegetation, and debris on the walls of
the basin and the staging area on the north end of the basin will be pushed into the bottom of the basin.
The soil and debris will then be S/S to a depth of approximately two feet below the current basin bottom.

Following S/S, any remaining depression will be backfilled to grade. After sufficient compaction, an engineered cap will be constructed that will minimize infiltration, intrusion, and surface erosion. The treated soil and the engineered cap will minimize surface infiltrafion and reduce the potential for leaching of COCs to unit groundwater. The design of the engineered cap will be approved by the EPA and SCDHEC prior to construction. The cap will cover an area of approximately 0.5 acres (21,780 square ft). The capped area will be maintained and Institutional Controls will remain in place as long as the waste remains a threat to human health or the environment.

Carcinogenic and noncarcinogenic risks posed by the pipeline soils are due to naturally occurring metals and radionuclides that are typical of SRS soils. However, relatively high levels of radioactivity were detected in the LAOCB pipelines. Although this contamination does not currently represent a risk to human health and the environment, future deterioration of the steel walls of the pipeline could potentially release contaminants to the environment and result in unacceptable risk. Based on these criteria, a remedial action is appropriate for the LAOCB pipeline.

An evaluation of potential alternatives was performed in accordance with the NCP as summarized in Section VIII. Based on this evaluation, the selected alternative for remediating the LAOCB pipeline is Alternative P-3: In-situ Stabilization and Disposal in the LAOCB. This alternative will meet remedial action objectives by permanently eliminating ingestion of soils and produce grown in soils, eliminating direct radiation exposure, and providing a permanent reduction in contaminant mobility and potential future impacts to groundwater. In addition, this alternative poses minimal exposure of remedial workers and the community, is the least expensive alternative that meets remedial action objectives, and has met state and Federal regulatory and community acceptance.

Implementation of the LAOCB pipeline alternative (P-3) will first involve in-situ grouting of

the pipelines
to minimize the release of residual contaminants from inside the pipeline during excavation. Next, the
pipelines will be excavated, cut into manageable sections, and placed in the LAOCB along with any
contaminated soils associated with the pipelines. After being placed in the LAOCB, pipeline soil and voids
between pipeline sections will be grouted to create a monolith that will further reduce the mobility of
pipeline contaminants. As described in Alternative S-4 for LAOCB soils, the remaining depression in the
basin will be backfilled with clean soil. After sufficient compaction, an engineered cap will be constructed
that will minimize infiltration, intrusion, and surface erosion.

Based on characterization and risk evaluations of the soil in the LAACB, soil along the LAACB pipeline.
or soil along the effluent drainage ditch south of the LAACB, the No Action is the selected remedy. No
remedial action is required; however, the LAACB will be backfilled with native soil and vegetation will be
established in a similar fashion to the clew closure of the F-, H-, K-, and P-Acid/Caustic Basins (WSRC,
1995a). Final grade will be sloped to promote drainage and conform with surrounding terrain. The No
Action alternative will be protective of human health and the environment, and no post ROD
documentation or reviews will be necessary.

In the long-term, if the property is ever transferred to non-Federal ownership, the U.S. Government will, in
compliance with Section 120(h) of CERCLA, create a deed for the new property owner. The deed shall
include notification disclosing former waste Management and disposal activities as well as remedial actions
taken on the site. The deed notification shall, in perpetuity, notify any potential purchaser that the property
has been used for the management and disposal of radioactive oil and chemical wastewater. The deed shall
also include deed restrictions precluding residentiail use of the property. However, the need for these deed
restrictions may be reevaluated at the time ef transfer in the event that contamination no longer poses an
unacceptable risk under residential use. In addition, if the site is ever transferred to non-Federal ownership,

a survey plat of the area will be prepared by a certified professional land surveyor and recorded with the appropriate county recording agency.

These selected remedies and the No Action are intended to be the final action for the LAOCB/LAACB source unit. The solution is intended to be permanent and effective in both the long and short terms. These alternatives are considered to be the least cost options which are still protective of human health and the environment. Further assessment of the groundwater contamination will be conducted to define the extent of groundwater contaminant plumes under the comprehensive L-Area Southern Groundwater OU. This assessment will provide the data necessary to conduct a risk assessment Feasibility Study, Proposed Plan, and ROD for groundwater in the vicinity of the unit. The SCDHEC has modified the SRS RCRA permit to incorporate the selected remedy. This proposal is consistent with EPA guidance and is an effective use of risk management principles.

X. STATUTORY DETERMINATIONS

Based on the LAOCB/LAACB RFI/RI Report and the BRA, the LAOCB source OU poses significant risk to human health. Therefore, a determination has been made that in-situ S/S of the pipeline, excavation and placement of pipeline in the LAOCB, and in-situ S/S and capping of the LAOCB is protective of human health and environment for the residual contamination in the LAOCB pipeline and LAOCB soil.

The selected remedy is protective of human health and the environment, complies with Federal and State of South Carolina requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The high levels of radioactive contamination in the LAOCB warrant a remedy in which in-situ S/ and capping is a practical alternative. In-situ S/S and capping with result in the protection of unit groundwater through the S/S of unit COCs,and will be protective of on-unit human and ecological receptors by shielding radiation exposure and preventing the ingestion of unit COCs.

Based on characterization and risk evaluations, it has been determined that the LAACB source OU poses no significant risk to human health and the environment. A No Action alternative is appropriate for the LAACB and will be protective of human health and the environment. The LAACB will be backfilled with native soil and vegetation will be established in a similar fashion to the clean closure of the F-, H-, K-, and P-Acid/Caustic Basins (WSRC, 1995a).

Section 300.430 (f)(4)(ii) of the NCP requires that a five year review of the ROD be performed if hazardous substances, pollutants, or contaminants remain in the waste unit. The three Parties, DOE,

SCDHEC, and EPA, have determined that a five year review of the ROD for the LAOCB/LAACB will be performed to ensure continued protection of human health and the environment.

XI. EXPLANATION OF SIGNIFICANT CHANGES

The SB/PP and the draft RCRA permit modification provided for involvement with the community through a document review process and a public comment period. A public meeting was advertised and held on May 7, 1997. Comments that were received during the 45-day public comment period (April 4 - May 18, 1997) are addressed in Appendix A of this Record of Decision and are available with the final RCRA permit. There were no significant changes to the selected remedy as a result of public comments.

In selecting the remedy in this Record of Decision, a Savannah River Site bulk disposal alternative was not evaluated in the feasibility study, but is currently being developed and evaluated for radiologically contaminated soil/debris as a SDCR Should the SDCF concept become a Savannah River Site remedial option for radiologically contaminated soils prior to implementation of the selected LAOCB and LAOCB pipeline remedy, then the bulk disposal SDCF alternative will be evaluated for the LAOCB. This evaluation will fully consider the nine criteria established by the NCP in determining if the SDCF alternative is an appropriate remedy for the LAOCB and if the SDCF remedy is determined appropriate for the LAOCB, the change in remedy will cause no significant loss of monetary resources.

Should use of the SDCF concept be deemed appropriate for the LAOCB, this Record of Decision would require modification.

XII. RESPONSIVENESS SUMMARY

There were eight comments received during the public comment period. The Responsiveness Summary (see Appendix A) of this Record of Decision addresses these comments.

XIII. POST-ROD DOCUMENT SCHEDULE

The post-ROD document and implementation schedule is summarized below and is illustrated in Figure 13:

1. Corrective Measures/Remedial Design Work Plan (CM/RDWP) (Rev. 0) will be submitted for EPA and SCDHEC review within approximately 1 month after issuance of ROD.

2. The combined CM/Remedial Design Report (RDR)Remedial Action Work Plan (RAWP)(Rev. 0) will be submitted within approximately 4.5 months after issuance of ROD.

<IMG SRC 97204Y>

3. Corrective Measures/Remedial Action start on LAOCB soils and LAOCB pipelines will begin following EPA and SCDHEC approval of the RDR and RAWP.

XIV. REFERENCES

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APPENDIX A

RESPONSIVENESS SUMMARY

Responsiveness Summary

The 45-day public comment period for the Statement of Basis/Proposed Plan for the L-Area Oil & Chemical Basin and Acid/Caustic Basin (904-83G & 904-79G) began on April 4, 1997 and ended on May
18, 1997. A public meeting was held on May 7, 1997 and a Citizens Advisory Board (CAB) meeting was

held on May 13, 1997. Specific comments and responses are found below. The comments are italicized
and the responses are bolded. The CAB recommendations are also provided.

Public Comments

Comment 1: No remedial action (No Action Alternative) be performed at the LAOCB and the $4.6 million be used for remediation of higher risk sites at SRS.

Response 1: A risk assessment for the LAOCB was performed in accordance with CERCLA guidance. The relative risk values for the LAOCB indicate that remediation is required per the statutory requirements of CERCLA. The LAOCB is the second highest ranking unit with respect to risk as defined in the FFA. DOE concludes that there is significant risk to the environment and to the worker because of the following:

1) Transuranic Wastes are present in the LAOCB and should be stabilized.
2) The LAOCB is currently open to the atmosphere.
3) Vegetation uptake and mammals, reptiles, and fowl present a current risk of the uncontrolled release of radionuclides from the LAOCB.
4) The potential of adverse weather conditions (e.g., tornado) facilitating the uncontrolled release of radionuclides exists.
5) The LAOCB is the source of existing and potential future groundwater contamination.
6) Even with the exclusion of the risk posed by Cs-137 and Co-60 (>99 percent) at the LAOCB, the risk posed by the long-lived radionuclides (e.g., Pu-239) identified in the LAOCB soils is unacceptable.

Since the LAOCB poses unacceptable risk and a remedial action is appropriate, a CMS/FS was performed to identify appropriate remedial alternatives. The alternatives were screened in accordance wfth CERCLA guidance and a detailed analysis of select alternatives, using the nine evaluation criteria, was performed as required by the NCP.

The No Action alternative was fully evaluated and rejected, as presented in the administrative record (CMS/FS), because it would not provide a permanent reduction in contaminant mobility. In addition, The No Action alternative may, result in continued groundwater contamination that would require more funding to address than if the source term (LAOCB soil) were remediated.

EPA and SCDHEC have approved the Statement of Basis/Proposed Plan which recommends in-situ stabilization and capping. In-situ statbilization and capping was determined to be the least expensive alternative that would provide permanent reduction of contaminant mobility and meet the statutory requirements of CERCLA.

Comment 2: Groundwater remediation should be considered as part of the general L-Area groundwater situation.

Response 2: An area Groundwater Operable Unit (GOU) is proposed in the current FFA Appendix C and is entitled the L-Area Southern GOU. A schedule for addressing this GOU is currently under development DOE, EPA, and SCDHEC concur on this strategy of addressing the groundwater as a separate OU.

Comment 3. Deed restrictions should be placed on the land records now instead of waiting until some possible future land disposal action by the Federal Government

Response 3: Deed restrictions are not appropriate or needed at this time and would not apply until the property is transferred from government ownership. If the property is ever transferred to non-Federal ownership, a deed will be created and will have deed notification and deed restrictions. As stated on page 16 of 21 in the Statement of Basis/Proposed Plan, the need for the restrictions may be reevaluated at the time of property transfer.

Public Meeting Comments

The following comments were taken from the May 7, 1997 LAOCB Public Meeting transcript. The following comments are paraphrased from the public meeting transcript during the presentation of the proposed remedy for this waste unit.

Comment 4: My name is Lee Poe ftom Aiken, South Carolina, and based on the data provided, my conclusion is that it is unnecessary, as long as institutional controls are maintained at SRS, to spend $4.5 million on the remediation of the LAOCB. This conclusion is based on the following reasons:

1) The remedial action would erpose the workers of SRS to unnecessary risks
2) The current risk of the basin is minimal and comparable to risks at other areas on and off the site
3) Delaying an action at LAOCB until there is a decision on the land use in the vicinity of the L40CB is appropriate.
4) The $4.5 million that we are talking about spending on this remedial activity should be applied to things at the SRS duo have more immediate and red risk than the risk from this basin to some future population that is a

tenuous
situation of best.

These comments are consistent with the Mr. Poe's formal written comments on the Statement of Basis/Proposed Plan for the LA0CB/LAACB, Revision 1 (February 1997) submitted to fMRC Public Invohmement on April 7, 1997.

Response 4: See response to Comment #1.

Comment 5: My name is Trish McCracken from Augusta, Georgia, and I think it is important to prioritize projects of this nature at the SRS. The cost and spending are very important from the taxpayers' standpoint. If my understanding of the data is correct, the current risk at the LAOCB is low and comparable to many sites across the country. I find it very surprising that Region IV EPA and the State of South Carolina would impose more cost at this site than they do at other industrial sites which probably present the same level of risk. If the regulatory agencies are going to impose these measures at this site, then they should be imposed across the country.

Response 5: The LAOCB is the second highest ranking unit with respect to risk as defined in the FFA. The FFA has been approved and agreed upon by the DOE, EPA, and SCDHEC. This action is consistent with current environmental laws (i.e., RCRA and CERCLA) that are enforced by EPA and SCDHEC. DOE concludes that there is significant risk to the environment and the worker as outlined in Response #1, and a remedial action is appropriate.

Comment 6: My name is Sam Booher from Augusta, Georgia and if the decision is to proceed with the backfill and grouting of the LAOCB. I would like to request that DOE give serious consideration to removing the liquids, whether it's rainwater, oil, I don't care what the liquid is, before you pour dirt in there.

Response 6: DOE will consider removal and disposal of the liquids prior to backfilling. These activities will be detailed in the Remedial Design Report and Remedial Action Work

Plan.

Comment 7: My name is Suzanne Matthews from Aiken, South Carolina and I do believe that No Action at this no risk L-Basin is appropriate because the funding is not going to be there.

Now speaking, maybe for CAB, the CAB is going to emphasize the priority living of waste units at SRS, and they will support the remediation of high risk waste areas and not the waste areas with low risk.

Response 7: See response to comment 5.

Comment 8: This is Sam Booher again, and I would like to make a suggestion for future public meetings of this type. I would like to have heard at least a brief summary on each of the remedial alternatives considered for the LAOCB before presenting the selected remedy.

It seems that of the six considered alternatives, three of them consisted of filling/capping the basin.

Response 8: A detailed screening and summary of all alternatives considered for the LAOCB is presented in the CMS/FS and also presented in the SB/PP. These documents have been approved by EPA and SCDHEC, and are available in the Administrative Record. Radionuclides are unique contaminants with a very limited selection of remedial responses/technologies, with stabilization and containment being the preferred technologies. DOE will in the future provide a brief overview of the alternatives considered at public meetings of this type so that the public may have a better understanding of the rationale for choosing the selected remedies.

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 03/23/1998
Operable Unit: 20
ROD ID: EPA/541/R-98/021

Media: Groundwater, Soil

Contaminant: Inorganics, Metals, PAH, Radioactive

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. SRS is a secured U.S. government facility with no permanent residents. SRS is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina.

SRS is owned by the Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided nuclear materials for the space program and for medical, industrial, and research efforts. Chemical and radioactive wastes are by-products of nuclear material production processes. The entire SRS facility was placed on the National Priorities List (NPL) in December 1989.

Operable Unit (OU1):

The M-Area Hazardous Waste Management Facility (HWMF) is a source-specific operable unit within the A/M Area Fundamental Study Area. The M-Area HWMF includes an unlined surface impoundment (settling basin), a portion of an inactive process sewer line, drainage and seepage areas, and a Carolina bay known as Lost Lake. The nearest plant boundary is approximately 5800 feet northwest of the M-Area HWMF.

The M-Area settling basin was constructed in 1958 to settle out metals discharged from M-Area manufacturing operations. The basin dimensions were approximately 330 feet by 280 feet by 17 feet with a volumetric capacity of approximately eight million gallons. Overflow from the settling basin was directed to a natural seepage area and ultimately to Lost Lake. In July 1985, a permitted wastewater treatment facility was placed in operation and discharges to the settling basin were discontinued.

A Record of Decision (ROD) addressing OU1 was completed in June 1992.

OU2:

The Metallurgical Laboratory HWMF is a source-specific operable unit within the A/M Area fundamental Study Area. The Metallurgical Laboratory HWMF includes an abandoned portion of a process sewer line, a seepage basin, a drainage outfall, and a Carolina bay. The nearest plant boundary is located approximately three-fourths of a mile to the northwest of this operable unit.

The Metallurgical Laboratory was used for corrosion testing on stainless steels and nickel-based alloys. This testing required degreasing and cleaning metal parts, etching sample identification information on the parts, and photographing the samples. No radioactive materials were known to have been discharged to the HWMF. During periods of heavy rainfall, wastewater and surface water overflowed a drainage outfall at the Metallurgical Laboratory Basin into the adjacent Carolina Bay. A RCRA closure plan for the basin and sewer line portions of the Metallurgical Laboratory HWMF was submitted and approved in June 1991. The intent of the closure plan is to ensure the basin and sewer line portions of the Metallurgical Laboratory HWMF will be closed in a manner that controls, minimizes, or eliminates post-closure migration of hazardous constituents and decomposition products to the vadose zone, groundwater, surface waters, or atmosphere.

A ROD addressing OU2 was completed in June 1992.

OU3:

The A/M Area, located in the northwest portion of SRS, contains nuclear fuel fabrication buildings, office buildings, and research areas. The A/M Area groundwater is a media-specific operable unit

within the A/M Area Fundamental Study Area. As a result of past waste disposal practices, the groundwater beneath A/M Area has been contaminated with organic solvents, primarily trichloroethylene (TCE) and tetrachloroethylene (perchloroethylene; PCE). Total plume size beneath the A/M Area, as currently defined, is approximately 1200 acres. The contamination in the A/M Area groundwater and the overlying unsaturated zone appears to be associated with releases from the following A/M Area source units: the A-014 Outfall, the M-Area Settling Basin/Lost Lake (M-Area HWMF), and the M-Area HWMF Process Sewer, and the 321-M Solvent Storage Area.

From 1952 to 1981, an estimated 13 million pounds of chlorinated solvents were used in the A/M Area to degrease fuel and target tubes used in SRS reactors. An estimated 50 to 90 percent of the solvents evaporated during degreasing operations. The remaining solvents were discharged as waste to the process sewer system. Additionally, significant quantities of chlorinated solvents were inadvertently spilled during handling and storage.

A ROD addressing OU3 was completed in June 1992.

OU4:

The Gunsite 720 Rubble Pit is located within SRS and is approximately 305 meters (100 feet) west of South Carolina Highway 125, 168 meters (550 feet) north of SRS Road A-2, and 2.5 kilometers (1.5 miles) from the nearest SRS boundary.

During the period from 1955 to 1960, to defend the SRS in the event of an air attack, the U.S. Army established onsite anti-aircraft artillery gun emplacements at several locations near the perimeter of SRS. The Gunsite 720 was one of those emplacements. In the early 1980s, while work was being performed in the area, nine empty, partially buried drums, labeled "duPont Freon 11" were found at the gunsite. The drums were excavated in July 1987, and placed on a pallet at the gunsite. The drums were excavated in July 1987, and placed on a pallet at the gunsite. The area around the drums was screened during excavation and the liquid (rainwater) that collected in the excavated drums was sampled prior to disposal. No evidence of hazardous substances was found. In October, 1989, the drums were removed from the unit.

A ROD addressing OU4 was completed in March 1997.

OU5:

The Gunsite 113 Access Road Unit is located in the northeast corner of SRS, adjacent to the access road leading to Gunsite 113, and is approximately 91.5 meters (300 feet) east of where SRS Road 8 crosses the SRS facility boundary.

The area appears to have been used as a surface disposal area for

spoil dirt and/or road construction debris. There is no documentation or record of any hazardous substance management, disposal, or any other type of waste disposal at this unit. There is no evidence that any recent disposal activities have occurred in this area or that disposal activities were more widespread. Also, there is no evidence of any burning or excavation at this waste unit.
A ROD addressing OU5 was completed in March 1997.

OU6:
The F-Area HWMF (basins F-1, F-2, and F-3) operated from 1955 until November 1988. During that time, the facility received waste effluents from F-Area chemical separation facilities processes such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads. The three basins had a combined maximum operating capacity of 20.5 million gallons of wastewater.
These basins were closed by dewatering, physically and chemically stabilizing the remaining sludges and placing a protective multi-layer cover system over them to reduce rainwater contact with basin bottoms.
Closure of the F-Area HWMF was begun in 1989 and completed in January 1991. The F-Area HWMF was certified closed in February 1991. Closure activities specifically included removal of standing water remaining in the basin; stabilization of the basin sludge with a layer of granite, limestone and blast furnace slag; construction of a low permeability cap over the basin; and restoration of the area.
A ROD addressing OU6 was completed in September 1993.

OU7:
The H-Area HWMF is a source specific operable unit within the H-Area Fundamental Study Area. The H-Area HWMF consists of three unlined, earthen surface impoundments located in the center of SRS, southwest of Road E and north of road 4 approximately 6 miles from the nearest site boundary.
The H-Area HWMF operated from 1955 until November 1988. The original H-Area HWMF consisted of basins H-1, H-2, and H-3 and operated from 1955 to 1962. In 1962 H-3 was replaced by H-4. At the time of closure, the H-Area HWMF had a combined maximum operating capacity of 26.5 million gallons of wastewater. The H-Area HWMF received waste effluents from H-Area chemical separation facilities processes such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads.
The four basins were closed by dewatering, physically and chemically stabilizing the remaining sludges and placing a protective multi-layer cover system over them to reduce rainwater contact with

basin bottoms.

OU8:
The F-Area HWMF is a source specific operable unit within the F-Area Fundamental Study Area. The F-Area HWMF is located in the center of SRS, Southwest of Road E and North of Road 4 approximately 16 miles from the nearest plant boundary. The F-Area HWMF consisted of three unlined earthen basins that had a combined maximum operating capacity of 20.5 million gallons of waste water during operation. It received waste effluents from F-Area chemical separations facilities such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads. Significant amounts of nitrates and caustics were received.
A ROD addressing OU8 was completed in April 1995.

OU9:
The H-Area HWMF consists of a series of three hydraulically connected unlined basins (H-1, H-2, and H-4). Basin H-4 was built in 1962 to replace basin H-3. Wastewater flow to the basins was terminated on November 7, 1988 in accordance with the requirements of RCRA. The H-Area HWMF received waste effluents from H-Area chemical separations facilities such as nitric acid recovery unit, waste storage system evaporator overheads, and general purpose overheads. The waste stream contained hazardous constituents and low levels of radionuclides.
A ROD addressing OU9 was completed in April 1995.

OU10:
The Fire Department Hose Training Facility (FDHTF) is located approximately 200 meters (700 feet) northeast of the intersection of Roads C and 6 and approximately six meters (20 feet) west and downgradient of a heat exchanger storage pad. The FDHTF is a source control and groundwater operable unit. The FDHTF was built between 1975 and March 1979 and operated by the SRS Fire Department between 1979 and 1982 to train personnel in fighting waste oil fires. Training exercises typically included pouring burnable oil into the unit, igniting the oil, and then having the fire department extinguish the fire with water from fire hydrants located adjacent to the unit. No known hazardous wastes were placed in the unit.
The SRS Fire Department discontinued use of the FDHTF and recommended the facility for cleanup and closure in March 1982. Available documentation indicates cleanup activities occurred on November 21, 1982 during which 14 loads of oil-contaminated soil were excavated from an area approximately 6 by 6 by 1 meter and

transported to the sanitary landfill. However, the date of this cleanup activity could not be verified.
A ROD addressing OU10 was completed in August 1998.

OU11:
The Central Shops Burning/Rubble Pit (631-6G) (BRP6G)is located in the Central Shops Area near the center of the SRS. It operated from 1951 through 1955 for the disposal and burning of waste materials. The unit consisted of a shallow unlined excavation, approximately 3m (10 feet) deep. Materials believed to be disposed of in the pit included waste oils, rags, paper, cardboard, plastics, degreasers, wood, rubber, and drummed organic solvents. These materials were periodically burned in the pit, usually on a monthly basis. The volume of waste disposed of at BRP6G was not recorded.
A ROD addressing OU11 was completed in May 1997.

OU12:
The M-Area West unit is located west of the M-Area Production Facility on a dirt road approximately 1.8 kilometers north of Silverton Road. There are no structures of any type located at or near M-Area West. The only nearby man-made feature is a dirt access road located about 30 to 40 feet west of the waste areas.
The unit consists of two small areas. Several drums and other small innocuous debris were found on the land surface adjacent to a dirt road approximately 1 kilometer west of the M-Area production facility. The total waste at the unit consisted of six empty 55-gallon drums, four 1-gallon cans and a 1-gallon glass jar. The cans and the jar were originally contained in one of the larger drums. With the exception of a crushed drum and small amounts of metal debris, all other materials were removed from the site in 1992.
There is no documented information available regarding past hazardous or non-hazardous waste disposal activities at M-Area West. Markings on the drums found at the unit suggest that they once contained oil and solvents, and that they are approximately 37 years old. There is no evidence that any recent disposal activity has occurred or that the disposal activity was more widespread. Also, there is no evidence of any burning or excavation at this waste unit.
A ROD addressing OU12 was completed in September 1995.

OU13:
The Silverton Road Waste Unit (SRWU) is located in the northwestern part of SRS in Aiken County, approximately 1.5 miles southwest of A/M Area. The SRWU was first used before construction of the SRS. Municipal, agricultural, and commercial trash, rubbish, garbage, debris, and refuse probably constituted the waste stream until the early 1950s. After procurement by the federal

government, the SRWU land continued to be used as an open dump for disposal of metal shavings, 55-gallon drums, cardboard drums, tires, lumber, etc. No records of waste disposal activities were kept. In 1974, the disposal of waste at the SRWU ceased, and the area was bulldozed, graded, covered with soil, and planted with grasses.
A ROD addressing OU13 was completed in March 1997.

OU14:
The F-Area Burning /Rubble Pits (FBRP) comprise a source unit located within the SRS, approximately 3000 feet west of F-Area and 1100 feet north of SRS Road C. Between 1951 and 1973, SRS used Pits 231-F and 231-1F to burn a variety of wastes which were considered non-hazardous at that time. Some of these waste materials (degreasers and solvents) are now considered to be hazardous based on ingestion or possible dermal contact. Waste was usually burned on a monthly basis. The chemical composition and volumes of the disposed waste are unknown, but waste materials burned included paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents.
A ROD addressing OU14 was completed in March 1997.

OU15:
The D-Area Burning/Rubble Pits (DBRP) are located in the western part of the SRS in Barnwell County, approximately 2600 feet west of D Area and 1.6 miles west of State Highway. Between 1951 and 1973, burning pits were used at SRS to burn a variety of hazardous and non-hazardous waste. The chemical composition and volumes of the disposed waste are unknown. Combustible materials, which were burned monthly, included paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents. No known or suspected radioactive materials were allowed in the burning pits. Burning of waste in the SRS pits was discontinued by October 1973. A layer of soil was then placed over the residue in the pits and they were subsequently used as rubble pits.
A ROD addressing OU15 was completed in March 1997.

OU16:
The Old F-Area Seepage Basin (OFASB) is located within the SRS, approximately 600 feet north of F Area and one mile east of Road C and is located in Aiken County. The Savannah River and associated swamps are located approximately six miles west of the basin. The OFASB is designated as Building Number 904-49G and covers a total area of 1.3 acres.
Between November 1954 and mid-May 1955, 9 to 14 million gallons of wastewater were discharged to the basin which served as an unlined seepage basin for the purpose of reducing radioactive

substance concentrations. Wastewater included overhead condensates from evaporators, laundry washwaters, non-reactor cooling water from F and H Areas, and possibly other chemicals.
A ROD addressing OU16 was completed in May 1997.

OU17:
The L-Area Oil and Chemical Basin (LAOCB) and L-Area Acid Caustic Basin (LAACB) are located south of L-Area in an area of low to moderate relief. They are situated on the southern flank of a hill approximately 300 feet south of the L-Area perimeter fence and 1,250 feet north of L Lake.
The LAOCB was designed and constructed as an unlined seepage basin in 1961 for the purpose of disposing of small volumes of wastes that were not appropriate for discharge to local streams, regular seepage basins, or the 200-Area waste management system. The exact quantity of waste water discharged to the LAOCB basin is not documented. Liquid wastes consisting of small volumes of slightly radioactive oil and chemical wastewater were sent to the LAOCB from throughout SRS, but came primarily from the reactor areas. Wastes were transported to the drainage pad in tank trucks, metal drums, skid tanks, and other containers. The Hot Shop (Building 717-G) discharged decontaminated wastewater containing radionuclides, detergents, and spent degreasing solvents through the pipeline to the basin.
A ROD addressing OU17 was completed in March 1997.

OU18:
The Burma Road Rubble Pit (BRRP) is located approximately one-half mile southwest of F-Area Separations Facility and one-tenth mile southwest of C Road. The BRRP is between Upper Three Runs Creek and Four Mile Creek.
The BRRP consists of two unlined earthen pits dug into surficial soil and filled with various waste materials. A small circular area of disturbed soil was detected adjacent to these pits and is considered to have been used as a source of backfill for the pits. It has been determined that the BRRP source control OU does not contribute contamination to the area groundwater or surrounding soils.
A ROD describing OU18 was completed in August 1998.

OU20:
The K-Area Bingham Pump Outage Pit (KBPOP) is situated in the Tobacco Road formation which extends from ground surface to a depth of 95 feet below ground surface. Between 1957 and 1958, miscellaneous construction debris generated by major modifications and repairs to the primary and secondary reactor cooling water systems was buried in the KBPOP. There were no pumps buried and

no liquid waste was disposed of in the KBPOP.
A ROD addressing OU20 was completed in March 1998.

OU23:
The F-Area Retention Basin (FRB) is located outside and south of the F-Area perimeter fence, approximately 1035 meters (3397 feet) from Fourmile Branch. The FRB, with an area of 0.6 acres, was designed and operated as an unlined, temporary container for potentially contaminated cooling water from the F-Area Canyon Facility and stormwater drainage from the F-Area Tank Farm. Cooling water from the Canyon Facility generally had low levels of radioactivity, while water from the Tank Farm is believed to have had only trace quantities of nonradionuclide chemicals. The quantities of water released to the retention basin and the level of various constituents contained within the water are unknown.
A ROD addressing OU23 was completed in September 1998.

OU27:
The D-Area Oil Seepage Basin is located on the Ellenton Plain, the highest of three terraces between the Savannah River to the west and the Aiken Plateau to the east. Construction of the D-Area Oil Seepage Basin trenches began in 1952. Employee interviews indicated the basin was used in the disposal of waste oil originating from D-Area Powerhouse operations to dispose of nonburnable waste and for the routine burning of office and cafeteria waste. Unknown amounts and types of waste were disposed into the basin. Records of the contents of the disposed drums do not exist. To date, there is no evidence to indicate the presence of radionuclides in the drums. Furthermore, employee interviews have indicated that no radionuclides were disposed within the trenches. In 1975, the D-Area Oil Seepage Basin was removed from service and backfilled with soil. Approximately one foot of standing liquid, plus an unknown number of 55-gallon drums possibly containing waste oil, remained in the basin when it was backfilled. The basin remains inactive and is covered with natural vegetation, including bushes and grasses, and is surrounded by trees.
RODs addressing OU27 were completed in March 1995 and August 1998.

OU29:
The TNX Area is a pilot scale test facility for the SRTC. The pilot scale facilities are used to provide technical support to various SRS production areas. From 1953 to August 1988, wastewater generated by research performed in the TNX Area was disposed of in seepage basins. In August 1988, wastewater was rerouted to the TNX Effluent Treatment Facility.

A ROD addressing OU29 was completed in November 1994.

OU32:
The Burial Ground Complex (BGC) is an area which occupies approximately 195 acres in the central part of SRS between F and H Separation Areas, on a nearly flat divide between Upper Three Runs Creek to the north and Four Mile Creek to the south.
The BGC includes the Old Radioactive Waste Burial Ground (ORWBG) and other OUs such as the Mixed Waste Management Facility (MWMF), the Low Level Radioactive Waste Disposal Facility (LLRWDF), Solvent Tanks S1-S22 (located in the ORWBG and currently being characterized), Solvent Tanks S23-S30, and Solvent Tank S32.
The ORWBG comprises a disposal area for solid radioactive waste produced at the SRS, as well as shipments from other U.S. DOE and Department of Defense facilities. The ORWBG has contributed to localizedshallow aquifer groundwater contamination. The plume of groundwater contamination from the ORWBG seeps into the old F-Area effluent stream which flows into Four Mile Creek which in turn flows into the Savannah River. Other RCRA/CERCLA units within the BGC are undergoing characterization and investigation to determine the impacts to the environment.
The ORWBG began receiving waste in 1952 and was filled in 1972. Examples of materials disposed of at the Old Radioactive Waste Burial Ground (ORWBG) include the incidental waste from laboratory and production operations, contaminated equipment, lead, spent deionizer resins, spent lithium-aluminum targets, irradiated process oil from pumps in the tritium facilities and reactor areas, mercury from gas pumps in tritium facilities, cadmium, scintillation fluid, and shipments from off-site.
A ROD addressing OU32 was completed in June 1996.

OU33:
The mixed waste management facility (MWMF) operated from 1969 until March 11, 1986. During that time, this facility, which comprises approximately 58 acres, received low-level radioactive waste materials produced at SRS. Some of these materials are classified as mixed waste containing both hazardous and radioactive components under the RCRA. These trenches were closed by precompacting and placing a protective multi-layer cover system over them to reduce rainwater contact with trench bottoms.
RCRA preventive actions at the MWMF were conducted pursuant to the requirements of RCRA. In 1985 a RCRA Closure Plan was submitted, and closure of the MWMF was begun in 1988 and completed in December 1990. The MWMF was certified closed in 1991. Closure activities specifically included precompaction,

construction of a low permeability cap over the trenches, and restoration of the area.
A ROD addressing OU33 was completed in September 1994.

OU34:
The Tank 105-C HWMF was installed in 1961 as part of an off-line heat exchanger repair program and was used as a temporary holding tank for liquid solution. Sumps from the heat exchanger cleaning area drained into Tank 105-C. Oil in the tank was probably attributable to oil leaks into these sumps. The reacted or spent oxalic acid solution that resulted from the rinsing process was pumped into an above ground neutralization tank in the stack area of the reactor building.
In October 1990, a RCRA Closure Plan was submitted to the SCDHEC. SRS received approval of the closure plan on January 16, 1991, with no revision required. Closure activities specifically included the neutralization of waste to a pH of less than 12.5, removal of as much waste as reasonably possible, and shipment of removed waste to an onsite storage/disposal facility. Any remaining waste and the tank void were stabilized with concrete.
A ROD addressing OU34 was completed in September 1994.

OU35:
Par Pond is a 2640-acre man-made reservoir located northeast of P Area and east of R Area in the eastern portion of SRS. The southern shore of the reservoir lies approximately 1.5 miles from the eastern SRS boundary. The southern shore of the reservoir lies approximately 200 feet north of Road B. Par Pond discharges through controlled releases into Lower Three Runs Creek, which in turn discharges into the Savannah River. The length of Lower Three Runs Creek from the outfall of Par Pond to the Savannah River is approximately 20 miles.
Par Pond was built to augment the cooling water requirements of both P and R Reactors. During the 1950s, an effluent pathway was constructed from R Reactor to Par Pond. The pathway consisted of the R Canal and Pond B. Releases in the form of process leaks, purges, and makeup cooling water have contaminated Par Pond with cesium-137 and other radioactive and non-radioactive contaminants. Mercury has been detected in fish from the Savannah River and SRS waterbodies since the analyses began in 1971, with comparable concentrations measured in onsite and offsite fish.
A ROD describing OU35 was completed in February 1995.

OU41:
OU41 contains the P-Area CP R/O Basin (P-CRPB). The P-CRPB is located approximately 330 feet southeast of the limited area fence

surrounding P Area in northwestern Barnwell County.
A ROD addressing OU41 was completed in September 1998.

OU42:
OU42 contains the C-Area CP R/O Basin (C-CRPB). The C-CPRB is located approximately 700 feet southeast of the limited area fence surrounding C Area in northwestern Barnwell County.
A ROD addressing OU42 was completed in September 1998.

OU45:
The Grace Road Site is located approximately 1.3 kilometers south of B-Area and about 244 meters east of the intersection of Grace Road and SRS Road 2. It consists of numerous drums and cans, concrete slabs, brick foundations, and miscellaneous debris. The unit also contained numerous drums and cans varying in size from ? gallon cans to 55-gallon drums and various car parts. Most of the debris was on the surface or partially buried in scattered locations across the unit. Markings on a few of the smaller drums and cans indicated that they once contained oil and grease. There is no evidence that any recent disposal activity has occurred or that the disposal activity was more widespread. Also, there is no evidence of any burning or excavation at this waste unit.
Between February and May 1992, all the debris, drums and concrete slabs were removed from the Grace Road Site. The items removed were either used at soil erosion control areas or were disposed of in the sanitary landfill. No records of any type of waste management activity have been found for the Grace Road Site.
A ROD addressing OU45 was completed in March 1997.

OU51:
The Motor Shops Seepage Basin (716-A) (MSSB) is located in A Area south of the railroad tracks near the automotive shop in Aiken County. A small drainage feature runs through the area approximately 91 meters (300 feet) to the east of the MSSB.
The MSSB was constructed and placed in service in 1977 to receive liquid waste from the 716-A Motor Shops oil/water separator. The MSSB was designed and constructed as an unlined seepage basin. The wastewater flowed into the basin from the northwest through two influent pipes from the Motor Shop and seeped naturally into the soil beneath the basin. Effluent discharges from the Motor Shops included wastewater with trace amounts of engine oil, grease, kerosene, ethylene glycol, and soapy water.
A ROD addressing OU51 was completed in June 1998.

OU52:
The K-Area CP R/O Basin (K-CPRB). The K-CPRB is located

approximately 500 feet west of the limited area fence surrounding K Area in northwestern Barnwell County.
A ROD addressing OU52 was completed in September 1998.

OU54:
The F-Area CP R/O Basin (F-CPRB) is located approximately 50 feet southeast of the limited area fence surrounding F Area in southwestern Aiken County.
A ROD addressing OU54 was completed in September 1998.

Remedy: The preferred alternative for the K Bingham Pump Outage Pit (KBPOP) operable unit (OU) is Institutional Controls which will restrict this land to nonresidential use and preclude residential use of this area. The risk levels present at the KBPOP are at the lower end of the risk range. However, the presence of buried debris with fixed contamination requires Institutional Controls in order to be protective from unauthorized removal/excavation concerns. Implementation of the Institutional Controls alternative will require both near- and long-term actions which will be protective of human health and the environment. For the near-term, signs will be posted at the KBPOP indicating that this area was used to manage hazardous materials. In addition, existing Savannah River Site (SRS) access controls will be used to maintain this site for nonresidential use.

In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government will take those actions necessary pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 120(h). These actions will include a deed notification disclosing former waste management and disposal activities as well as any remedial actions taken on the site. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of construction debris and other materials, including hazardous substances.

The deed shall also include deed restrictions precluding residential use of the property. However, the need for deed restrictions may be reevaluated at the time of transfer in the event that exposure assumptions differ and/or contamination no longer poses an unacceptable risk under residential use. In addition, if the site is ever transferred to non-federal ownership, a survey plat of the area will be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency. Institutional Controls meets the remedial goals for the KBPOP (OU) by precluding future on-site residential use of the area, buried waste contact, removal, or excavation.

The remedial investigation/baseline risk assessment (RI/BRA) concludes that the KBPOP is not impacting groundwater. Constituents are not observed to have migrated horizontally and clayey zones underneath the base of the pit will limit vertical migration potential.

Estimated Present Worth Capital Cost: $30,000
Estimated Present Worth O&M Cost (5-year): $320,000
Estimated Total Present Worth Cost: $350,000

Text: Full-text ROD document follows on next page.

EPA 541-R98-021

<SCR IMG 980210>

United States Department of Energy

Savannah River Site

Record of Decision
Remedial Alternative Selection for the
K-Area Bingham Pump Outage Pit (643-1G) (U)

WSRC-RP-97-178
Revision 1
October 1997

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

<SCR IMG 98021A>

Prepared for the U.S. Department of Energy under Contract No. DE-AC09-96-SR18500

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U.S. Department of Energy
and
Westinghouse Savannah River Company
Aiken, South Carolina

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

K-Area Bingham Pump Outage Pit (643-1G)

WSRC-RP-97-178
Revision 1
October 1997

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U.S. Department or Energy Under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

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DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

K-Area Bingham Pump Outage Pit (SRS Building Number 643-1G)
Savannah River Site
Aiken, South Carolina

The K-Area Bingham Pump Outage Pit (KBPOP) Operable Unit (OU) is listed as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS). This OU is comprised of source (soil) control and groundwater units.

Statement of Basis and Purpose

This decision document presents the selected remedial alternative for the KBPOP located at the SRS in Aiken, South Carolina. The selected alternative was developed in accordance with CERCLA, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this specific CERCLA unit.

Description of the Selected Remedy

The preferred alternative for the KBPOP operable unit is Institutional Controls which will restrict this land to nonresidential use and preclude residential use of this area. The risk levels present at the KBPOP are at the lower end of the risk range. However, the presence of buried debris with fixed contamination requires Institutional Controls in order to be protective from unauthorized removal/excavation concerns. Implementation of the Institutional Controls alternative will require both near- and long-term actions which will be protective of human health and the environment. For the near-term, signs will be posted at the KBPOP indicating that this area was used to manage hazardous materials. In addition, existing SRS access controls will be used to maintain this site for nonresidential use.

In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government will take those actions necessary pursuant to CERCLA 120(h). These actions will include a deed notification disclosing former waste management and disposal activities as well as any remedial actions taken on the site. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of construction debris and other materials, including hazardous substances.

The deed shall also include deed restrictions precluding residential use of the property. However, the need for deed restrictions may be reevaluated at the time of transfer in the event that exposure assumptions

differ and/or contamination no longer poses an unacceptable risk under residential use. In addition, if the site is ever transferred to non-federal ownership, a survey plat of the area will be prepared, certified by a professional land surveyor, and recorded with the appropriate county recording agency.

Institutional Controls meets the remedial goals for the KBPOP operable unit by precluding future on-site residential use of the area, buried waste contact, removal, or excavation.

The RI/BRA concludes that the KBPOP is not impacting groundwater. Constituents are not observed to have migrated horizontally and clayey zones underneath the base of the pit will limit vertical migration potential.

The post-Record of Decision (ROD) document, the KBPOP Corrective Measures Implementation/Remedial Action Report (CMI/RAR), will be submitted to the regulatory agencies four months after issuance of the ROD. The regulatory review period, SRS revision period, and final regulatory review and approval period for the CMI/RAR will be 90 days, 60 days, and 30 days, respectively.

The KBPOP is not subject to the requirements for Resource Conservation and Recovery Act (RCRA) permit modification per Appendix C of the FFA for the SRS.

Statutory Determinations

Based on the KBPOP Remedial Investigation Report with Baseline Risk Assessment, the KBPOP poses no significant risk to the environment and minimal risk to human health. Therefore, a determination has been made that Institutional Controls are sufficient for protection of human health and the environment for the KBPOP operable unit.

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial actions, and is cost-effective. The low levels of contaminants in the soil make treatment impractical. Because treatment of the principal threats of the site was found to be impracticable, this remedy does not satisfy the statutory preference for treatment as a principal element.

Section 300.430 (f)(4)(ii) of the NCP requires that a five-year review of the ROD be performed if hazardous substances, pollutants, or contaminants remain in the waste unit. The three Parties, U.S. Department of Energy, South Carolina Department of Health and Environmental Control, and U.S. Environmental Protection Agency, have determined that a five-year review of the ROD for the KBPOP will be performed to ensure continued protection of human health and the environment.

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DECISION SUMMARY
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K-Area Bingham Pump Outage Pit (643-IG)

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Revision 1
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Savannah River Site
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LIST OF ACRONYMS AND ABBREVIATIONS

ARARs	Applicable or Relevant and Appropriate Requirements
ASCAD TM	Approved Standardized Corrective Action Design
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMI/RAR	Corrective Measures Implementation/Remedial Action Report
COCS	Constituents of Concern
COPCs	Constituents of Potential Concern
CFR	Code of Federal Regulations
CSM	Conceptual Site Model
DOE	U.S. Department of Energy
EAV	E-Arca Vaults
EPA	U.S. Environmental Protection Agency
FFA	Federal Facility Agreement
FS	Feasibility Study
HI	Hazard Index
KBPOP	K-Area Bingham Pump Outage Pit
NCP	National Oil and Substances Pollution Contingency Plan
OU	Operable Unit
RAOs	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act

RGs	Remedial Goals
RI	Remedial Investigation
ROD	Record of Decision
SCDHEC	South Carolina Department of Health and Environmental Concern
SDCF	Soils/Debris Consolidation Facility
SRS	Savannah River Site
WSRC	Westinghouse Savannah River Company

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I. SAVANNAH RIVER SITE AND OPERABLE UNIT NAME, LOCATION, DESCRIPTION, AND PROCESS HISTORY

Savannah River Site Location, Description, and Process History

The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of western South Carolina. SRS is a secured U.S. Government facility with no permanent residents, and is located approximately 25

miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina (Figure 1).

SRS is owned by the U.S. Department of Energy (DOE). Management and operating services are currently provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense and the space program. Chemical and radioactive wastes are by-products of nuclear material production processes.

Operable Unit Name, Location, Description, and Process History

The Federal Facility Agreement (FFA) for the SRS lists the K-Area Bingham Pump Outage Pit (KBPOP), 643-1G, as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit requiring further evaluation, using an investigation/assessment process to determine the actual or potential impact to human health and the environment. The KBPOP is not subject to requirements for Resource Conservation and Recovery Act (RCRA) permit modification per Appendix C of the FFA. The K Reactor (Figure 1) is located in the west-central part of the SRS (approximately 4 miles cast of the SRS boundary). The KBPOP is located immediately south and outside of the K Reactor fence line (Figure 2) with a surface boundary of approximately 400 feet in length and 60 feet in width (Figure 3).

Surface water drainage ditches surround the KBPOP to the north, west, and south. These ditches collect and redirect runoff water to reduce erosion. As depicted in Figure 2, the KBPOP is located on the west side of a small topographical high. Consequently, surface water drainage from other areas has little or no effect on the surface of the KBPOP. Generally, no surface water is found in the drainage ditches.

The KBPOP is situated in the Tobacco Road formation which extends from ground surface to a depth of 95 feet below ground surface. The Tobacco Road formation is composed of dark red to tan, very fine to fine sandy clay and clayey sands with laminated tan and purple, silty, clayey very fine to medium sands.

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The groundwater flow direction is to the southwest across the KBPOP and the groundwater flow rate for the water table aquifer beneath the KBPOP is estimated at approximately 91.25 ft/year.

Between 1957 and 1958, miscellaneous construction debris (pipes, cables, ladders, etc.) generated by major modifications and repairs to the primary and secondary reactor cooling water systems was buried in the KBPOP. There were no pumps buried and no liquid waste was disposed of in the KBPOP. The depth of excavation at the KBPOP ranged from 9 to 14 feet, which indicates a sloping pit base (this is consistent with the use of the pit for disposal purposes). Low-level radioactive debris generated by the repairs (less than 25 mR/hr with no detected alpha activity) was buried in the KBPOP. Debris with radioactive contamination greater than 25 mR/hr was placed at the SRS Burial Ground. Table 1 illustrates the estimated inventory of activity at the time of burial and as of December 31, 1995. The estimated burial inventories provided in Table 1 are based on a conservative estimation from the process history of reactor operations and was taken from the 1987 BPOPs Environmental Information Document. This list is not considered to be an all inclusive list of radionuclides that were evaluated during the KBPOP characterization. For complete details on the list of radionuclides that were evaluated during the unit characterization, refer to the KBPOP RI Work Plan.

The KBPOP was backfilled with approximately four feet of fill material in 1958 and is now an open grassy area marked by orange ball markers and concrete monuments. Annual inspections are conducted for signs of soil subsidence; and, sunken areas are filled to grade as needed.

II. SITE AND OPERABLE UNIT COMPLIANCE HISTORY

SRS Operational History

The primary mission of SRS was to produce tritium, plutonium-239, and other special nuclear materials for our nation's defense programs. Production of nuclear materials for the defense program was discontinued in 1988. SRS has provided nuclear materials for the space program, as well as for medical, industrial, and research efforts up to the present. Chemical and radioactive wastes are by-products of nuclear material production processes. These wastes have been treated, stored, and in some cases, disposed at SRS. Past disposal practices have resulted in soil and groundwater contamination.

SRS Compliance History

Waste materials handled at SRS are regulated and managed under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities have required

Table 1. Estimated Radionuclide Inventory at the K-Area Bingham Pump Outage Pit

Radionuclide	Inventory at Burial (Curies)	Inventory Corrected for Decay Through December 31, 1995 (Curies)
Cobalt-60	0.172	1.34xl0 -3
Strontium-90	0.112	4.70xl0 -2
Ruthenium-103/106	0.130	1.12xl0 -12
Cesium-137	0.414	1.75x10 -1
Promethium-147	0.172	7.50x10 -6
Total	1.00	2.23xl0 -1

Federal operating or post-closure permits under RCRA. SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control (SCDHEC); the permit was most recently renewed on September 5, 1995. Part V of the permit mandates that SRS establish and implement an RCRA Facility Investigation Program to fulfill the requirements specified in Section 3004(u) of the Federal permit.

On December 21, 1989, SRS was included on the National Priorities List (NPL). The inclusion created a need to integrate the established RCRA Facility Investigation Program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA, DOE has negotiated a Federal Facility Agreement (FFA, 1993) with the U. S. Environmental Protection Agency (EPA) and the SCDHEC to coordinate remedial activities at SRS into one comprehensive strategy which fulfills these dual regulatory requirements.

Operable Unit Compliance History

As previously stated, the KBPOP is listed in the FFA as a CERCLA unit requiring further evaluation to determine the actual or potential impact to human health and the environment. The KBPOP is not subject to RCRA 3004(u) permit modification requirements per Appendix C of the FFA. The Remedial Investigation (RI) Work Plan (rev. 0) was submitted to the regulatory agencies in June 1992. The RI Field Start occurred in January 1995. The RI characterization and Baseline Risk Assessment (BRA) were conducted for the unit between 1995 and 1997. The results of the RI and BRA were presented in the RI/BRA Report (WRSC, 1997b). The RI/BRA Report was submitted in accordance with the FFA and the approved implementation schedule, and was approved by the EPA and the SCDHEC in May 1997. The Feasibility Study (FS) was submitted in accordance with the FFA and the approved implementation schedule, and was approved by EPA and SCDHEC in June 1997. The Proposed Plan (PP) was also submitted in accordance with the FFA and the approved implementation schedule, and was approved by SCDHEC in June 1997 and EPA in July 1997.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

CERCLA requires that the public be given an opportunity to review and comment on the proposed remedial alternative. Public participation requirements are listed in Sections 113 and 117 of CERCLA. These requirements include establishment of an Administrative Record

File
that documents the investigation and selection of the remedial alternatives for addressing the KBPOP soil and groundwater. The Administrative Record File must be established "at or near the facility at issue". The SRS Public Involvement Plan (DOE, 1994) is designed to facilitate

public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS Public Involvement Plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act. Section 117(a) of CERCLA, as amended, requires the notice of any proposed remedial action and provides the public an opportunity to participate in the selection of the remedial action. The Proposed Plan for the K-Area Bingham Pump Outage Pit (WSRC, 1997c), a part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the KBPOP.

The FFA Administrative Record File, which contains the information pertaining to the selection of the response action, is available at the EPA office and at the following locations:

U.S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

Reese Library
Augusta State University

2500 Walton Way
Augusta, Georgia 30910
(706) 737-1744

Asa H. Gordon Library
Savannah State University
Tompkins Road
Savannah, Georgia 31404
(912) 356-2183

The public was notified of the public comment period through the mailings of the SRS Environmental Bulletin, a newsletter sent to approximately 3500 citizens in South Carolina and Georgia, and through notices in the Aiken Standard, the Allendale Citizen Leader, the Augusta Chronicle, the Barnwell People-Sentinel, and The State newspapers. The public comment period was also announced on local radio stations.

The 30-day public comment period began on July 8, 1997 and ended on August 6, 1997. A public meeting was not requested. Since there were no comments received during the public comment period, a Responsiveness Summary was not prepared.

IV. SCOPE AND ROLE OF OPERABLE UNIT WITHIN THE SITE STRATEGY

The overall strategy for addressing the K Bingham Pump Outage Pit (KBPOP) was to: (1) characterize the waste unit delineating the nature and extent of contamination and identifying the media of concern (perform the RI); (2) perform a baseline risk assessment to evaluate media of concern, constituents of concern (COCs), exposure pathways, and characterize potential risks; and (3) evaluate and perform a final action to remediate, as needed, the identified media of concern.

The KBPOP is an operable unit (OU) located within the Pen Branch Watershed along with several other K-Area waste units (Figure 4). No wetlands or creeks are adjacent to the area surrounding the KBPOP. Several source control and groundwater OUs within this watershed

will be evaluated to determine future impacts, if any, to associated streams and wetlands. It is the intent of SRS, EPA, and SCDHEC to manage these sources of contamination to minimize impact to the watershed.

Based on characterization and risk assessment information, the KBPOP source control unit does not impact the watershed. Upon disposition of all source control and groundwater operable units within this watershed, a final, comprehensive evaluation of the watershed will be conducted to determine whether any additional actions are necessary for the watershed. The proposed action for the KBPOP soil and groundwater aquifer is a final action.

The KBPOP is one of four Bingham Pump Outage Pit areas at the SRS, collectively referred to as the BPOP Approved Standardized Corrective Action Design (ASCAD TM) waste unit group. ASCAD TM provides for complete characterization, technology evaluation, and remedial design of the KBPOP lead unit within the BPOP waste unit group. This is followed by a focused characterization, technology validation, and unit-specific design for the secondary ASCAD TM BPOP waste units (i.e., R/P/L BPOPs). ASCAD TM then provides for streamlining the design development process and projects focused technologies for remedial action for the secondary units based on the lead unit.

Under the ASCAD TM strategy, the information from the lead site, KBPOP, will be used to define the site profile envelopes for comparison to the conditions that are expected to be found at the

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R/P/L BPOPs secondary sites. Envelopes are bounding conditions that should be met in order to apply the remedial alternative used on the lead site. The general concept is that all the Bingham Pump Outage Pits have similar operational histories, received similar wastes, and would

probably have similar contamination profiles. The secondary sites will be characterized to determine if their site profile matches the profile of the lead site. If the secondary site(s) profiles are within the KBPOP site envelopes, the preferred alternative selected for the KBPOP will be implemented at the secondary site(s).

V. SUMMARY OF OPERABLE UNIT CHARACTERISTICS

A conceptual site model (CSM) was developed for the KBPOP that identifies the primary sources, primary contaminated media, migration pathways, exposure pathways, and potential receptors for each unit. The CSM for the KBPOP is presented in Figure 5; and, is based on the data that is presented in the CERCLA documentation for this unit. The Quality Control Summary Reports (WSRC, 1995a, b) and the RI with BRA Report (WSRC, 1997b) contain detailed analytical data for all of the environmental media samples taken in the characterization of the KBPOP. These documents are available in the Administrative Record (see Section III).

The primary source of contamination at the KBPOP is the buried waste. Leaching has been defined as the primary release mechanism and provides the initial movement of constituents from the pit into surrounding soil horizons. Dust and/or volatile emissions, a secondary release mechanism, could be transported via the air/wind and/or stormwater runoff pathways to off-unit locations.

The soil underneath the KBPOP would constitute the secondary source of contamination, if impacted. For this secondary source, infiltration/percolation would provide the means for constituents to migrate vertically, potentially reaching the groundwater. Once constituents enter the groundwater system, movement away from the unit boundaries is certain.

The only potential risk associated with the KBPOP is restricted to the soil at the unit due to external radiation exposure from the surface soil for both hypothetical future residents and workers.

Media Assessment

The Remedial Investigation Report with Baseline Risk Assessment for the K-Area Bingham Pump Outage Pit (643-IG) (U) (WSRC, 1997b) contains detailed analytical data for all of the environmental media samples taken in the characterization of the unit.

The KBPOP characterization proceeded in a phased approach to collect soil and groundwater data to evaluate the nature and extent of contamination and the potential risk. A total of 36 soil, 6 groundwater, and 6 geotechnical samples were collected. The following summaries for the soil and groundwater arc based on the screening that was completed for the remedial investigation and not the baseline risk assessment. Baseline risk assessment results are discussed in Section V1.

Soil

During the KBPOP remedial investigation, unit-specific background sampling was conducted at three soil boring locations (KBP1, KBP2, and KBP3) positioned upgradient from the pit (Figure 6). For the soil borings, composite samples were collected from each of five intervals (0-1 ft, 10-12 ft, 12-14 ft, 14-16 ft, and 16-18 ft). The background soil samples were divided into data sets: surface soil (0-1 ft) and deep soil (>9 ft). Soil samples were not collected in the entire 0-4 ft range since this soil interval represents the fill material that was placed at the unit in 1958.

Figure 6 also graphically depicts the thirty-six soil samples which were collected from the three pit borings (KBP6, KBP9, and KBP11) and the six perimeter borings (KBP4, KBP5, KBP7, KBP8, KBP10, and KBP12).

For soil, the results from the K Bingham Pump Outage Pit (KBPOP) sample analyses indicate that minor concentrations/activities of constituents have migrated from the pit into the surrounding soil horizons; however, horizontal migration is limited to the boundaries of the pit and vertical migration is limited to the upper clayey zones.

The geotechnical and geologic data indicate that a less permeable zone is present underneath the

pit that will inhibit less mobile constituents from migrating vertically and potentially impacting the groundwater.

Groundwater

A total of six groundwater samples were collected from the water table aquifer in the vicinity of the KBPOP. These include two background samples (KH1 and KH4), an additional upgradient sample (KH3), and three down- or sidegradient samples (KH2, KH5, and KH6) (Figure 7). The initial groundwater samples were collected using temporary piezometers.

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The metal concentrations were unusually high and were detected in both upgradient and downgradient sampling locations for the KBPOP and are interpreted to be directly related to the sampling protocol used. These unusually high metal concentrations arc the indirect result of the high turbidity associated with each sample. To demonstrate the validity of this interpretation, Confirmatory Characterization was conducted in July 1996, during which two RCRA-standard groundwater monitoring wells (one upgradient (KBP1D) and one downgradient (KBP2D)) were installed at the KBPOP. Results from the sampling of these wells support the interpretation that the KBPOP has not impacted the groundwater and that the metal constituents detected are naturally occurring.

The detection of iodine-129 is suspect because no other fission products (i.e., technetium-99 and strontium-90) were detected in this temporary piezometer sample and because false positives are

often associated with gamma PHA (the method used to analyze the sample). Moreover, this detection is also suspect because iodine-129 was not detected in the groundwater samples taken from the RCRA-standard monitoring wells which were installed and sampled during the KBPOP Confirmtory Characterization.

Soil Leachability Analysis

Soil leachability modeling was performed with a detailed unit-specific model. The model calculates concentrations of soil water constituents at the base of the vadose zone. Groundwater concentrations are then calculated from these values by applying the groundwater dilution factor. The nature of the input data and the analytical model assumptions are such that the estimates of groundwater concentrations are conservative.

The leachable constituents of potential concern for the KBPOP include metals, inorganic compounds, radionuclides, organics, and pesticides with the predominant risk driver for the hypothetical future on-unit resident and on-unit worker being iodine-129. As stated previously, the iodine-129 detection is highly questionable and below the reported detection limit for iodine-129. Using the highly questionable value with the conservative soil leachability models overestimates the future groundwater values. Therefore, corrective action for the groundwater is not warranted based upon the soil leachability analysis.

VI. SUMMARY OF OPERABLE UNIT RISKS

As part of the investigation/assessmcnt process for the KBPOP waste unit, a BRA was performed using data gathered during the assessment phase. Detailed information regarding the development of constituents of potential concern (COPCs), the fate and transport of

contaminants, and the risk assessment can be found in the Remedial Investigation Report with Baseline Risk Assessment for the K-Area Bingham Pump Outage Pit (643-1G) (U) (WSRC, 1997b).

An exposure assessment was performed to provide an indication of the potential exposures which could occur based on the chemical concentrations detected during the unit-specific sampling activities. The current land use is an inactive industrial site. The only current exposure scenario identified for the KBPOP was for on-unit workers and/or visitors, who may perform environmental research on a limited and intermittent basis at the KBPOP. Conservative future exposure scenarios identified for the KBPOP included future on-unit industrial workers and future on-unit resident adults and children. The future residential scenario includes homegrown produce as an exposure point, which is not considered under the current on-unit visitor or future industrial worker scenarios.

The following exposure pathways were evaluated for the human receptors in the KBPOP RI/BRA:

- The current (known) on-unit worker was evaluated for exposure to contaminated soils through ingestion, dermal contact, inhalation of particulates in air, and direct radiation. A drinking water pathway was determined to not be credible for the current on-unit worker since shallow groundwater is not used as a source of drinking water at the SRS.

- The hypothetical future on-unit industrial worker was evaluated for exposure to surface soil through incidental ingestion, inhalation of windblown dust in air, dermal contact, and direct radiation. In addition, exposure to groundwater through ingestion and dermal contact was evaluated. Inhalation of volatiles ftom groundwater was not evaluated since it was not expected to be a significant exposure pathway for the hypothetical future on-unit industrial worker.

- The hypothetical future on-unit resident (adult/child) was evaluated for exposure to surface soil through incidental ingestion, inhalation of windblown dust in air, dermal contact, direct radiation, and ingestion of homegrown produce. In addition, exposure to groundwater through ingestion, dermal contact, and inhalation of volatiles in groundwater was evaluated.

Based on the results of the risk assessment COPCs that contribute significantly to an exposure pathway having a significant human cancer risk (>1 x 10 -6) or human noncarcinogenic hazard (>1.0), or are determined to pose unacceptable ecological risk, are designated as constituents of

concern (COCs). For human health, COCs are substances associated with risks or hazards exceeding targets for the protection of human health, as defined in the NCP and CERCLA. Human health carcinogenic primary COCs are constituents with an individual cancer risk greater than or equal to 1 x 10 -6 in an exposure media with a cumulative excess lifetime cancer risk greater than or equal to 1 x 10 -4. Human health carcinogenic secondary COCs are constituents with an individual cancer risk greater than or equal to 1 x 10 -6 in an exposure media with a cumulative excess lifetime cancer risk greater than or equal to 1 x l0 -6. Human health primary noncancer COCs are constituents with a hazard quotient greater than or equal to 0.1 in an exposure media with a hazard index greater than or equal to 3. Human health secondary COCs are constituents with a hazard quotient greater than or equal to 0.1 in an exposure media with a hazard index greater than or equal to 1 but less than 3. For ecological resources, a weight-of-evidence type approach is conducted to identify ecological COCs. The unit-specific risks for the KBPOP are further explained below.

Human Health Risk Assessment Results for the KBPOP

Current Land Use

Under the current land use scenario, carcinogenic risks and noncarcinogenic hazards from nonradiological and radiological constituents were characterized for exposure of a known (current) on-unit industrial worker to surface soil and air. Table 2 presents the summary of risk and hazard calculations for the known on-unit worker.

Current Land Use - Carcinogenic Risk

A total carcinogenic (cancer) risk of 7 x 10 -7 was derived for the known on-unit

worker. This cancer risk is below 1 X 10 -6, indicating an acceptable cancer risk.

Current Land Use - Noncarcinogenic Risk and Hazard

There were no nonradiological primary or secondary constituents of concern identified for the current on-unit industrial worker; therefore, there were no nonradiological risks or hazards for the current on-unit worker.

Future Land Use

Under the future land use scenario, carcinogenic risks and noncarcinogenic hazards associated with nonradiological constituents were calculated for exposure of the hypothetical worker to surface soil, air, and groundwater. Carcinogenic risks and noncarcinogenic hazards for these same factors, plus homegrown produce, were then calculated for the hypothetical on-unit resident (adult and child). Radiological risks were calculated for exposure of the hypothetical resident

Table 2. K-Area Bingham Pump Outage Pit Summary of Risk and Hazard Calculations for Exposure of Known On-Unit Industrial Workers

	K BPOP Soil (0-1 ft)				
	Exposure to Radionuclides		Exposure to Chemicals		
Matrix	Route	Risk	Route	Risk	Hazard
Soil (0-1 ft)	Ingestion	1.3E-11	Ingestion	NC	NC
	Dermal	1.69-13	Dermal	NC	NC
	Inhalation (P)	1.2E-16	Inhalation (P)	NC	NC
	External	7.3E-07	Inhalation (V)	NC	NC
Totals		7E-07		NC	NC

P - Particulates
V - Volatiles
NC - Not Calculated

and worker to surface soil, air, groundwater, homegrown produce (on-unit resident only), and external radiation. Table 3 presents the summary of risk and hazard calculations for the hypothetical future on-unit residents (adult/child) and workers. The 0-4 ft soil interval was not sampled in its entirety during the KBPOP characterization since this interval represents backfill soil that was placed at the unit in 1958. The 0-1 ft soil interval was sampled and is representative of the backfill material. However, the lack of data from the entire 0-4 ft interval may underestimate the risk of potential exposure of hypothetical future receptors to soil located in this interval.

Future Land Use - Nonradiological Carcinogenic Risk

The total cancer risk for nonradioactive carcinogens for the future hypothetical on-unit industrial worker and resident exposed to surface soil (0-1 ft) and groundwater was $2x10^{-6}$ and $6x10^{-6}$, respectively. Ingestion of groundwater by the hypothetical future industrial worker and resident was the primary route for this risk level. For the worker and resident, bis(2-ethylhexyl)phthalate was the secondary COC which led to the nonradiological carcinogenic risk. However, its presence is suspect since the phthalates are common laboratory contaminants.

Future Land Use - Noncarcinogenic Hazard

The total noncarcinogenic HI for the hypothetical on-unit industrial worker and resident exposed to surface soil (0-1 ft) and groundwater was 0.7 and 4.0. For the future resident, the noncancer hazard was due primarily to the ingestion of manganese (primary COC) in groundwater. The maximum on-unit concentration of manganese was less than a factor of two greater than the background screening value, indicating that the concentration likely reflects background

conditions. Although the new round of sampling did not include manganese, the results of the other sampled metals indicated that, if sampled, the concentration would be extremely low or non-detected.

Future Land Use - Radiological Carcinogenic Risk

The total cancer risk for radiological constituents for the hypothetical on-unit industrial worker and resident exposed to surface soil (0-1 ft) and groundwater was 1 x 10 -5 and 5 x 10 -5, respectively. The radiological carcinogenic risk was primarily due to the ingestion of radium-228, tritium, uranium-238, and uranium-233/234 in groundwater and external exposure to cesium-137 in surface soil for both hypothetical future receptors. All of the constituents were secondary COCs for ingestion of groundwater for the future worker and resident. Tritium was also a secondary COC for the inhalation of groundwater for the hypothetical future resident. Radium-228, uranium-233/234, and uranium-238 were also detected in background samples which indicates

Table 3. K-Area Bingham Pump Outage Pit Summary of Risk and Hazard Calculations for Exposure of Hypothetical Future On-Unit Residents and Industrial Workers

	RESIDENTS (0-1 ft)					WORKERS (0-1 ft)				
	Exposure to Radionuclides			Exposure to Chemicals		Exposure to Radionuclides		Exposure to Chemicals		
Matrix	Route	Risk	Route	Risk	Hazard	Route	Risk	Route	Risk	Hazard
Soil	Ingestion	1.1E-08	Ingestion	NC	NC	Ingestion	2.6E-09	Ingestion	NC	NC
	Dermal	7.713-11	Dermal	NC	NC	Dermal	3.413-11	Dermal	NC	NC
	Inhalation (P)	2.2E-13	Inhalation (P)	NC	NC	Inhalation (P)	2.0E-13	Inhalation (P)	NC	NC
	External	1.4E-05	External	NC	NC	External	2.8E-06	External	NC	NC
Produce	Ingestion	2.1E-07	Ingestion	NC	NC					

Ingestion NA Ingestion NC NC
Groundwater Ingestion 3.3E-05 Ingestion 5.0E-06 4.0E+00
Ingestion 1.1E-05 Ingestion 14E-06 6.1E-01
Dermal 1.0E-08 Dermal 7.7E-07 2.0E-01 Dermal
5.7E-09 Dermal 2.9E-07 6.7E-02
Inhalation (V) 7.2E-06 Inhalation (V) 4.7E-08 3.9E-03
Inhalation (V) NC Inhalation (V) NC NC

Totals 5E-05 6E-06 4E+00
1E-05 2E-06 7E-01

Note: Groundwater risk calculations were revised to exclude samples taken using temporary piezometers which result in silty samples that elevate the results of the inorganic constituents.

NA - Not Applicable
NC - Not Calculated
P - Particulates
V - Volatiles

that a significant portion of the estimated risks of these naturally-occurring radionuclides is the result of background conditions at the KBPOP. In the RI/BRA Report, the maximum concentrations of tritium and radium-228 in the groundwater were compared to their respective MCL values. The maximum concentrations of tritium and radium-228 were below their respective MCL values. Based on this comparison, tritium and radium-228 were not retained as COCs at the KBPOP and remedial goals were not developed for tritium and radium-228. Cesium-137 in soil was observed at levels consistent with global fallout activity.

Ecological Risk Assessment Results for the KBPOP

The ecological risk assessment evaluated the likelihood of occurrence for adverse ecological effects from exposure to chemicals associated with the KBPOP OU. The ecological setting

of the unit is not unique or significant. There are no known endangered, threatened, or special concern species in the vicinity of the unit that are likely to be dependent on or affected by the habitat at the unit. The species that inhabit the unit are not rare in the region nor are they considered to be of special societal value. The area of the unit is small and the habitat is low in diversity and productivity.

Based on the characterization of the environmental setting and identification of potential receptor organisms, a CSM was developed to determine the complete exposure pathways through which ecological receptors could be exposed to COPCs. The focused evaluation addressed small mammals inhibiting the unit (represented by the oldfield mouse). The ultimate assessment endpoint was the diversity and health of the ecological community encompassing the unit.

None of the constituents detected in the soil at the KBPOP is concluded to have the potential for adverse effects to the oldfield mice that may use the unit as a foraging area. It is also unlikely that the constituents would cause a significant adverse effect on the ecological community. Therefore, there are no ecological COCS at the KBPOP.

Human Health Risk-Based Remedial Goals

Chemical-specific remedial goals (RGs) are concentration goals for individual chemicals for specific media and land use scenarios at CERCLA sites. General sources of chemical-specific RGs include: (1) concentrations based on Applicable or Relevant and Appropriate Requirements (ARARs), and (2) concentrations based on risk values from the risk assessment. RGs are derived for (hose contaminants in a pathway that result in an exceedance of a cancer risk of 1 x 10 -6 or an HI of 1.0. These constituents are defined as constituents of concern (COCs). Separate

calculations are made for each of three target risk levels for both cancer and noncancer concerns.

The target cancer risk levels are 1 x 10 -4, 1 x 10 -5, and 1 x 10 -6. The target HIs (noncancer) are 3, 1, and 0.1.

Table 4 provides a list of the RGs for the KBPOP by receptor and medium as identified in the RI/BRA. Although RGs were established in the RI/BRA Report for bis(2-ethyl hexyl)phthalate, manganese, uranium-233/234, and uranium-238 in the groundwater media, remediation of the groundwater for these constituents was determined to be unnecessary due to (1) bis(2-ethylhexyl)phthalate is a common laboratory artifact and its presence is suspect, (2) manganese is suspect due to high turbidity factors at the time of sampling, and (3) uranium-233/234 and uranium-238 were detected in background samples indicating that these constituents are present as a result of background conditions at the unit.

Cesium-137 was determined to be the only soil COC at the KBPOP because of external radiation exposure from the surface soil for both hypothetical future residents and workers. However, the level of cesium-137 is consistent with global fallout. Therefore, remediation of the surface soil for cesium-137 was determined to be unnecessary. There are no groundwater or ecological COCs at the KBPOP.

Site-Specific Considerations

Site-specific considerations, based on the results of the conclusions of the RI/BRA, which suggest limited or no potential for significant risk include:

1. The miscellaneous debris at the KBPOP is covered by 4 feet of clean soil which provides an adequate barrier under the planned future use of this area.

2. Constituents detected in groundwater which led to risk and hazard exceedances for the future on-unit worker and resident are suspect due to the use of temporary piezometers. The temporary piezometers which were used to collect the groundwater samples did not have a filter pack around the screen intervals. Therefore, the samples from the piezometers were unfiltered; and, at the time of sampling, were observed to have a high turbidity factor. This high turbidity factor was believed to have caused the unusually high metal

concentrations.

In addition, there was only one elevated iodine-129 activity level which was believed to be a false positive reading.

3. Confirmatory sampling, which used permanent monitoring wells, was conducted and did not confirm the presence of these constituents in the groundwater. Therefore, the suspect

Table 4. K-Area Bingham Pump Outage Pit Remedial Goals for Constituents of Concern by Receptor and Medium

Receptor	Media	Constituent	RME Human Health Remedial Goals a			Value in Media
			Target Cancer Risk			Target Hazard Quotient
			1x10 -4	1x10 -5	1x10 -6	3	1	0.1
Future Worker	Soils	Cs-137 (pCi/g)	1.06E+01 b	1.06E+00 b	1.06E-01 b	---	---	---	2.61E-01
Future Resident	Soils	Cs-137 (2219)	2.08E+00 b	2.08E-01 b	2.08E-02 b	---	---	---	2.61E-01
Future Worker	Groundwater	Bis(2-ethylhexyl)phthalate (mg/L)	2.05E+00 b	2.05E-01 b	2.05E-02 b	9.39E-01 b	3.13E-01 b	3.13E-02 b	2.85E-02
		Manganese	----	----	----	2.35E+00 b	7.82E-01 b	7.82E-02 b	3.05E+00
Future Resident	Groundwater	Bis(2-ethylhexyl)phthalate (mg/L)	4.95E-01 b	4.95E-02	4.95E-03 b	9.54E-01 b	3.18E-01 b	7.83E-02 b	2.85E-02
		Manganese (mg/L)	----	----	----	2.35E+00 b	7.83E-01 b	7.83E-02 b	3.05E+00
Future Worker	Groundwater	Uranium-233/234 (pCi/L)	3.57E+02 b	3.57E+01	3.57E+00 b	---	---	---	6.24E+00
		Uranium-238 (pCi/L)							6.53E+00

2.58E+02 b	2.58E+01	2.58E+00 b	---	---	---	
Future Resident	Groundwater	Uranium-233/234 (pCi/L)				6.24E+00
5.87E+01 b	5.87E+00 b	5.87E+01 b	---	---	---	
		Uranium-239 (pCi/L)				6.53E+00
4.24E+01 b	4.24E+00 b	4.24E-01 b	---	---	---	

a Calculation of human health remedial goals for noncancer hazards is not applicable to radionuclides.

b These values represent the remedial goals in soil and groundwater for each COC required to reach the risk and hazard levels shown.

contaminants were removed from the risk considerations. When they were removed from risk consideration, the calculations fall within or below the risk range of 1xl0 -4 to 1xl0 -6.

The remaining groundwater constituents are either naturally-occurring, common laboratory artifacts, or below MCL values. There is no risk to the groundwater from a soil leachability standpoint.

4. Cesium-137 was the primary constituent which led to exceedances in the risk calculations for soil. The activity level at which ccsium-137 (0.295 pCi/g) is present in the soil is corsistent with activity levels of global fallout; and, cesium-137 has a half-life of 30.2 years. The KBPOP does not pose a risk to the ecological community.

5. The KBPOP is located in an area which has been recommended as an industrial zone by the Citizens Advisory Board and the Savannah River Site Future Use Project Report (DOE, 1996), precluding future residential use.

VII. REMEDIAL ACTION OBJECTIVES AND DESCRIPTION OF CONSIDERED ALTERNATIVES FOR THE KBPOP SOURCE CONTROL OPERABLE UNIT

Remedial Action Objectives

Remedial action objectives (RAOs) specify unit-specific contaminants, media of concern, potential exposure pathways, and remediation goals. The RAOs are based on the nature and extent of contamination, threatened resources, and the potential for human and environmental exposure. Initially, preliminary remediation goals are developed based upon ARARs, or other information from the RI/BRA. These goals arc modified, as necessary, as more information concerning the unit and potential remedial technologies become available. Final remediation goals are determined when the remedy is selected and shall establish acceptable exposure levels that are protective of human health and the environment.

ARARs are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal, State, or local environmental law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Three types of ARARs; action-, chemical-, and location-specific; have been developed to simplify identification and compliance with environmental requirements. Action-specific requirements set controls on the design, performance, and other aspects of implementation of specific remedial activities. Chemical-specific requirements are media-specific and health-based concentration limits developed for site-specific levels of

constituents in specific media. Location-specific ARARs must consider Federal, State, and local requirements that reflect the physiographical and environmental characteristics of the unit or the immediate area. There were no action-specific, location-specific, or chemical-specific ARARs relevant to establishing RAOs for the KBPOP source unit.

The RI/BRA indicates that the secondary sources (i.e., KBPOP soil) associated with the KBPOP pose minimal carcinogenic risk to human health. Threatened, endangered, or sensitive

species are not found at the KBPOP and the unit does not offer attractive or unique cover or forage opportunities for wildlife. Thus, ecological receptors are not at significant risk from the KBPOP OU. The RI/BRA also indicated that the KBPOP is not impacting groundwater at the unit. Constituents were not observed to have migrated horizontally and clayey zones underneath the base of the pit will limit vertical mJgration potential. Based on these conclusions, the Feasibility Study (FS) was conducted to consider possible actions which could reduce the risk associated with the KBPOP soil.

Based on the risk posed by cesium-137 in the KBPOP soil, the general remedial action objectives for the KBPOP soil are as follows:

1. Reduce risks to human health via external exposure to radiological constituents (i.e., cesium-137) in the soil.

2. Achieve RGs (see Table 4) established for unit soil.

There were no RAOs established for ecological receptors, or soil leachability contaminants, or groundwater contaminants since the RI/BRA data for the KBPOP indicated that these areas were not of concern for the unit.

The four feet of fill covering the miscellaneous construction debris buried at the KBPOP is adequate to be protective for direct radiation from the debris. At the time of burial, the radioactive contamination was less than 25 mR/hr with no detected alpha activity. Table 1 indicates greater than a factor of four decrease in curie content (two equivalent half-life).

KBPOP Soil Alternatives

As part of the investigation/assessment process for the KBPOP waste unit, a FS was performed using data generated during the assessment phase. Detailed information regarding the development and evaluation of the remedial alternatives can be found in the Feasibility Study for the K-Area Bingham Pump Outage Pit (643-1G)(U)(WSRC, 1997a).

The RI/BRA indicates that the KBPOP soil poses minimal risk to human health. External radiation from the KBPOP soil for the future on-unit resident and worker results in risk (i.e., 1×10^{-5} for the future resident and 3×10^{-6} for the future worker) within the range of concern (i.e., 1×10^{-4} and 1×10^{-6}). Therefore, a FS was conducted which included detailed analyses of soil alternatives. The preferred alternative for the KBPOP soil is Institutional Controls. This alternative will restrict this land to future industrial use and limit access to the soil, which might expose future workers to low concentrations of hazardous constituents, through use of administrative controls such as the site use and site clearance permits.

Six alternatives were evaluated for remedial action of the KBPOP operable unit soil. Each alternative is described below:

Alternative 1 - No Action

Under this alternative, no remedial actions would be conducted and no limitations would be placed on future uses of the site. EPA policy and regulations require the consideration of a no remedial action to serve as a baseline against which the other alternatives can be compared. Because no remedial action would be taken at the unit, the KBPOP would remain in its present condition. All contaminated soil and debris are within the KBPOP boundaries. The KBPOP is within the SRS facility and is not accessible to the public. The debris is covered by four feet of fill which is currently preventing direct contact. There would be no reduction of risk. The present worth cost of this alternative is $280,000 which includes Record of Decision reviews every five years for thirty years.

Alternative 2 - Institutional Controls

Under this alternative, Institutional Controls would be implemented at the KBPOP and the site would remain undisturbed. Implementation of this alternative would require both near- and long-term actions.

In the near-term, signs would be posted at the waste unit which indicate that this area was used

for disposal of waste materials and contains buried waste. In addition existing access controls would be used to maintain the KBPOP for nonresidential use.

Periodic inspections would be conducted and maintenance would be performed to help ensure that the cover remains intact. Maintenance, as needed, would consist primarily of mowing and subsidence repairs. Minor drainage modifications may be conducted as needed to prevent ponding and to promote surface water runoff.

In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government would take those actions necessary pursuant to CERCLA 120(h). These actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site. The deed notification would, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of construction debris and other materials, including hazardous substances.

The deed would also include deed restrictions precluding residential use of the property. However, the need for these deed restrictions may be reevaluated at the time of transfer in the event that exposure assumptions differ and/or contamination no longer poses an unacceptable risk under residential use.

This alternative is shown to provide adequate protection of human health and the environment in the near-term. Long-term protection of human health and the environment would be achieved through deed restrictions and maintenance of the cover and signs. The present worth cost of this alternative is $350,000 which includes periodic repairs to the KBPOP and Record of Decision reviews every five years for thirty years.

Alternative 3 - Placement of a Soil Cover

Under this alternative, the KBPOP would be covered by a low permeability soil cover with a minimum thickness of 3 feet (nominal in-place saturated hydraulic conductivity of $1x10^{-5}$ cm/sec or less). Limited site clearing and grading might be required to place the soil cover. The soil cover would have an upper surface with a slope of three to five percent to promote surface water runoff and minimize surface erosion. A topsoil (vegetative soil layer - minimum thickness between 3-6 inches) would be placed on top of the soil cover.

The topsoil (vegetative soil layer) would be added and area would be compacted and seeded. The topsoil would be seeded with native grasses to increase evapotranspiration. The topsoil layer would also protect the soil cover from damage due to erosion, frost, and burrowing animals. The topsoil layer would also provide water storage capacity to reduce the rate of runoff which, if too high, could cause erosion of the soil cover. Institutional controls would be necessary to restrict the area to future industrial use and to prohibit excavation of the soil cover.

This alternative is shown to provide adequate protection of human health and the environment in the near- and long-term. The contaminated material would be isolated by the soil cover and contaminant mobility would be minimized by reductions in infiltration and erosion. The present

worth cost of this alternative is $650,000 which includes labor and materials needed to place the soil cover and Record of Decision reviews every five years for thirty years.

Alternative 4 - In-Situ Solidification of Soil and Debris, Soil Cover

Under this alternative, a concrete-based agent would be injected into the KBPOP and mixed with the soil and debris to form a solidified mass. The concrete material is injected into

the ground in columns. The columns are placed in an overlapping pattern to provide treatment over the entire target area, The solidification process would produce a monolithic structure which would eliminate or reduce the mobility of the contaminants. A soil cover would then be placed over the treated site.

This alternative is shown to provide adequate protection of human health and the environment in the near- and long-term. The source of contamination would be removed from the KBPOP. The present worth cost of this alternative is $2,920,000 which includes labor and equipment required for in-situ stabilization of the KBPOP soil and debris, and construction of a soil cover. Site and soil cover maintenance and Record of Decision reviews every five years for 30 years are also included in the cost estimate.

Alternative 5 - Excavate Soil and Debris, Solidify/Stabilize Soil, Backfill Treated Soil and Debris, Soil Cover

Under this alternative, the identified soil and debris would be excavated by backhoe or other similar equipment. Excavation would extend to at least four feet below the lower boundary of the debris. The excavation could go deeper if necessary. The excavated material would then be staged at the KBPOP. Impermeable tarps would be placed on the ground prior to placement of the excavated material and similar tarps would be placed over individual piles to avoid producing airborne parliculates and contaminated runoff. Other containment measures would be implemented as needed.

Debris would be separated from the soil using mechanical means such as screens and electromagnets. The excavated soil would be treated by solidification with Portland cement. The material would be mixed with the cement to form solid blocks that would reduce or eliminate the mobility of the contaminants. Preliminary testing would be required to determine an appropriate ratio of cement to soil and/or debris. The debris and treated soil would then be backfilled into the excavation and a soil cover would be placed over the KBPOP.

This alternative is shown to provide adequate protection of human health and the environment in the near- and long-term. The present worth cost of this alternative is $3,620,000 which includes labor and materials needed to pre-treat the soil prior to excavation for waste handling

purposes,

to excavate and treat the soil and debris, and to construct a soil cover over the KBPOP and for Record of Decision reviews every five years for thirty years.

Alternative 6 - Excavate Soil and Debris, Dispose in E-Area Vaults or Soil/Debris Consolidation Facility (if applicable)

This alternative would require excavation by backhoe or similar means and removal of an estimated 13,150 cubic yards of soil and debris. Excavation would extend to at least four feet below the lower boundary of the debris. The excavation could go deeper if necessary. The excavated material would be hauled from the site and disposed at either the E-Area Vaults or the Soil/Debris Consolidation Facility (if applicable). The excavation would be backfilled with soil and seeded.

This alternative provides overall protection of human health and the environment by removing the contamination from the KBPOP. This alternative meets all of the RGs through complete source removal which eliminates the potential for long-term direct contact with contaminated soil or debris. Excavation would present limited short-term exposures to workers. The present worth cost of this alternative is $17,000,000 which includes labor and materials needed to pre-treat soil and subsoil for waste handling purposes, to excavate the wastes, to treat the wastes following excavation for packaging and disposal requirements, to transport the waste, and to dispose of the KBPOP soil. Record of Decision reviews would not be required under this alternative because concentrations of constituents remaining at the KBPOP would not exceed RGs.

KBPOP Groundwater Alternatives

Based on the conclusion of the KBPOP RI/BRA Report (WSRC, 1997b), there was no

groundwater contamination which would pose a current or future threat to human health or the environment. In addition, constituents from the KBPOP soil are not observed to have migrated horizontally and clayey zones underneath the base of the pit will limit vertical migration potential. Therefore, there were no groundwater alternatives considered in the FS.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF THE ALTERNATIVES

Each of the remedial alternatives was evaluated using the nine criteria established by the NCP. The criteria were derived from the statutory requirements of CERCLA Section 121. The criteria are:

- overall protection of human health and the environment,
- compliance with ARARs,

- long-term effectiveness and permanence,
- reduction of toxicity, mobility, or volume through treatment,
- short-term effectiveness,
- implementability,
- cost,
- state acceptance, and
- community acceptance.

In selecting the preferred alternative, the above criteria were used to evaluate the alternatives developed in the FS (WSRC, 1997a). Seven of the criteria were used to evaluate all the alternatives, based on human health and environmental protection, cost, feasibility, and implementability issues. The preferred alternative was further evaluated based on the final two criteria: state acceptance and community acceptance.

Table 5 presents the evaluation of the soil remedial alternatives. A summary of the comparative analysis of soil alternatives are provided below:

Overall Protection of Human Health and the Environment

All alternatives provide immediate protection because the debris is covered by four feet of soil and no short-term health concerns were identified. Alternative 1 (No Action) provides the least long-term protection because erosion or development could increase exposure. Alternatives 2 (Institutional Controls (Access and Deed Restrictions/Notifications)) and 3 (Placement of a Soil Cover) each offer improvements in protection through reduced exposure potential. Alternatives 4 (In-Situ Solidification of Soil and Debris, Soil Cover) and 5 (Excavate Soil and Debris, Solidify/Stabilize Soil, Backfill Treated Soil and Debris, Soil Cover) provide increased protection because exposure pathways are limited through treatment. Alternative 6 (Excavate Soil and Debris, Dispose in E-Area Vaults (EAV) or Soil/Debris Consolidation Facility (SDCF) (if applicable)) provides the greatest protection of all of the alternatives because the contaminated material is removed from the KBPOP.

Compliance with ARARs

There were no chemical- or location-specific ARARs identified for Alternatives 1 through 6. In addition, there were no action-specific ARARs identified for Alternatives 1 and 2.

Action-specific ARARs identified for Alternatives 3 through 6 are generally similar. These alternatives require erosion control plans, Occupational Safety and Health Administration safety and health plans, and closure performance standards. Alternatives 4 through 6 are required to

Table 5. Comparative Analysis of Remedial Alternatives Considered for the K-Area Bingham Pump Outage Pit Source Control (Soil) Operable Unit

Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Placement of a Soil Cover	Alternative 4 In-Situ Solidification of Debris;	Alternative 5 Excavate Soil & Debris;	Alternative 6 Excavate Soil & Debris; Dispose at E-

(Access & Deed Soil; Backfill Solidification of Area Vaults or Restrictions) Treated Soil & Soil; Backfill Soil/Debris Debris; Soil Cover Treated Soil & Consolidation Facility

Debris; Soil Cover (if applicable)

OVERALL PROTECTIVENESS

Human Health Protection Provides immediate protection as all other alternatives, but affords lower long-term protection due to possibility of cover or site development. Current risks are within EPA's acceptable limits.

Provides immediate protection through access restrictions; provides long-term protection through access and use restrictions.

Provides immediate and long-term protection through elimination of exposure pathways.

Same as Alternative 3, except provides additional protection by solidification.

Alternative Same as Alternative 4. Provides protection of human health by removing contaminated material.

Environmental Protection Lowest degree of environmental protection because cover erosion could result in exposure.

Greater long-term protection than Alternative 1 because site minimized.

More than Alternative 2 because soil cover would further reduce contact with contaminates material.

More than Alternative 3 because solidification would further reduce contaminant

Same as Alternative 4. Provides protection of environment by removing contaminated material.

COMPLIANCE WITH ARARS

Chemical-Specific ARARs None identified.

Same as Alternative 1.

Same as Alternative 1.

Same as Alternative 1.

Same as Alternative 1.

Location-Specific ARARs None identified.

Same as Alternative 1.

Same as Alternative 1.

Same as Alternative 1.

Same as Alternative 1.

Table 5. Comparative Analysis of Remedial Alternatives Considered for the K-Area Bingham Pump Outage Pit Source Control (Soil) Operable Unit (cont'd)

Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
	No Action	Institutional Controls	Placement of a Soil Cover	In-Situ Solidification of Debris; Backfill	Excavate Soil & Dispose at E-Area Vaults or Soil/Debris Consolidation Facility	Excavate Soil & Treated Debris; Soil Cover
		(Access & Deed Restrictions)		Solidification of Soil; Backfill	Treated Soil & Debris; Soil Cover	
						(if applicable)
COMPLIANCE WITH ARARS (cont'd)						
Action-Specific ARARs	None identified.	None identified.	Meets all identified ARARs.	Same as Alternative 3.	Same as Alternative 3.	Same as Alternative 3.
LONG-TERM EFFECTIVENESS AND PERMANENCE						
Magnitude of Residual Risk	Least reduction of all alternatives because no reduction would occur and threat could increase if site is not maintained. Current risk is within EPA's acceptable limits.	Slightly less than Alternative 1 because site would be maintained.	Same as Alternative 2.	Same as Alternative 2.	Greatest protection because all contaminated material is removed.	Same as Alternative 2.
Adequacy and Reliability of controls	No Controls.	Controls can prevent contact with contaminated material	More reliable than Alternative 3.	More reliable than Alternative 4.	Greatest reliability because all contaminated material is removed.	Same as Alternative 2.

media.
Need for 5-year Review All alternatives All alternatives All alternatives All alternatives All alternatives No review is necessary
except 6 requires except 6 requires except 6 requires except 6 requires 5- except 6 requires because no waste would
5-year review. 5-year review. 5-year review. year review. 5-year review. remain at K BPOP.
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT
Treatment Process Used None. None. None. Directly treats Same as None.
inorg anics. Alternative 4.

Table 5. Comparative Analysis of Remedial Alternatives Considered for the K-Area Bingham Pump Outage Pit Source Control (Soil) Operable Unit (cont'd)

Criteria Alternative 1 Alternative 2 Alternative 3 Alternative 4 Alternative 5 Alternative 6
No Action Institutional Placement of a In-Situ Excavate Soil & Excavate Soil &
Controls Soil Cover Solidification of Debris; Debris; Dispose at E-
(Access & Deed Soil; Backfill Solidification of Area Vaults or
Restrictions) Treated Soil & Soil; Backfill Soil/Debris
Debris; Soil Cover Treated Soil & Consolidation Facility
Debris; Soil Cover (if applicable)
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT (cont'd)
Amount Destroyed or Treated None. None. None. Treats all inorganics Same as None.
within site, but total Alternative 4.
mass of organics
remains the same
Reduction of Toxicity, Mobility, None. None. Mobility of Volume of Same as None.
or Volume Through Treatment contaminants contaminated Alternative 4,
reduced by soil material

would be except debris cover. increased by up to would not be 100% of the original treated by volume; mobility of solidification. contaminants would be less than under Alternative 3.

Irreversible Treatment remedies	Not applicable, no treatment.	Not applicable; no treatment.	Not applicable; no treatment.	Not applicable; Material would be removed.	No further could be undertaken on the treated material.
Type and Quantity of Residuals remaining Remaining after Treatment	Not applicable; no treatment.	Same as Alternative 4.	Not applicable; no treatment.	Not applicable; no treatment.	Same residuals as Alternatives 1 through 3, but volume would increase & residuals would be solidified.

Table 5. Comparative Analysis of Remedial Alternatives Considered for the K-Area Bingham Pump Outage Pit Source Control (Soil) Operable Unit (cont'd)

Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
	No Action	Institutional Controls	Placement of a Soil Cover	In-Situ	Excavate Soil &	Excavate Soil &

Solidification of Debris; Debris; Dispose at E-
(Access & Deed Soil;
Backfill Solidification of Area Vaults or
Restrictions) Treated
Soil & Soil; Backfill Soil/Debris
Debris;
Soil Cover Treated Soil & Consolidation Facility

Debris; Soil Cover (if applicable)
SHORT-TERM EFFECTIVENESS
Community Protection No threat to Same as Same as Same as
Alternative Same as Same as Alternative 1.
community during Alternative 1. Alternative 1. 1.
Alternative 1.
implementation.
Worker Protection No threat of Same as Same as Greater
than Greater than Same as Altenative 5.
exposure to Alternative 1. Alternative 1.
Alternatives 1, 2, and Alternative 4
worker. 3 because
treatment because treatment
would
require limited would require
contact
with excavation of
contamin
ate contaminated
material
. material.
Environmental Impacts No environmental Same as Same as Slight
environmental Greater than Same as Alternative 5.
threat during Alternative 1. Alternative 1. threat
because of Alternative 4
implementation. limited
contact with because treatment
contamin
ated would require
material
s. excavation of

contaminated

material.
Time Until Action is Complete Immediate. Immediate. Immediately
Immediately Same as Same as Alternative 4.
effective, but
effective, but onsite Alternative 4.
onsite action action
would require
would require 1 2 to 3
months after
to 2 months after remedial
design and
remedial design

contractor selection.

and contractor selection.

Table 5. Comparative Analysis of Remedial Alternatives Considered for the K-Area Bingham Pump Outage Pit Source Control (Soil) Operable Unit (cont'd)

Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Placement of a Soil Cover	Alternative 4 In-Situ Solidification of Debris; Backfill Treated Soil & Debris; Soil Cover	Alternative 5 Excavate Soil & Solidification of Soil; Backfill Treated Soil & Debris; Soil Cover (if applicable)	Alternative 6 Excavate Soil & Debris; Dispose at E-Area Vaults or Soil/Debris Consolidation Facility
IMPLEMENTABILITY						
Ability to Construct and Operate	No construction or operation.	Same as Alternative 1.	Simple to construct and maintain.	More difficult than Alternative 4.	Similar to Alternative 3 because special equipment is required for treatment.	Requires regulatory evaluation and comparison to waste acceptance criteria.
Ease of Doing More Action if Further Remedies Needed	Additional action easily implemented.	Same as Alternative 1.	Same as Alternative 1.	No Contaminated material could be undertaken on treated waste.	Same as Alternative 4.	Same as Alternative 3.

Ability to Monitor Effectiveness	Alternative 4.	Alternative includes no monitoring; future exposure could occur in absence of controls.	Frequent inspection of property would provide notice of changes.	Same as Alternative 2.	Same as 2, except because waste would not remain on site.	Same as Alternative 3, except because waste would not be monitored.	No need to monitor effectiveness of solidification would
Availability of Services and Equipment	Same as Alternative 4.	No services or equipment needed.	Services are available locally.	Services and equipment are available.	Same as Alternative 4.	Less than Alternative 3, longer lead time may be needed to secure services and equipment.	
COST							
PW O & M Cost (5-year)	$0	$30,000	$330,000	$2,600,000	$3,300,000	$17,000,000	
PW Capital Cost	$0	$320,000	$320,000	$320,000	$320,000	$0	
Total PW Cost	$280,000	$350,000	$650,000	$2,920,000	$3,620,000	$17,000,000	

meet proper disposal and decontamination specifications as listed in 40 Code of Federal Regulations (CFR) 264.114. Alternative 5 is required to meet waste pile design, operation, and closure requirements as listed in 40 CFR 264.251 and 40 CFR 264.258(a). Alternative 6 requires transportation of hazardous materials which would require adherence to 49 CFR 107. Alternatives 3 through 6 would comply with the appropriate ARARs.

Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence can be measured in broad terms by (1) the magnitude of residual risk associated with the waste unit, and (2) the adequacy of controls after implementation of the remedial alternative. Of the alternatives being considered, Alternative 1 provides the least long-term effectiveness because the threat of exposure may increase as the

cover erodes. The residual risk present at the KBPOP is the same for Alternatives 1 through 5 because contaminants will remain the KBPOP. Alternatives 2 (Institutional Controls) provide added controls for limiting future exposures through maintenance and administrative controls. Alternative 3 (Placement of a Soil Cover) provides added controls for limiting future exposures through minimization of infiltration reaching the waste. However, these alternatives do not involve any form of treatment that would permanently reduce the magnitude of residual risk. Alternatives 4 and 5 involve treatment of contaminated media and placement of a soil cover. Alternative 6 provides the greatest reduction in residual risk because the contaminated material is removed from the waste unit. Alternative 4 (In-situ Solidification of Soil, backfill, and Soil Cover), Alternative 5 (Excavation and Solidification of Soil, Backfill; and Soil Cover), and Alternative 6 (Excavate, Dispose at EAV or SDCF (if applicable), Soil cover) offer a greater reduction in the magnitude of residual risk than would Alternatives 1 (No Action), 2 (Institutional Controls), and 3 (Placement of a Soil Cover).

Existing SRS institutional controls would be adequate for the protection of human health as long as the institutional controls are maintained. In the absence of existing controls, the No Action alternative would not be protective of human health. Based upon the hypothetical scenario (hat institutional controls cannot be guaranteed and/or proposed caps could be allowed to fail, the need for institutional controls to maintain protectiveness would decrease corresponding to the extent to which contaminated media are treated to permanently reduce the magnitude of residual risk. Consequently, the need for controls is greatest for the alternatives that do not treat or remove any of the contaminated media (Alternative 1 - No Action, Alternative 2 - Institutional Controls, and Alternative 3 - Placement of a Soil Cover) followed by alternatives that treat all known contaminated soil at the KBPOP (Alternative 4 - In-situ Solidification of Soil, Backfill Treated Soil, Soil Cover and Alternative 5 - Excavate Soil and Debris, Solidification of Soil,

Backfill Treated Soil and Debris, Soil Cover). Alternative 6 (Excavate Soil and Debris, Dispose at EAV or SDCF (if applicable), Soil Cover) would require the least controls of all alternatives being considered since it would involve the permanent removal of all contaminated soil known to exceed concentration-based remediation goals.

All alternatives, except Alternative 6, require 5-year review because contaminated material would be left at the waste unit.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 1 (No Action), 2 (Institutional Controls), 3 (Placement of a Soil Cover), and 6 (Excavate Soil and Debris, Dispose at EAV or SDCF (if applicable), Soil Cover) offer no form of active treatment and, therefore, do not satisfy the NCP preference for remedial alternatives that offer a reduction in contaminant toxicity, mobility, or volume through treatment. Alternative 6, however, does reduce the volume of contaminated material at the KBPOP through removal to another location. Alternative 3 provides mobility reduction through the placement of a soil cover. Alternatives 4 (In-situ Solidification of Soil, Backfill Treated Soil, Soil Cover) and 5 (Excavate Soil and Debris, Solidification of Soil, Backfill Treated Soil and Debris, Soil Cover) each offer greater reduction in mobility by implementing solidification in addition to the placement of a soil cover. However, these alternatives will increase the volume of contaminated material by up to 100%.

Short-Term Effectiveness

The short-term risks to remedial workers increases with the volume of contaminated media directly handled or processed and project duration. Handling (e.g., excavating, moving) and/or processing (e.g., treating) contaminated media increases the risk of remedial worker exposure to radiation effects. In addition, remedial workers are exposed to potential construction-related risks (e.g., falls, cuts, heavy equipment operation) which increases with corresponding increases in project duration; however, potential short-term risks should be manageable for all alternatives being considered. With strict adherence to project health and safety plans, it should be possible

to maintain short-term risks of all considered alternatives within acceptable limits.

None of the alternatives present any threats to surrounding communities during implementation.
The potential risk to remedial workers would be lowest for Alternatives 1 (No Action) and 2
(Institutional Controls) which do not require intrusive on-site work, so no worker exposure
concerns are presented by these alternatives. Alternative 3 (Placement of a Soil Cover) is not

expected to present any significant worker exposure either, as soil cover construction will not
generate significant contact with the contaminated material.

Alternatives 4 (In-situ Solidification of Soil, Backfill Treated Soil, Soil Cover), 5 (Excavate Soil
and Debris, Solidification of Soil, Backfill Treated Soil and Debris, Soil Cover), and 6 (Excavate
Soil and Debris, Dispose at EAV or SDCF (if applicable), Soil Cover) each involve contact with
the contaminated material; and, therefore present some degree of worker risk. Because
Alternative 4 provides in-situ treatment, contact would be minimal and the worker risk would be
less than for Alternatives 5 and 6. Alternatives 5 and 6 each require excavation; and, therefore
present the highest level of worker exposure. Adequate personal protection could be provided for
workers under each alternative.

None of the alternatives would require significant amounts of time to complete. A maximum of 3
months after remedial design and contractor selection is estimated for completion of on-site
activities.

Implementability

No major implementation problems were identified for Alternatives 1 (No Action), 2
(Institutional Controls), and 3 (Placement of a Soil Cover). Alternatives 4 (In-situ Solidification
of Soil, Backfill Treated Soil, Soil Cover) and 5 (Excavate Soil and Debris,

Solidification of Soil,
Backfill Treated Soil and Debris, Soil Cover) may present minor difficulties in selection of qualified contractors. Alternative 4 may also present potential implementation problems because of the requirements for grouting through debris. Alternative 6 (Excavate Soil and Debris, Dispose at EAV or SDCF (if applicable), Soil Cover) may present potential implementation problems if the availability of space at the disposal facility hinders disposal. Evaluation of regulatory and acceptance criteria would also be required for Alternative 6.

Cost

Total estimated present worth costs range between $280,000 for Alternative 1 (No Action) to $17,000,000 for Alternative 6 (Excavate Soil and Debris, Dispose in E-Area Vaults or Soil/Debris Consolidation Facility (if applicable)). Alternative 2 ($350,000) involves institutional controls including placement of access and deed restrictions. Alternative 3 ($650,000) involves placement of a soil cover. Alternative 4 ($2,920,000) involves in-situ stabilization of the contaminated soil, backfilling the treated soil and debris, and placement of a soil cover. Alternative 5 ($3,620,000) involves excavation of the soil and debris, solidification of the soil, backfilling the treated soil and debris, and placement of a soil cover,

With the exception of Alternatives 1 and 6, the estimated operation and maintenance of costs of all alternatives are approximately $320,000 for the long-term (30 years) maintenance of the soil cover and 5-year remedy reviews. The estimated operation and maintenance costs for the No Action alternative (Alternative 1) is $280,000 because it only involves conducting 5-year remedy reviews. Alternative 6 would have no additional operation and maintenance costs since it would permanently remove all contaminated soil and debris from the KBPOP waste unit and would not require 5-year remedy reviews. All cost estimates are provided for comparison purposes only and are not intended to forecast actual budgetary expenditures.

State and Community Acceptance

The State and Federal regulatory agencies have accepted and approved Alternative 2 (Institutional Controls) primarily because it is the least expensive alternative that is still protective of human health and the environment since the waste unit poses minimal risk to the hypothetical future industrial worker and future resident and no risk to the current worker. The KBPOP Proposed Plan public comment period ended on August 6, 1997 and there were no public comments received. Therefore, the community has shown acceptance of Alternative 2 as the final remedial alternative for the KBPOP.

IX. THE SELECTED REMEDY

The miscellaneous construction debris (i.e., pipes, cables, ladders, etc.) with fixed contamination (primary source) has been buried in the KBPOP since 1958. The presence of the debris plays a primary role in the remedy selection. There was no indication from the characterization data that the contamination present on the debris has moved and the level of radioactivity as shown in Table 1 has diminished over the years. The degree of exposure toxicity to the waste is considered minimal and the potential for exposure is also considered to be minimal.

In addition, based on the risks identified in Section VI, the KBPOP soil poses minimal risk to human health. Carcinogenic risks to the potential future worker (3×10^{-6}) or resident (1×10^{-5}) are driven by external exposure to the soil at 0-1 ft. which is contaminated with cesium-137. Since the entire 0-4 ft soil interval was not sampled, the risk present at the unit may be underestimated.

In order to manage the uncertainty associated with the possibility of direct exposure and unrestricted excavation, probable underestimation of risk, and to ensure that the degree of and the potential for exposure remain minimal, institutional controls are appropriate for the KBPOP operable unit..

An evaluation of potential alternatives was performed in accordance with the NCP as summarized in Section VIII. Based on this evaluation, the selective alternative for the KBPOP operable unit is Alternative 2 - Institutional Controls. Institutional Controls meets the remedial action objectives (i.e., reduction of risk to human health via external exposure to cesium-137 in the soil) and remedial goals (see Table 4) for the KBPOP operable unit by precluding future on-site residential use of the area, buried waste contact, removal, or excavation.

Based on the RI/BRA, there is no need for remediation of the KBPOP from an ecological standpoint.

The Institutional Controls alternative is intended to be permanent and effective in the near- and long-term. Alternative 2 is considered to have the lowest cost option which is still protective of human health and the environment.

Implementation of this alternative will require both near- and long-term actions. For the near-term, signs will be posted at the KBPOP indicating that this area was used to manage hazardous materials. In addition, existing SRS access controls will be used to maintain this site for nonresidential use.

In the long-term, if the property is ever transferred to non-federal ownership, the U.S. Government will take those actions necessary pursuant to CERCLA 120(h). These actions will include a deed notification disclosing former waste management and disposal activities as well as remedial actions taken on the site. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of construction debris and other materials, including hazardous substances.

The deed shall also include deed restrictions precluding residential use of the property. However, the need for deed restrictions may be reevaluated at the time of transfer in the event that exposure assumptions differ and/or contamination no longer poses an unacceptable risk under residential use.

Throughout the period of Federal ownership, as well as for any future ownership, under Institutional Controls (Alternative 2), there will be no risk greater than $3x10^{-6}$ to the future industrial worker. Furthermore, there will be no appreciable risk to the environment.

Based on the conclusions of the RUBRA, the KBPOP is not impacting groundwater. Constituents are not observed to have migrated horizontally and clayey zones underneath the base of the pit will limit vertical migration potential.

This proposal is consistent with EPA guidance and is an effective use of risk management principles.

X. STATUTORY DETERMINATIONS

Based on the KBPOP Remedial Investigation Report with Baseline Risk Assessment, the KBPOP poses no significant risk to the environment and minimal risk to human health. Therefore, a determination has been made that Institutional Controls are sufficient for protection of human health and the environment for the KBPOP operable unit.

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial actions, and is cost-effective. The low levels of contaminants in the soil make treatment impractical. Because treatment of the principal threats of the site was found to be impracticable, this remedy does not satisfy the statutory preference for treatment as a principal element.

Section 300.430 (f)(4)(ii) of the NCP requires that a five-year review of the ROD be performed if hazardous substances, pollutants, or contaminants remain in the waste unit. The three Parties, DOE, SCDHEC, and EPA, have determined that a five-year review of the ROD for the KBPOP will be performed to ensure continued protection of human health and the environment.

XI. EXPLANATION OF SIGNIFICANT CHANGES

The Proposed Plan for the K-Area Bingham Pump Outage Pit (643-IG) provided for involvement with the community through a document review process and a public comment period. No comments were received during the 30-day public comment period (July 8, 1997

-
August 6, 1997). There were no changes made to the preferred alternative as presented in the Proposed Plan; therefore, there were no significant changes made to the presentation of the alternative in this Record of Decision.

XII RESPONSIVENESS SUMMARY

A public meeting was not requested during the PP public comment period and there were no comments received during the public comment period; therefore, a Responsiveness Summary is not required for the KBPOP.

XIII. POST-ROD DOCUMENT SCHEDULE

Due to the limited actions (i.e., posting signs, use of existing access controls, site maintenance, etc.) involved with the implementation of the Institutional Controls alternative, a streamlined post-ROD document is appropriate for the KBPOP. The actions involved with implementation of the selected remedy do not require any design.

The post-ROD document and implementation schedule is summarized below and is illustrated in Figure 8:

1. Corrective Measures Implementation/Remedial Action Report (CMI/RAR) (rev. 0) for the KBPOP will be submitted for EPA and SCDHEC review four months after issuance of the ROD.

2. EPA and SCDHEC have 90 days to review the KBPOP CMI/RAR (rev. 0).

3. SRS has 60 days to revise the KBPOP CMI/RAR (rev. 0) after receipt of regulatory comments.

4. EPA and SCDHEC have 30 days for final review and approval of the KBPOP CMI/RAR (rev. 1).

<SCR IMG 98021J>

XIV. REFERENCES

DOE (U.S. Department of Energy), 1994. Public Involvement, A Plan for the Savannah River Site. Savannah River Operations Office, Aiken, South Carolina (1994).

DOE, 1996. Savannah River Site Future Use Project Report, Stakeholder Recommendations for Savannah River Site Land and Facilities (U). Savannah River Operations Office, Aiken, South Carolina (January 1996).

FFA, 1993. Federal Facility Agreement for the Savannah River Site, Administrative Docket No. 89-05-FF, (Effective Date: August 16, 1993).

WSRC (Westinghouse Savannah River Company), 1995a. Quality Control Summary Report for the K-Area Bingham Pump Outage Pit, Stage 3 and 4. ESH-EMS-950561, Environmental Protection Department (Environmental Monitoring Section), Westinghouse Savannah River Company, Aiken, South Carolina (June 1995).

WSRC (Westinghouse Savannah River Company), 1995b. Quality Control Summary Report for the RF/RI Assessment of the K-Area Bingham Pump Outage Pit, Stage 1. ESH-EMS-950392, Environmental Protection Department (Environmental Monitoring Section), Westinghouse Savannah River Company, Aiken, South Carolina (June 1995).

WSRC (Westinghouse Savannah River Company), 1997a. Feasibility Study for the K-Area Bingham Pump Outage Pit (643-1G) (U). WSRC-RP-96-831, Rev. 1.1, Westinghouse Savannah River Company, Aiken, South Carolina (May 1997).

WSRC (Westinghouse Savannah River Company), 1997b. Remedial Investigation Report with Baseline Risk Assessment for the K-A rea Bingham Pump Outage Pit (643-1G) (U). WSRC-RP-95-1555, Rev. 1.2, Westinghouse Savannah River Company, Aiken, South Carolina (February

1997).

WSRC (Westinghouse Savannah River Company), 1997c. Proposed Planfor the K-Area Bingham Pump Outage Pit (643-1G) (U). WSRC-RP-97-106, Rev. 1.1, Westinghouse Savannah River Company, Aiken, South Carolina (June 1997).

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<SCR IMG 98021K>

Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

May 28 1998

Mr K. A. Collinsworth, Manager
Federal Facility Agreement Section
Division of Site Assessment and Remediation
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

Mr. J. L. Crane
SRS Remedial Project Manager
Waste Management Division
Environmental Protection Agency, Region IV
61 Forsyth Street, SW
Atlanta, GA 30303

Dear Mr. Collinsworth and Mr. Crane:

SUBJECT: Transmittal of the Issued Record of Decision (ROD) for the K-Area

Bingham Pump Outage Pit

In accordance with the terms of the Federal Facility Agreement (FFA), the Department of

Energy (DOE) is transmitting the ROD for the K-Area Bingham Pump Outage Pit which was signed by DOE (10/14/97) Environmental Protection Agency (EPA) 3/23/98 and South Carolina Department of Health and Environmental Control (SCDHEC) 4/14/98.

Questions from you or your staff may be directed to me at (803) 725-7032.

Sincerely,

<SCR IMG 98021L>

BTH/CLM:ed

OD-98-216

Enclosure
1. Signed Record of Decision (ROD) for the K-Area Bingham Pump Outage Pit

c: A. B. Gould, DOE-ECD, 703-A
C. V. Anderson, DOE-ERD, 703-A
C. B. Warren, EPA-IV
K. B. Feely, EPA-IV*
J. K. Lindler, SCDHEC-Columbia
J. T. Litton, SCDHEC-Columbia
G. K. Taylor, SCDHEC-Columbia
M. D. Sherritt, SCDHEC-Columbia
SRS Administrative Record Files (Palmer, 730-2B, 1000)*

*w/enclosure

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 06/26/1998
Operable Unit: 51
ROD ID: EPA/541/R-98/071

Media: Soil

Contaminant: Dioxins/Dibenzofurans, Inorganics, Metals, PAH, PCBs, Petroleum Hydrocarbon, Radioactive, VOC

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. SRS is a secured U.S. government facility with no permanent residents. SRS is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina.

SRS is owned by the Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided nuclear materials for the space program and for medical, industrial, and research efforts. Chemical and radioactive wastes are by-products of nuclear material production processes. The entire SRS facility was placed on the National Priorities List (NPL) in December 1989.

Operable Unit (OU1):
The M-Area Hazardous Waste Management Facility (HWMF) is a source-specific operable unit within the A/M Area Fundamental Study Area. The M-Area HWMF includes an unlined surface impoundment (settling basin), a portion of an inactive process sewer line, drainage and seepage areas, and a Carolina bay known as Lost Lake. The nearest plant boundary is approximately 5800 feet northwest of the M-Area HWMF.
The M-Area settling basin was constructed in 1958 to settle out metals discharged from M-Area manufacturing operations. The basin dimensions were approximately 330 feet by 280 feet by 17 feet with a volumetric capacity of approximately eight million gallons. Overflow from the settling basin was directed to a natural seepage area and ultimately to Lost Lake. In July 1985, a permitted wastewater treatment facility was placed in operation and discharges to the settling basin were discontinued.
A Record of Decision (ROD) addressing OU1 was completed in June 1992.

OU2:
The Metallurgical Laboratory HWMF is a source-specific operable unit within the A/M Area fundamental Study Area. The Metallurgical Laboratory HWMF includes an abandoned portion of a process sewer line, a seepage basin, a drainage outfall, and a Carolina bay. The nearest plant boundary is located approximately three-fourths of a mile to the northwest of this operable unit.
The Metallurgical Laboratory was used for corrosion testing on stainless steels and nickel-based alloys. This testing required degreasing and cleaning metal parts, etching sample identification information on the parts, and photographing the samples. No radioactive materials were known to have been discharged to the HWMF. During periods of heavy rainfall, wastewater and surface water overflowed a drainage outfall at the Metallurgical Laboratory Basin into the adjacent Carolina Bay. A RCRA closure plan for the basin and sewer line portions of the Metallurgical Laboratory HWMF was submitted and approved in June 1991. The intent of the closure plan is to ensure the basin and sewer line portions of the Metallurgical Laboratory HWMF will be closed in a manner that controls, minimizes, or eliminates post-closure migration of hazardous constituents and decomposition products to the vadose zone, groundwater, surface waters, or atmosphere.
A ROD addressing OU2 was completed in June 1992.

OU3:
The A/M Area, located in the northwest portion of SRS, contains nuclear fuel fabrication buildings, office buildings, and research

areas. The A/M Area groundwater is a media-specific operable unit within the A/M Area Fundamental Study Area. As a result of past waste disposal practices, the groundwater beneath A/M Area has been contaminated with organic solvents, primarily trichloroethylene (TCE) and tetrachloroethylene (perchloroethylene; PCE). Total plume size beneath the A/M Area, as currently defined, is approximately 1200 acres. The contamination in the A/M Area groundwater and the overlying unsaturated zone appears to be associated with releases from the following A/M Area source units: the A-014 Outfall, the M-Area Settling Basin/Lost Lake (M-Area HWMF), and the M-Area HWMF Process Sewer, and the 321-M Solvent Storage Area.
From 1952 to 1981, an estimated 13 million pounds of chlorinated solvents were used in the A/M Area to degrease fuel and target tubes used in SRS reactors. An estimated 50 to 90 percent of the solvents evaporated during degreasing operations. The remaining solvents were discharged as waste to the process sewer system. Additionally, significant quantities of chlorinated solvents were inadvertently spilled during handling and storage.
A ROD addressing OU3 was completed in June 1992.

OU4:
The Gunsite 720 Rubble Pit is located within SRS and is approximately 305 meters (100 feet) west of South Carolina Highway 125, 168 meters (550 feet) north of SRS Road A-2, and 2.5 kilometers (1.5 miles) from the nearest SRS boundary.
During the period from 1955 to 1960, to defend the SRS in the event of an air attack, the U.S. Army established onsite anti-aircraft artillery gun emplacements at several locations near the perimeter of SRS. The Gunsite 720 was one of those emplacements. In the early 1980s, while work was being performed in the area, nine empty, partially buried drums, labeled "duPont Freon 11" were found at the gunsite. The drums were excavated in July 1987, and placed on a pallet at the gunsite. The drums were excavated in July 1987, and placed on a pallet at the gunsite. The area around the drums was screened during excavation and the liquid (rainwater) that collected in the excavated drums was sampled prior to disposal. No evidence of hazardous substances was found. In October, 1989, the drums were removed from the unit.
A ROD addressing OU4 was completed in March 1997.

OU5:
The Gunsite 113 Access Road Unit is located in the northeast corner of SRS, adjacent to the access road leading to Gunsite 113, and is approximately 91.5 meters (300 feet) east of where SRS Road 8 crosses the SRS facility boundary.

The area appears to have been used as a surface disposal area for spoil dirt and/or road construction debris. There is no documentation or record of any hazardous substance management, disposal, or any other type of waste disposal at this unit. There is no evidence that any recent disposal activities have occurred in this area or that disposal activities were more widespread. Also, there is no evidence of any burning or excavation at this waste unit.
A ROD addressing OU5 was completed in March 1997.

OU6:
The F-Area HWMF (basins F-1, F-2, and F-3) operated from 1955 until November 1988. During that time, the facility received waste effluents from F-Area chemical separation facilities processes such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads. The three basins had a combined maximum operating capacity of 20.5 million gallons of wastewater.
These basins were closed by dewatering, physically and chemically stabilizing the remaining sludges and placing a protective multi-layer cover system over them to reduce rainwater contact with basin bottoms.
Closure of the F-Area HWMF was begun in 1989 and completed in January 1991. The F-Area HWMF was certified closed in February 1991. Closure activities specifically included removal of standing water remaining in the basin; stabilization of the basin sludge with a layer of granite, limestone and blast furnace slag; construction of a low permeability cap over the basin; and restoration of the area.
A ROD addressing OU6 was completed in September 1993.

OU7:
The H-Area HWMF is a source specific operable unit within the H-Area Fundamental Study Area. The H-Area HWMF consists of three unlined, earthen surface impoundments located in the center of SRS, southwest of Road E and north of road 4 approximately 6 miles from the nearest site boundary.
The H-Area HWMF operated from 1955 until November 1988. The original H-Area HWMF consisted of basins H-1, H-2, and H-3 and operated from 1955 to 1962. In 1962 H-3 was replaced by H-4. At the time of closure, the H-Area HWMF had a combined maximum operating capacity of 26.5 million gallons of wastewater. The H-Area HWMF received waste effluents from H-Area chemical separation facilities processes such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads.
The four basins were closed by dewatering, physically and chemically stabilizing the remaining sludges and placing a protective

multi-layer cover system over them to reduce rainwater contact with basin bottoms.

OU8:
The F-Area HWMF is a source specific operable unit within the F-Area Fundamental Study Area. The F-Area HWMF is located in the center of SRS, Southwest of Road E and North of Road 4 approximately 16 miles from the nearest plant boundary. The F-Area HWMF consisted of three unlined earthen basins that had a combined maximum operating capacity of 20.5 million gallons of waste water during operation. It received waste effluents from F-Area chemical separations facilities such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads. Significant amounts of nitrates and caustics were received.
A ROD addressing OU8 was completed in April 1995.

OU9:
The H-Area HWMF consists of a series of three hydraulically connected unlined basins (H-1, H-2, and H-4). Basin H-4 was built in 1962 to replace basin H-3. Wastewater flow to the basins was terminated on November 7, 1988 in accordance with the requirements of RCRA. The H-Area HWMF received waste effluents from H-Area chemical separations facilities such as nitric acid recovery unit, waste storage system evaporator overheads, and general purpose overheads. The waste stream contained hazardous constituents and low levels of radionuclides.
A ROD addressing OU9 was completed in April 1995.

OU10:
The Fire Department Hose Training Facility (FDHTF) is located approximately 200 meters (700 feet) northeast of the intersection of Roads C and 6 and approximately six meters (20 feet) west and downgradient of a heat exchanger storage pad. The FDHTF is a source control and groundwater operable unit. The FDHTF was built between 1975 and March 1979 and operated by the SRS Fire Department between 1979 and 1982 to train personnel in fighting waste oil fires. Training exercises typically included pouring burnable oil into the unit, igniting the oil, and then having the fire department extinguish the fire with water from fire hydrants located adjacent to the unit. No known hazardous wastes were placed in the unit.
The SRS Fire Department discontinued use of the FDHTF and recommended the facility for cleanup and closure in March 1982. Available documentation indicates cleanup activities occurred on November 21, 1982 during which 14 loads of oil-contaminated soil

were excavated from an area approximately 6 by 6 by 1 meter and transported to the sanitary landfill. However, the date of this cleanup activity could not be verified.
A ROD addressing OU10 was completed in August 1998.

OU11:
The Central Shops Burning/Rubble Pit (631-6G) (BRP6G)is located in the Central Shops Area near the center of the SRS. It operated from 1951 through 1955 for the disposal and burning of waste materials. The unit consisted of a shallow unlined excavation, approximately 3m (10 feet) deep. Materials believed to be disposed of in the pit included waste oils, rags, paper, cardboard, plastics, degreasers, wood, rubber, and drummed organic solvents. These materials were periodically burned in the pit, usually on a monthly basis. The volume of waste disposed of at BRP6G was not recorded.
A ROD addressing OU11 was completed in May 1997.

OU12:
The M-Area West unit is located west of the M-Area Production Facility on a dirt road approximately 1.8 kilometers north of Silverton Road. There are no structures of any type located at or near M-Area West. The only nearby man-made feature is a dirt access road located about 30 to 40 feet west of the waste areas.
The unit consists of two small areas. Several drums and other small innocuous debris were found on the land surface adjacent to a dirt road approximately 1 kilometer west of the M-Area production facility. The total waste at the unit consisted of six empty 55-gallon drums, four 1-gallon cans and a 1-gallon glass jar. The cans and the jar were originally contained in one of the larger drums. With the exception of a crushed drum and small amounts of metal debris, all other materials were removed from the site in 1992.
There is no documented information available regarding past hazardous or non-hazardous waste disposal activities at M-Area West. Markings on the drums found at the unit suggest that they once contained oil and solvents, and that they are approximately 37 years old. There is no evidence that any recent disposal activity has occurred or that the disposal activity was more widespread. Also, there is no evidence of any burning or excavation at this waste unit.
A ROD addressing OU12 was completed in September 1995.

OU13:
The Silverton Road Waste Unit (SRWU) is located in the northwestern part of SRS in Aiken County, approximately 1.5 miles southwest of A/M Area. The SRWU was first used before construction of the SRS. Municipal, agricultural, and commercial trash, rubbish, garbage, debris, and refuse probably constituted the

waste stream until the early 1950s. After procurement by the federal government, the SRWU land continued to be used as an open dump for disposal of metal shavings, 55-gallon drums, cardboard drums, tires, lumber, etc. No records of waste disposal activities were kept. In 1974, the disposal of waste at the SRWU ceased, and the area was bulldozed, graded, covered with soil, and planted with grasses.
A ROD addressing OU13 was completed in March 1997.

OU14:
The F-Area Burning /Rubble Pits (FBRP) comprise a source unit located within the SRS, approximately 3000 feet west of F-Area and 1100 feet north of SRS Road C. Between 1951 and 1973, SRS used Pits 231-F and 231-1F to burn a variety of wastes which were considered non-hazardous at that time. Some of these waste materials (degreasers and solvents) are now considered to be hazardous based on ingestion or possible dermal contact. Waste was usually burned on a monthly basis. The chemical composition and volumes of the disposed waste are unknown, but waste materials burned included paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents.
A ROD addressing OU14 was completed in March 1997.

OU15:
The D-Area Burning/Rubble Pits (DBRP) are located in the western part of the SRS in Barnwell County, approximately 2600 feet west of D Area and 1.6 miles west of State Highway. Between 1951 and 1973, burning pits were used at SRS to burn a variety of hazardous and non-hazardous waste. The chemical composition and volumes of the disposed waste are unknown. Combustible materials, which were burned monthly, included paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents. No known or suspected radioactive materials were allowed in the burning pits. Burning of waste in the SRS pits was discontinued by October 1973. A layer of soil was then placed over the residue in the pits and they were subsequently used as rubble pits.
A ROD addressing OU15 was completed in March 1997.

OU16:
The Old F-Area Seepage Basin (OFASB) is located within the SRS, approximately 600 feet north of F Area and one mile east of Road C and is located in Aiken County. The Savannah River and associated swamps are located approximately six miles west of the basin. The OFASB is designated as Building Number 904-49G and covers a total area of 1.3 acres.
Between November 1954 and mid-May 1955, 9 to 14 million gallons of wastewater were discharged to the basin which served as an

unlined seepage basin for the purpose of reducing radioactive substance concentrations. Wastewater included overhead condensates from evaporators, laundry washwaters, non-reactor cooling water from F and H Areas, and possibly other chemicals.
A ROD addressing OU16 was completed in May 1997.

OU17:
The L-Area Oil and Chemical Basin (LAOCB) and L-Area Acid Caustic Basin (LAACB) are located south of L-Area in an area of low to moderate relief. They are situated on the southern flank of a hill approximately 300 feet south of the L-Area perimeter fence and 1,250 feet north of L Lake.
The LAOCB was designed and constructed as an unlined seepage basin in 1961 for the purpose of disposing of small volumes of wastes that were not appropriate for discharge to local streams, regular seepage basins, or the 200-Area waste management system. The exact quantity of waste water discharged to the LAOCB basin is not documented. Liquid wastes consisting of small volumes of slightly radioactive oil and chemical wastewater were sent to the LAOCB from throughout SRS, but came primarily from the reactor areas. Wastes were transported to the drainage pad in tank trucks, metal drums, skid tanks, and other containers. The Hot Shop (Building 717-G) discharged decontaminated wastewater containing radionuclides, detergents, and spent degreasing solvents through the pipeline to the basin.
A ROD addressing OU17 was completed in March 1997.

OU18:
The Burma Road Rubble Pit (BRRP) is located approximately one-half mile southwest of F-Area Separations Facility and one-tenth mile southwest of C Road. The BRRP is between Upper Three Runs Creek and Four Mile Creek.
The BRRP consists of two unlined earthen pits dug into surficial soil and filled with various waste materials. A small circular area of disturbed soil was detected adjacent to these pits and is considered to have been used as a source of backfill for the pits. It has been determined that the BRRP source control OU does not contribute contamination to the area groundwater or surrounding soils.
A ROD describing OU18 was completed in August 1998.

OU20:
The K-Area Bingham Pump Outage Pit (KBPOP) is situated in the Tobacco Road formation which extends from ground surface to a depth of 95 feet below ground surface. Between 1957 and 1958, miscellaneous construction debris generated by major modifications and repairs to the primary and secondary reactor cooling water

systems was buried in the KBPOP. There were no pumps buried and no liquid waste was disposed of in the KBPOP.
A ROD addressing OU20 was completed in March 1998.

OU23:
The F-Area Retention Basin (FRB) is located outside and south of the F-Area perimeter fence, approximately 1035 meters (3397 feet) from Fourmile Branch. The FRB, with an area of 0.6 acres, was designed and operated as an unlined, temporary container for potentially contaminated cooling water from the F-Area Canyon Facility and stormwater drainage from the F-Area Tank Farm. Cooling water from the Canyon Facility generally had low levels of radioactivity, while water from the Tank Farm is believed to have had only trace quantities of nonradionuclide chemicals. The quantities of water released to the retention basin and the level of various constituents contained within the water are unknown.
A ROD addressing OU23 was completed in September 1998.

OU27:
The D-Area Oil Seepage Basin is located on the Ellenton Plain, the highest of three terraces between the Savannah River to the west and the Aiken Plateau to the east. Construction of the D-Area Oil Seepage Basin trenches began in 1952. Employee interviews indicated the basin was used in the disposal of waste oil originating from D-Area Powerhouse operations to dispose of nonburnable waste and for the routine burning of office and cafeteria waste. Unknown amounts and types of waste were disposed into the basin. Records of the contents of the disposed drums do not exist. To date, there is no evidence to indicate the presence of radionuclides in the drums. Furthermore, employee interviews have indicated that no radionuclides were disposed within the trenches. In 1975, the D-Area Oil Seepage Basin was removed from service and backfilled with soil. Approximately one foot of standing liquid, plus an unknown number of 55-gallon drums possibly containing waste oil, remained in the basin when it was backfilled. The basin remains inactive and is covered with natural vegetation, including bushes and grasses, and is surrounded by trees.
RODs addressing OU27 were completed in March 1995 and August 1998.

OU29:
The TNX Area is a pilot scale test facility for the SRTC. The pilot scale facilities are used to provide technical support to various SRS production areas. From 1953 to August 1988, wastewater generated by research performed in the TNX Area was disposed of in seepage basins. In August 1988, wastewater was rerouted to the TNX

Effluent Treatment Facility.
A ROD addressing OU29 was completed in November 1994.

OU32:
The Burial Ground Complex (BGC) is an area which occupies approximately 195 acres in the central part of SRS between F and H Separation Areas, on a nearly flat divide between Upper Three Runs Creek to the north and Four Mile Creek to the south.
The BGC includes the Old Radioactive Waste Burial Ground (ORWBG) and other OUs such as the Mixed Waste Management Facility (MWMF), the Low Level Radioactive Waste Disposal Facility (LLRWDF), Solvent Tanks S1-S22 (located in the ORWBG and currently being characterized), Solvent Tanks S23-S30, and Solvent Tank S32.
The ORWBG comprises a disposal area for solid radioactive waste produced at the SRS, as well as shipments from other U.S. DOE and Department of Defense facilities. The ORWBG has contributed to localizedshallow aquifer groundwater contamination. The plume of groundwater contamination from the ORWBG seeps into the old F-Area effluent stream which flows into Four Mile Creek which in turn flows into the Savannah River. Other RCRA/CERCLA units within the BGC are undergoing characterization and investigation to determine the impacts to the environment.
The ORWBG began receiving waste in 1952 and was filled in 1972. Examples of materials disposed of at the Old Radioactive Waste Burial Ground (ORWBG) include the incidental waste from laboratory and production operations, contaminated equipment, lead, spent deionizer resins, spent lithium-aluminum targets, irradiated process oil from pumps in the tritium facilities and reactor areas, mercury from gas pumps in tritium facilities, cadmium, scintillation fluid, and shipments from off-site.
A ROD addressing OU32 was completed in June 1996.

OU33:
The mixed waste management facility (MWMF) operated from 1969 until March 11, 1986. During that time, this facility, which comprises approximately 58 acres, received low-level radioactive waste materials produced at SRS. Some of these materials are classified as mixed waste containing both hazardous and radioactive components under the RCRA. These trenches were closed by precompacting and placing a protective multi-layer cover system over them to reduce rainwater contact with trench bottoms.
RCRA preventive actions at the MWMF were conducted pursuant to the requirements of RCRA. In 1985 a RCRA Closure Plan was submitted, and closure of the MWMF was begun in 1988 and completed in December 1990. The MWMF was certified closed in

1991. Closure activities specifically included precompaction, construction of a low permeability cap over the trenches, and restoration of the area.
A ROD addressing OU33 was completed in September 1994.

OU34:
The Tank 105-C HWMF was installed in 1961 as part of an off-line heat exchanger repair program and was used as a temporary holding tank for liquid solution. Sumps from the heat exchanger cleaning area drained into Tank 105-C. Oil in the tank was probably attributable to oil leaks into these sumps. The reacted or spent oxalic acid solution that resulted from the rinsing process was pumped into an above ground neutralization tank in the stack area of the reactor building.
In October 1990, a RCRA Closure Plan was submitted to the SCDHEC. SRS received approval of the closure plan on January 16, 1991, with no revision required. Closure activities specifically included the neutralization of waste to a pH of less than 12.5, removal of as much waste as reasonably possible, and shipment of removed waste to an onsite storage/disposal facility. Any remaining waste and the tank void were stabilized with concrete.
A ROD addressing OU34 was completed in September 1994.

OU35:
Par Pond is a 2640-acre man-made reservoir located northeast of P Area and east of R Area in the eastern portion of SRS. The southern shore of the reservoir lies approximately 1.5 miles from the eastern SRS boundary. The southern shore of the reservoir lies approximately 200 feet north of Road B. Par Pond discharges through controlled releases into Lower Three Runs Creek, which in turn discharges into the Savannah River. The length of Lower Three Runs Creek from the outfall of Par Pond to the Savannah River is approximately 20 miles.
Par Pond was built to augment the cooling water requirements of both P and R Reactors. During the 1950s, an effluent pathway was constructed from R Reactor to Par Pond. The pathway consisted of the R Canal and Pond B. Releases in the form of process leaks, purges, and makeup cooling water have contaminated Par Pond with cesium-137 and other radioactive and non-radioactive contaminants. Mercury has been detected in fish from the Savannah River and SRS waterbodies since the analyses began in 1971, with comparable concentrations measured in onsite and offsite fish.
A ROD describing OU35 was completed in February 1995.

OU41:
OU41 contains the P-Area CP R/O Basin (P-CRPB). The P-CRPB is

located approximately 330 feet southeast of the limited area fence surrounding P Area in northwestern Barnwell County.
A ROD addressing OU41 was completed in September 1998.

OU42:
OU42 contains the C-Area CP R/O Basin (C-CRPB). The C-CPRB is located approximately 700 feet southeast of the limited area fence surrounding C Area in northwestern Barnwell County.
A ROD addressing OU42 was completed in September 1998.

OU45:
The Grace Road Site is located approximately 1.3 kilometers south of B-Area and about 244 meters east of the intersection of Grace Road and SRS Road 2. It consists of numerous drums and cans, concrete slabs, brick foundations, and miscellaneous debris. The unit also contained numerous drums and cans varying in size from ? gallon cans to 55-gallon drums and various car parts. Most of the debris was on the surface or partially buried in scattered locations across the unit. Markings on a few of the smaller drums and cans indicated that they once contained oil and grease. There is no evidence that any recent disposal activity has occurred or that the disposal activity was more widespread. Also, there is no evidence of any burning or excavation at this waste unit.
Between February and May 1992, all the debris, drums and concrete slabs were removed from the Grace Road Site. The items removed were either used at soil erosion control areas or were disposed of in the sanitary landfill. No records of any type of waste management activity have been found for the Grace Road Site.
A ROD addressing OU45 was completed in March 1997.

OU51:
The Motor Shops Seepage Basin (716-A) (MSSB) is located in A Area south of the railroad tracks near the automotive shop in Aiken County. A small drainage feature runs through the area approximately 91 meters (300 feet) to the east of the MSSB.
The MSSB was constructed and placed in service in 1977 to receive liquid waste from the 716-A Motor Shops oil/water separator. The MSSB was designed and constructed as an unlined seepage basin. The wastewater flowed into the basin from the northwest through two influent pipes from the Motor Shop and seeped naturally into the soil beneath the basin. Effluent discharges from the Motor Shops included wastewater with trace amounts of engine oil, grease, kerosene, ethylene glycol, and soapy water.
A ROD addressing OU51 was completed in June 1998.

OU52:

The K-Area CP R/O Basin (K-CPRB). The K-CPRB is located approximately 500 feet west of the limited area fence surrounding K Area in northwestern Barnwell County.
A ROD addressing OU52 was completed in September 1998.

OU54:
The F-Area CP R/O Basin (F-CPRB) is located approximately 50 feet southeast of the limited area fence surrounding F Area in southwestern Aiken County.
A ROD addressing OU54 was completed in September 1998.

Remedy: The selected remedy for the Motor Shops Seepage Basin (716-A) (MSSB) is No Action. Investigation of the operable unit (OU) was performed to determine if hazardous substances had been released to the environment. The baseline risk assessment (BRA) indicated that there were no significant releases to the environment. Therefore, it appears that either there were no significant discharges of hazardous materials to the seepage basin or natural remediation processes (i.e., bioremediation) have reduced the levels of hazardous materials to the extent that they no longer pose risk to human health or the environment.

The BRA considered both the future residential and future industrial land use scenarios. Benzo(a)pyrene was the only preliminary constituent of concern (COC) (human health) detected in the soil at MSSB. Benzo(a)pyrene was detected only in the top foot of soil at levels which give risk values greater than 1E-6 (but less than 1E-4) for future adult/child resident. Further uncertainty analysis indicated that benzo(a)pyrene should not be considered a COC for the MSSB due to: 1) low frequency of detection, 2) unit history that strongly suggests it came from an adjacent source, and 3) conservative methodology was utilized in the risk assessment. No ecological or contaminant migration COCs were identified at this unit. Therefore, No Action is the appropriate remedy and a five year Record of Decision (ROD) review will not be required.

Estimated Capital Cost: not provided
Estimated Annual O&M Costs: not provided
Estimated Present Worth Costs: not provided

Text: Full-text ROD document follows on next page.

EPA 541-R98-071

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United States Department of Energy

Savannah River Site

OU - 51

Record of Decision

Remedial Alternative Selection for the

Motor Shops Seepage Basin (716-A)(U)

WSRC-RP-97-840
Revision 0
April 1998

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

Prepared for the U. S. Department of Energy under Contract No. DE-AC09-96-SR18500
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DISCLAIMER

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Prepared for
U. S. Department of Energy
and
Westinghouse Savannah River Company
Aiken, South Carolina

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION
FOR THE MOTOR SHOPS SEEPAGE BASIN (716-A)(U)

WSRC-RP-97-840
Revision 0
April 1998

Savannah River Site
Aiken, South Carolina

Prepared by:
Westinghouse Savannah River Company
for the
U. S. Department of Energy Under Contract DE-AC09-96SR18500

Savannah River Operations Office
Aiken, South Carolina

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DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

Motor Shops Seepage Basin (716-A)
Savannah River Site
Aiken, South Carolina

The Motor Shops Seepage Basin (716-A)(MSSB) is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) solid waste management unit/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA)(FFA 1993) for the Savannah River Site (SRS).

Statement of Basis and Purpose

This decision document presents the selected remedial alternative for the MSSB located at the Savannah River Site (SRS) in Aiken, South Carolina. The selected alternative was developed in accordance with CERCLA, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this specific RCRA/CERCLA

operable unit.

Description of the Selected Remedy

The selected remedy for MSSB is No Action. Investigation of this operable unit was performed to determine if hazardous substances had been released to the environment. The Baseline Risk Assessment indicated that there were no significant releases to the environment. Therefore, it appears that either there were no significant discharges of hazardous materials to the seepage basin or natural remediation processes (i.e., bioremediation) have reduced the levels of hazardous materials to the extent that they no longer pose risk to human health or the environment.

The Baseline Risk Assessment considered both the future residential and future industrial land use scenarios. Benzo(a)pyrene was the only preliminary constituent of concern (human health) detected in the soil at MSSB. Benzo(a)pyrene was detected only in the top foot of soil at levels which give risk values greater than 1×10^{-6} (but less than 1×10^{-4}) for the future adult/child resident. Further uncertainty analysis indicated that benzo(a)pyrene should not be considered a constituent of concern for the MSSB due to: 1) low frequency of detection, 2) unit history that strongly suggests it came from an adjacent source, and 3) conservative methodology was utilized in the risk assessment. No ecological or contaminant migration constituents of concern were identified at this unit. Therefore, No Action is the appropriate remedy and a five year ROD review will not be required. The South Carolina Department of Health and Environmental Control has modified the SRS RCRA permit to incorporate the No Action remedy.

Declaration Statement

Based on the MSSB Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation (RFI/RI) Report and the Baseline Risk Assessment, the MSSB poses no significant risk to the environment and to human health. It is, therefore, proposed that No Action be performed at the MSSB. The selected remedy is protective of human health and the environment and complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action. Since there is no current or potential threat to human health and the environment and No Action is warranted, the CERCLA 121 requirements are not triggered.

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DECISION SUMMARY

REMEDIAL ALTERNATIVE SELECTION

FOR THE MOTOR SHOPS SEEPAGE BASIN (716-A)(U)

WSRC-RP-97-840
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April 1998

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U. S. Department of Energy Under Contract DE-AC09-96SR18500

Savannah River Operations Office
Aiken, South Carolina

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List of Acronyms and Abbreviations

ARAR	Applicable or Relevant and Appropriate Requirements
bls	Below land surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U. S. Department of Energy
ELCR	Excess Lifetime Cancer Risk

EPA	Environmental Protection Agency
ERA	Ecological Risk Assessment
FFA	Federal Facility Agreement
HI	Hazard Index
HQ	Hazard Quotient
MSSB	Motor Shops Seepage Basin (716-A)
NPDES	National Pollutant Discharge Elimination System
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
RBA	Risk-Based Activities
RBC	Risk-Based Concentration
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RFI	RCRA Facility Investigation
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RME	Reasonable Maximum Exposure
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulations
SRS	Savannah River Site
SWMU	Solid Waste Management Unit

TBC	To Be Considered
USC	Unit Specific Constituents

Record of Decision for the Motor Shops Seepage Basin (716-A)(U)
WSRC-RP-97-840
Savannah River Site
Revision 0
April 1998

1. SITE AND OPERABLE UNIT NAME, LOCATION, AND DESCRIPTION

Savannah River Site (SRS) occupies approximately 800 square kilometers (310 square miles) of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina (see Figure 1). SRS is a secured U. S. Government facility with no permanent residents. SRS is located approximately 40 kilometers (25 miles) southeast of Augusta, Georgia and 32 kilometers (20 miles) south of Aiken, South Carolina.

SRS is owned by the U. S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense.

The Motor Shops Seepage Basin (716-A)(MSSB) is located in A Area south of the railroad tracks near the automotive shop (Building 716-A)(see Figure 2) in Aiken County. The elevation varies between 104-107 m (340-350 ft) above mean sea level and slopes gently to the southwest. A small drainage feature runs through the area approximately 91 m (300 ft) to the east of the MSSB. The headwater is a former National Pollutant Discharge Elimination System (NPDES)-permitted outfall (A-011). This drainage feature turns southwest and discharges into a tributary of Tims Branch. Tims Branch discharges into the Upper Three Runs Creek located 5.6 km (3.5 mi) to the southeast. There is no surface water connection between the MSSB and the drainage feature. Groundwater is approximately 46 m (150 ft) below land surface (bls) in the A Area and does not outcrop in the vicinity of the MSSB.

II. OPERABLE UNIT HISTORY AND COMPLIANCE HISTORY

Operable Unit History

The MSSB was constructed and placed in service in 1977 to receive liquid waste from the 716-A Motor Shops oil/water separator. The MSSB was designed and constructed as an unlined seepage basin. The basin measures 63.1 m (207.0 ft) long, 10.7 m (35.1 ft) wide, and 2.0 in (6.6 ft) deep (Huber et al. 1987). It is surrounded by a berm 2.0 m (6.6 ft) high. The wastewater flowed into the basin from the northwest through two influent pipes from the Motor Shop (Building 716-A) and seeped naturally into the soil beneath the basin. The basin has not been closed or capped, but all discharges to the basin were terminated in 1983 when the influent lines from the Motor Shops were capped (Huber et al. 1987). Effluent discharges from the Motor Shops included wastewater with trace amounts of engine oil, grease, kerosene, ethylene glycol, and soapy water. A ramp was built into the eastern end of the basin in 1988 (WSRC 1990) to facilitate soil sampling. At present, the basin collects rainwater during periods of heavy precipitation.

Compliance History

At SRS, waste materials regulated under the Resource Conservation and Recovery Act (RCRA) are managed in accordance with the requirements of RCRA. Certain SRS activities have required treatment, storage, disposal or post-closure permits under RCRA. Non-regulated units, called solid waste management units (SWMU), include any activity where hazardous constituents may remain uncontrolled and may potentially release to the environment. Investigation and potential corrective action for these SWMU(s) are mandated tinder RCRA 3004(u). On September 5, 1995, SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control (SCDHEC which includes corrective action requirements. Module IV of the permit specifies the corrective action requirements mandated by Section 3004(u) of RCRA.

Hazardous substances, as defined by CERCLA, are also present in the environment at the SRS. On December 21, 1989, SRS was included on the National Priorities List. This inclusion created a need to integrate the

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established RFI Program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA, DOE has negotiated a Federal Facility Agreement (FFA 1993) with U. S. Environmental Protection Agency (EPA) and SCDHEC to coordinate remedial activities at SRS into one comprehensive strategy which fulfills these dual regulatory requirements.

The RCRA Facility Investigation/Remedial Investigation Work Plan for the 716-A Motor Shops Seepage Basin (WSRC 1996) was submitted to the regulators in 1996. The RCRA Facility Investigation/Remedial Investigation with the Baseline Risk Assessment for the 716-A Motor Shops Seepage Basin (WSRC 1997a) was submitted in accordance with the FFA and the approved implementation schedule, and approved by the EPA and the SCDHEC in September of 1997. The results of the investigation indicate that there is no impact (or potential impact) to human health or the environment from the MSSB. Therefore, No Action is warranted. No other alternatives were considered as indicated in the Statement of Basis/Proposed Plan for the Motor Shops Seepage Basin (716-A)(WSRC 1997b) which was approved by the regulators in January of 1998.

According to EPA guidance, if there is no current or potential threat to human health and the environment and No Action is warranted, the CERCLA 121 requirements are not triggered. This means that there is no need to evaluate other alternatives or the No Action alternative against the nine criteria specified under CERCLA.

The remedy selected satisfies both the CERCLA and RCRA 3004(u) requirements. The SCDHEC has modified the SRS RCRA permit to incorporate the No Action remedy.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Both RCRA and CERCLA require that the public be given an opportunity to review and comment on the draft permit modification and proposed remedial alternative. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternatives for addressing the MSSB soils and groundwater. The

Administrative Record File must be established at or near the facility at issue. The SRS Public Involvement Plan (DOE 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS Public Involvement Plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act. SCHWMR R.61-79.124 and Section 117(a) of CERCLA, as amended, require the advertisement of the draft permit modification and notice of any proposed remedial action and provide the public an opportunity to participate in the selection of the remedial action. The Statement of Basis/Proposed Plan for the Motor Shops Seepage Basin (716-A)(WSRC 1997b), which is part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the MSSB.

The FFA Administrative Record File, which contains the information pertaining to the selection of the response action, is available at the EPA office and at the following locations:

U. S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

Reese Library
Augusta State University
2500 Walton Way
Augusta, Georgia 30910
(706) 737-1744

Asa H. Gordon Library
Savannah State University
Tompkins Road
Savannah, Georgia 31404
(912) 356-2183

The public was notified of the public comment period through mailings of the SRS Environmenfal Bulletin, a newsletter sent to approximately 3500 citizens in South Carolina and Georgia, through notices in the Aiken Standard, the Allendale Citizen Leader, the Augusta Chronicle, the Barnwell People-Sentinel, and The State newspapers. The public comment period was also announced an local radio stations.

The 45-day public comment period began on February 12, 1998 and ended on March 28, 1998. A Responsiveness Summary was prepared to address comments received during the public comment period. The Responsiveness Summary is provided in Appendix A of this Record of Decision. The public comment period for the RCRA Permit Modification began on February 12, 1998 and ended on March 28, 1998.

IV. SCOPE AND ROLE OF OPERABLE UNIT WITHIN THE SITE STRATEGY

The overall strategy for addressing the MSSB was to: (1) characterize the waste unit delineating the nature and extent of contamination and identifying the media of concern (perform the RFI/RI); (2) perform a baseline risk assessment to evaluate media of concern, constituents of concern, exposure pathways, and characterize potential risks; and (3) evaluate and perform a final action to remediate, as needed, the identified media of concern.

The MSSB is an operable unit which is included in the Upper Three Runs watershed (Figure 3). The ground surface in the vicinity of the unit slopes gently to the southeast in the direction of Tims Branch. Tims Branch, the closest natural surface water drainage, is located approximately 1220 m (4000 ft) from the unit. There is no surface water connection between the MSSB and Tims Branch or any drainage feature in the area. Groundwater does not outcrop in the vicinity of the MSSB.

No action, which is the preferred remedy, is the final action.

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V. SUMMARY OF OPERABLE UNIT CHARACTERISTICS

For the analysis of the nature and extent of contamination, sample results are presented per the Conceptual Site Model (source and pathways), as well as by depth intervals comparable to those used in the Baseline Risk Assessment (see Figure 4). The original primary source of contamination was the wastewater discharges which ceased in 1983. All MSSB Phase I soil samples were used to characterize secondary

sources of contamination (surface and subsurface soils). Depth intervals for presenting soil sample results were 0-0.3 m (0-1 ft) and 0-1.2 m (0-4 ft) below land surface (bls). The 0-1.2 m (0-4 ft) depth interval includes both the 0-0.3 m (0-1 ft) and 0.3-1.2 in (1-4 ft) sample intervals.

Analytical results for MSSB Phase I soil samples were first screened against EPA risk-based concentrations (RBCs) or risk-based activities (RBAs) and then against unit-specific background levels. Constituents with detections exceeding both screening criteria were identified as Unit Specific Constituents (USCs). The only USC identified for the MSSB is benzo(a)pyrene, which was detected in one of 12 soil samples at a concentration exceeding both its RBC and twice average background level.

The Conceptual Site Model identifies soil, groundwater, air, and biota as possible exposure pathways for contamination from the MSSB. Groundwater was not sampled during the Phase I investigation. Groundwater sampling was to be performed during Phase II; however, since only one USC was detected (out of six on-unit soil sample locations)(See Figure 5) in Phase I unit soil samples, the Phase II investigation was deemed unwarranted. The decision rules presented in the work plan for the MSSB (WSRC 1996) supported terminating the investigation if no subsurface contamination from the basin was found during Phase I. Area groundwater is under evaluation as part of the overall groundwater remediation approach as presented in the RCRA permit application - Corrective Action Plan for the A-014 outfall area (Volume III, M-Area HWMF, WSRC-IM-91-53). Biota and air also were not sampled during the Phase I investigation. Potential contaminant concentrations in biota and air are derived during the Baseline Risk Assessment based on constituent levels measured in surface and subsurface soils.

The soils along the process sewer line were also to be characterized during the Phase II investigation if warranted by Phase I results. The Phase I soil results represent the worst case scenario for the MSSB. Based on the low levels of contamination detected and the identification of only one USC, soil sampling along the process sewer line was also deemed unwarranted.

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Media Assessment

Hand-augered soil borings were made at locations ABK-SB1 through ABK-SB6 (Figure 2) during the Phase I investigation to establish background conditions for unit soils. These locations are topographically and hydraulically upgradient from the MSSB. The samples were collected from Udorthent soils at sample depths corresponding to the depth of samples collected from the basin. Two soil samples were collected at each location at depth intervals of 0-0.3 m (0-1 ft) and 0.3-1.2 m (1-4 ft) bls. Background soil sample locations were carefully selected and are spread out over a large area due to the presence of existing buildings, roads, and other facilities (Figure 2). The sampling locations were in areas considered to be unaffected by potential contamination from the MSSB.

Within the basin, hand-augured soil borings were advanced at six locations, AOB-SB1 through AOB-SB6 (Figure 5), during the Phase I investigation. Two soil samples were collected at each location at depth intervals of 0-0.3 m (0-1 ft) and 0.3-1.2 m (1-4 ft) bls.

Table 1 presents the background data summary for constituents detected in surface soil (0-0.3 m [0-1 ft] bls) samples. Background values are calculated by averaging the constituent concentrations detected in all six surface soil samples. If an analyte was not detected in background surface soil samples but was detected in unit surface soil samples, a value of one-half the MDL is substituted for the analyte concentration for calculating the average background value. The twice average concentration levels presented in this table are then compared to detections in unit surface soil samples as a screening level (Table 2).

Table 3 presents the background data summary for constituents detected in subsurface soil (0-1.2 m [0-4 ft] bls) samples. Background values for subsurface soils are calculated similarly to surface soils, except that all 12 samples are used (i.e., six samples from 0-0.3 m [0-1 ft] and six samples from 0.3-1.2 m [1-4 ft] bls). The twice average concentration levels presented in this table are then used for comparisons to unit subsurface soil sample detections (Table 4).

Deep soils, process sewer fine soils, and groundwater were to be sampled during the Phase II investigation,

however, based on the Phase I (worst case) results, Phase II was not required.

Table 1. Summary of Analytes Detected in Background Surface (0-0.3 m [0-1 ft]) Soil Samples

Analyte Class	Analyte	Frequency of Detection	Units	Maximum Detection	Average Detection	2x Average Detection
Volatiles	1,1,1-Trichloroethane	5 / 5	mg/kg	1.13E-02	6.62E-03	1.32E-02
	Tetrachloroethene	5 / 5	mg/kg	1.30E-02	1.04E-02	2.07E-02
	Toluene	1 / 5	mg/kg	2.23E-03	1.03E-03	2.05E-03
	Xylenes (total)	2 / 5	mg/kg	3.50E-03	1.40E-03	2.81E-03
Semivolatiles	Anthracene	1 / 6	mg/kg	3.68E-02	1.28E-02	2.56E-02
	Benzo(a)anthracene	2 / 6	mg/kg	1.17E-01	3.45E-02	6.91E-02
	Benzo(a)pyrene	2 / 6	mg/kg	1.13E-01	3.56E-02	7.11E-02
	Benzo(b)fluoranthene	2 / 6	mg/kg	1.04E-01	3.46E-02	6.91E-02
	Benzo(g,h,i)perylene	1 / 6	mg/kg	6.98E-02	1.83E-02	3.66E-02
	Benzo(k)fluoranthene	2 / 6	mg/kg	1.08E-01	3.74E-02	7.48E-02
	Chrysene	2 / 6	mg/kg	1.58E-01	4.64E-02	9.27E-02
	Fluoranthene	2 / 6	mg/kg	2.49E-01	6.70E-02	1.34E-01
	Indeno(1,2,3-c,d)pyrene	1 / 6	mg/kg	6.61E-02	1.85E-02	3.70E-02
	Phenanthrene	1 / 6	mg/kg	1.72E-01	3.49E-02	6.98E-02
	Pyrene	2 / 6	mg/kg	2.04E-01	5.85E-02	1.17E-01
Pesticides/PCBs	p,p'-DDE	1 / 6	mg/kg	5.88E-03	1.36E-03	2.71E-03
	p,p'-DDT	1 / 6	mg/kg	4.78E-03	1.26E-03	2.51E-03
TAL Inorganics	Aluminum	6 / 6	mg/kg	9.99E+03		

					5.78E+03	1.16E+04
	Antimony	2 / 6	mg/kg	7.24E-01	3.47E-01	6.94E-01
	Arsenic	4 / 6	mg/kg	5.00E+00	2.25E+00	4.50E+00
	Barium	6 / 6	mg/kg	2.47E+01	1.76E+01	3.52E+01
	Beryllium	5 / 6	mg/kg	2.74E-01	1.63E-01	3.26E-01
	Cadmium	6 / 6	mg/kg	9.72E-01	3.27E-01	6.55E-01
	Calcium	6 / 6	mg/kg	2.81E+03	6.37E+02	1.27E+03
	Chromium	6 / 6	mg/kg	2.55E+01	1.04E+01	2.09E+01
	Cobalt	6 / 6	mg/kg	1.30E+00	9.69E-01	1.94E+00
	Copper	6 / 6	mg/kg	4.00E+00	2.42E+00	4.83E+00
	Iron	6 / 6	mg/kg	2.07E+04	7.87E+03	1.57E+04
	Lead	6 / 6	mg/kg	1.30E+01	6.72E+00	1.34E+01
	Sodium	5 / 6	mg/kg	3.95E+01	2.01E+01	4.02E+01
	Vanadium	6 / 6	mg/kg	5.01E+01	1.99E+01	3.98E+01
	Zinc	6 / 6	mg/kg	3.09E+01	1.22E+01	2.44E+01
Radiological	Gross Alpha	5 / 6	pCi/g	2.72E+01	1.27E+01	2.54E+01
Indicators	Nonvolatile Beta	3 / 6	pCi/g	1.85E+01	1.00E+01	2.01E+01
Miscellaneous	Total petroleum hydrocarbons	4 / 6	mg/kg	7.56E+01	2.34E+01	4.69E+01

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Soils

The only USC identified for the MSSB was benzo(a)pyrene, which was detected in one of 12 soil samples at a concentration exceeding both its RBC and twice average background level.

Polynuclear Aromatic Hydrocarbons (PAHs), such as benzo(a)pyrene, can be derived from oil, coal, charcoal, or other similar substances and may be of anthropogenic or natural origin. They are not very mobile and tend to readily adsorb to soils. Based on the disposal history of the MSSB, this occurrence of benzo(a)pyrene may be unit related. However, the compound's limited frequency of detection in MSSB soils, together with the unit's proximity to a railroad known to carry coal strongly suggests another possible source for this contamination.

Soil Leachability

For the purpose of soil leachability analysis, contaminant migration constituents of potential concern are defined as constituents detected in unit soils with a maximum concentration greater than twice their average background level. Two inorganic contaminant migration constituents of potential concern (antimony and cadmium) and three organic contaminant migration constituents of potential concern (benzo(a)anthracene, benzo(g,h,i)perylene, and phenanthrene) are retained for soil leachability equations.

Soil leachability calculations were performed using detailed, unit-specific equations in accordance with EPA soil screening guidance. The equations estimate the concentrations of the contaminant migration constituents of potential concern at the base of the vadose zone. Groundwater concentrations were then calculated from these values by applying a groundwater dilution factor. The nature of the input data and the analytical equation assumptions were such that the estimates of groundwater concentrations were conservative.

Based on the results of the equations, none of the organic contaminant migration constituents of potential concern were predicted to leach into groundwater and none of the inorganic contaminant migration constituents of potential concern were estimated to reach maximum concentration within 1000 years. Therefore, none of the contaminant migration constituents of potential concern calculated for the MSSB are likely to pose a future human health risk due to ingestion of groundwater.

VI. SUMMARY OF OPERABLE UNIT RISKS

As a component of the remedial investigation process, a baseline risk assessment was prepared for the MSSB. The baseline risk assessment consists of human health and ecological risk assessments. The risks calculated are based on the levels of benzo(a)pyrene detected for human health at MSSB because this is the only constituent to remain as a preliminary constituent of concern. Uncertainty analysis determined that benzo(a)pyrene is not unit related and the conservative risk methodology used in the Baseline Risk Assessment likely overstated the actual risk reported attributable to benzo(a)pyrene. The following describes the risk levels attributable to benzo(a)pyrene.

Carcinogenic risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of pathway-specific exposure to cancer-causing contaminants. The risk to an individual resulting from exposure to non-radioactive chemical carcinogens is expressed as the increased probability of cancer occurring over the course of a 70 year lifetime. Cancer risks are related to the EPA target risk range of one in ten thousand (1×10^{-4}) to one in one million (1×10^{-6}) for incremental cancer risk at NPL sites. Risk levels in the 1×10^{-4} to 1×10^{-6} range require a risk management decision where specific actions to reduce risk may be considered while cancer risk levels below 1×10^{-6} are considered to be insignificant.

Non-carcinogenic effects are also evaluated to identify a level at which there may be

concern for potential non-
carcinogenic health effects. The hazard quotient, which is the ratio of the exposure dose to the reference dose
(RfD), is calculated for each contaminant. Hazard quotients are summed for each exposure pathway to
determine the specific hazard index (HI) for each exposure scenario. If the HI exceeds unity (1.0), the
potential exists that adverse health effects might occur.

Summary information for the human health and ecological risk assessments is discussed in the following
sections.

Summary of Human Health Risk Assmment

Current Land Use Results

Under the current land use scenario, carcinogenic risks and noncarcinogenic hazards are characterized for
exposure of an on-unit worker to soil. Known on-unit workers are expected to be exposed to surface soils
(0-0.3 m [0-1 ft]). Figure 6 summarizes the risks and hazards graphically. Table 5 summarizes both the
current and future land use scenarios for surface soil. Table 6 summarizes both the current and future land use
scenarios for subsurface soil.

Noncarcinogenic Hazard

There are no noncarcinogenic HI values for the known on-unit worker exposure pathways because reference
dose values for noncancer effects are not available for benzo(a)pyrene, the only unit constituent of concern.

Carcinogenic Risk

All of the estimated total cancer risks are less than 1 x 10 -6, indicating that, under current conditions,
carcinogenic risk is insignificant at the unit. For the 0-0.3 m (0-1 ft) soil interval, the total cancer risk for the
known on-unit worker is 1 x 10 -8.

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Table 5. RME Risk Characterization Summary, Surface Soil (Depth 0-0.3 m [0 to 1 ft]) at the Motor Shops Seepage Basin

		Current			Future			
Medium	Exposure Route	Noncancer HI on-Unit Worker	Cancer Risk On-Unit Worker		Non cancer HI Industrial Worker		Cancer Risk Industrial Resident	
Soil	Ingestion	0E+00	3E-09	0E+00	0E+00	3E-06	B	5E-07
	Dermal Contact	0E+00	8E-09	0E+00	0E+00	5E-06	2E-06	B
	Inhalation	0E+00	1E-14	0E+00	0E+00	3E-11	2E-11	
Produce	Ingestion	NA	NA	0E+00	NA	2E-06	B	NA
Combined Hazard Index:		0E+00		0E+00	0E+00			
Combined Cancer Risk:			1E-08			1E-05	B	3E-06 B

NA - pathway not evaluated
0E+00 - pathway evaluated but no risks could be calculated due to lack of EPA-approved toxicity values
B - HI = 1 or ELCR = 1E-04 for chemical risks
E - HI > 1 or ELCR > 1E-04 for chemical risks

Table 6. RME Risk Characterizations Summary, Subsurface Soil (Depth 0-1.2 m [0 to 4 ft] at the Motor Shops Seepage Basin

Current Future

Medium	Exposure Route	Noncancer HI on-Unit Worker	Cancer Risk On-Unit Worker	Non cancer HI Resident	Industrial Worker	Cancer Risk Resident	Industrial Worker
Soil	Ingestion	NA	NA	0E+00	0E+00	3E-06 B	5E-07
	Dermal Contact	NA	NA	0E+00	0E+00	5E-06	2E-06 B
	Inhalation	NA	NA	0E+00	0E+00	3E-11	2E-11
Produce	Ingestion	NA	NA	0E+00	NA	2E-06 B	NA
C							
Combined Hazard Index:		0E+00	B	0E+00	0E+00		
Combined Cancer Risk:			0E+00			1E-05 B	3E-06 B

NA - pathway not evaluated
0E+00 - pathway evaluated but no risks could be calculated due to lack of EPA-approved toxicity values
B - HI = 1 or ELCR = 1E-04 for chemical risks
E - HI > 1 or ELCR > 1E-04 for chemical risks

Future Land Use Results

The future hypothetical on-unit workers are assumed to be exposed to surface soils (0-0.3 m 0-1 ft]) and subsurface soils (0-1.2 m (0-4 ft]). Figures 7 and 8 summarize the risks and hazards graphically for the Hypothetical On-Unit Industrial Worker.

Hypothetical On-Unit Industrial Worker

Under the future land use scenario, carcinogenic risks and noncarcinogenic hazards are calculated for exposure of the hypothetical on-unit worker to surface soils, redistributed subsurface soils, but not to homegrown produce.

Noncarcinogenic Hazard

There are no noncarcinogenic HIs for the hypothetical on-unit worker exposure pathways because reference dose values for noncancer effects are not available for benzo(a)pyrene, the only unit constituent of potential concern.

Carcinogenic Risk

For the 0-0.3 m (0-1 ft) and the 0-1.2 m (0-4 ft) soil intervals, the total cancer risk for the hypothetical on-unit industrial worker is 3 x 10 -6. The risk is from benzo(a)pyrene in the dermal contact pathway.

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Hypothetical On-Unit Resident

The future hypothetical on-unit residents are assumed to be exposed to surface soils (0-0.3 m [0-1 ft]) and subsurface soils (0-1.2 m [0-4 ft]). Hypothetical residents are also assumed to be exposed to homegrown produce. Figures 9 and 10 summarize the risks and hazards graphically for the Hypothetical Adult/Child Resident.

Noncarcinogenic Hazard

There are no noncarcinogenic HIs for the hypothetical on-unit resident exposure pathways because reference dose values for noncancer effects are not available for benzo(a)pyrene, the only unit constituent of potential concern.

Carcinogenic Risk

For the 0-0.3 m (0-1 ft) soil interval, the total cancer risk for the hypothetical on-unit resident is 1 x 10 -5. This is below 1 x 10 -4, but exceeds the initial level of concern for cancer risk (1 x 10 -6). Pathways with cancer risks greater than 1 x 10 -6 include soil ingestion (Excess Lifetime Cancer Risk [ELCR] = 3 x 10 -6), dermal contact (5 x 10 -6), and ingestion of produce (2 x 10 -6) grown in the soil. Benzo(a)pyrene, which is a secondary constituent of concern, is the only constituent of concern identified for the 0-0.3 m (0-1 ft) soil interval.

For the 0-1.2 m (0-4 ft) soil interval, the total cancer risk for the hypothetical on-unit resident is 1 x 10 -5. This is below 1 x 10 -4, but exceed the initial level of concern for cancer risk (1 x 10 -6). Pathways with cancer risks greater than 1 X 10 -6 include soil ingestion (ELCR = 3 x 10 -6), dermal contact (5 x 10 -6), and ingestion of produce (2 x 10 -6) grown in the soil. Benzo(a)pyrene, which is a secondary constituent of concern, is the only constituent of concern identified for the 0-1.2 m (0-4 ft) soil interval.

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Summary of Ecological Risk Assessment

The purpose of the ecological risk assessment (ERA) component of the Baseline Risk Assessment is to evaluate the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to unit-related constituents based on a weight-of-evidence approach. An ecological risk does not exist unless a given constituent has the ability to cause one or more adverse effects and it either co-occurs with, or is contacted by an ecological receptor for a sufficient length of time or at a sufficient intensity to elicit the identified adverse effect(s).

The assessment endpoint at the MSSB is the maintenance of the terrestrial ecosystem, with no loss of species or community alteration due to antimony or cadmium toxicity, the only ecological constituents of potential concern. The testable hypothesis is that the reasonable maximum exposure (RME) concentrations of antimony and cadmium present in surface and subsurface soils are not toxic to terrestrial animals at the unit. To verify or recant the testable hypothesis, a receptor species, the oldfield mouse, is selected to represent the assessment endpoint. Since it is unlikely that antimony bioaccumulates or cadmium biomagnifies in the food chain, direct measurement of antimony and cadmium concentrations in soil media, to be modeled to concentrations in the oldfield mouse, is selected as the appropriate measurement endpoint.

The ERA confirms that the RME concentrations of antimony and cadmium present in soils at the unit are not toxic to terrestrial animals at the unit. No ecological constituents of concern are identified at the MSSB waste unit. No hazard quotients (HQs) at the MSSB are greater than 1. The constituents detected in surface and subsurface soils at the unit do not pose unacceptable risk, do not threaten the assessment endpoint for the unit, and do not impact the policy goal applicable to the unit.

Uncertainty

Benzo(a)pyrene is the only human health preliminary constituent of concern detected in surface soils (0-0.3 m [0-1 ft] interval). It exceeds human health risk-based criteria (highest risk = 1 X 10 -5 for the hypothetical adult/child receptor); the dermal pathway is the most significant risk contributor, 5 x 10 -6. Benzo(a)pyrene was not detected in the subsurface soils greater than 0.3 m (1 ft). Although benzo(a)pyrene exceeds human health risk-based criteria, it is eliminated from further consideration as a constituent of concern for the following reasons:

- The use of 1 mg/cm 2 as the soil-to-skin adherence factor is high, which causes the risk

to be high and very conservative in nature.

- When comparing central tendency exposure risk estimates to RME estimates, the combined central tendency exposure estimates are an order of magnitude lower than the RME estimates for both the industrial worker and the adult/child receptors. Risks are probably significantly overestimated by using the RME value and a high soil adherence factor. The central tendency exposure risk estimates are, by definition, representative of more likely exposures than are the RME estimates.

- Benzo(a)pyrene was detected in one out of six surface (0-1 ft) soil samples and in one out of 12 subsurface soil samples (which includes the 0-0.3 m [0-1 ft] interval). Therefore, the frequency of detection is very low.

- Benzo(a)pyrene was detected two out of six times in the background samples for the surface soils. Organics are not screened out based on background comparisons as part of the constituent of potential concern selection process for the risk assessment.

Since benzo(a)pyrene is eliminated from further consideration as a constituent of concern, no human health remedial goal options are determined for this unit.

Site-Specific Considerations

Site-specific considerations, based on the conclusions of the Baseline Risk Assessment and RFI/RI, which suggest limited or no potential for significant risk include:

No samples were taken from the primary source of contamination (i.e., wastewater) because wastewater is no longer discharged to the seepage basin. The only Unit Specific Constituent (USC) found in the secondary sources of contamination (i.e., surface soil and subsurface soil) was benzo(a)pyrene. Benzo(a)pyrene is a polynuclear aromatic hydrocarbon (PAH). PAHs can be derived from oil, coal, charcoal, or other similar substances and may be of anthropogenic or natural origin. They are not very

mobile and tend to readily adsorb to soils. Based on the disposal history of the MSSB, this occurrence of benzo(a)pyrene may be unit related. However, the compound's limited frequency of detection in MSSB soils, together with the unit's proximity to a railroad known to carry coal, strongly suggests another possible source for this contamination.

Remedial Action Objectives

Remedial action objectives specify unit-specific contaminants, media of concern, potential exposure pathways, and remediation goals. Remediation goals are developed based upon Applicable or Relevant and Appropriate Requirements (ARARs) or can be risk-based. Because there are no constituents of concern at the unit, remedial action objectives are not required.

ARARs are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal, state, or local environmental law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Other available information that is not an ARAR (e.g., advisories, criteria, guidance) may be considered in the analysis if it helps to ensure protectiveness or is otherwise appropriate for use in a specific alternative. These guidances are referred to as to-be-considered (TBC) guidances. Three types of ARARs; action-, chemical-, and location-specific; have been developed to simplify identification and compliance with environmental requirements. Action-specific requirements set controls on the design, performance and other aspects of implementation of specific remedial activities. Chemical-specific requirements are media-specific, health-based concentration limits developed for site-specific levels of contaminants in specific media. Location-specific ARARs must consider federal, state, and local requirements that reflect the physiographical and environmental characteristics of the unit or the immediate area.

The only nonradiological chemical-specific ARARs for soils under Federal and South Carolina regulations are for polychlorinated biphenyls (PCBs) and lead (400 mg/kg). ARARs for PCBs are governed by the Toxic Substances Control Act (40 CFR Part 761). For an unrestricted access area (e.g., residential), the PCB clean-up standard is 1 mg/kg by weight, provided that the soil is excavated to a minimum depth of 25 cm (10 in) and that the excavated soil is replaced with clean soil (i.e., soil containing less than 1 mg/kg PCBs). One PCB, aroclor-1260, was detected twice in the surface soil interval at a concentration of 6.76E-02 mg/kg. This

concentration is below both the ARAR and RBC criteria. The maximum detection of lead was only 13 mg/kg which is well below the 400 mg/kg limit.

VII. DECLARATION STATEMENT

Based on the MSSB RCRA Facility Investigation/Remedial Investigation (RFI/RS) Report, the Baseline Risk Assessment, and the uncertainty analysis, the MSSB poses no significant risk to human health and the environment. The Baseline Risk Assessment determined that there are no constituents of concern present at MSSB, therefore no remedial goals were set and No Action is an appropriate remedy.

The selected remedy is protective of human health and the environment and complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action. No Action will not result in hazardous substances, pollutants, or contaminants remaining in the source unit, therefore five-year Record of Decision reviews are not required.

VIII. EXPLANATION OF SIGNIFICANT CHANGES

There were no significant changes made to the Record of Decision based on comments received during the public comment period for the Statement of Basis/Proposed Plan. Comments that were received during the public comment period are addressed in Appendix A.

IX. RESPONSIVENESS SUMMARY

A Responsiveness Summary of the comments received during the public comment period is included in Appendix A.

X. REFERENCES

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APPENDIX A

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

The public comment period for the Statement of Basis/Proposed Plan for the Motor Shops Seepage Basin (716-A) began on February 12, 1998 and ended on March 28, 1998. The public comment period for the RCRA Permit Modification began on February 12, 1998 and ended on March 28, 1998.

Public Comments

There were no public comments of the Motor Shops Seepage Basin Statement of Basis/Proposed Plan.

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 08/04/1998
Operable Unit: 10
ROD ID: EPA/541/R-98/059

Media: Groundwater, Soil

Contaminant: Base Neutral Acids, Inorganics, Metals, PAH, VOC

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. SRS is a secured U.S. government facility with no permanent residents. SRS is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina.

SRS is owned by the Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided nuclear materials for the space program and for medical, industrial, and research efforts. Chemical and radioactive wastes are by-products of nuclear material production processes. The entire SRS facility was placed on the National Priorities List (NPL) in December 1989.

Operable Unit (OU1):

The M-Area Hazardous Waste Management Facility (HWMF) is a source-specific operable unit within the A/M Area Fundamental Study Area. The M-Area HWMF includes an unlined surface impoundment (settling basin), a portion of an inactive process sewer line, drainage and seepage areas, and a Carolina bay known as Lost Lake. The nearest plant boundary is approximately 5800 feet northwest of the M-Area HWMF.

The M-Area settling basin was constructed in 1958 to settle out metals discharged from M-Area manufacturing operations. The basin dimensions were approximately 330 feet by 280 feet by 17 feet with a volumetric capacity of approximately eight million gallons. Overflow from the settling basin was directed to a natural seepage area and ultimately to Lost Lake. In July 1985, a permitted wastewater treatment facility was placed in operation and discharges to the settling basin were discontinued.

A Record of Decision (ROD) addressing OU1 was completed in June 1992.

OU2:

The Metallurgical Laboratory HWMF is a source-specific operable unit within the A/M Area fundamental Study Area. The Metallurgical Laboratory HWMF includes an abandoned portion of a process sewer line, a seepage basin, a drainage outfall, and a Carolina bay. The nearest plant boundary is located approximately three-fourths of a mile to the northwest of this operable unit.

The Metallurgical Laboratory was used for corrosion testing on stainless steels and nickel-based alloys. This testing required degreasing and cleaning metal parts, etching sample identification information on the parts, and photographing the samples. No radioactive materials were known to have been discharged to the HWMF. During periods of heavy rainfall, wastewater and surface water overflowed a drainage outfall at the Metallurgical Laboratory Basin into the adjacent Carolina Bay. A RCRA closure plan for the basin and sewer line portions of the Metallurgical Laboratory HWMF was submitted and approved in June 1991. The intent of the closure plan is to ensure the basin and sewer line portions of the Metallurgical Laboratory HWMF will be closed in a manner that controls, minimizes, or eliminates post-closure migration of hazardous constituents and decomposition products to the vadose zone, groundwater, surface waters, or atmosphere.

A ROD addressing OU2 was completed in June 1992.

OU3:

The A/M Area, located in the northwest portion of SRS, contains nuclear fuel fabrication buildings, office buildings, and research areas. The A/M Area groundwater is a media-specific operable unit

within the A/M Area Fundamental Study Area. As a result of past waste disposal practices, the groundwater beneath A/M Area has been contaminated with organic solvents, primarily trichloroethylene (TCE) and tetrachloroethylene (perchloroethylene; PCE). Total plume size beneath the A/M Area, as currently defined, is approximately 1200 acres. The contamination in the A/M Area groundwater and the overlying unsaturated zone appears to be associated with releases from the following A/M Area source units: the A-014 Outfall, the M-Area Settling Basin/Lost Lake (M-Area HWMF), and the M-Area HWMF Process Sewer, and the 321-M Solvent Storage Area.

From 1952 to 1981, an estimated 13 million pounds of chlorinated solvents were used in the A/M Area to degrease fuel and target tubes used in SRS reactors. An estimated 50 to 90 percent of the solvents evaporated during degreasing operations. The remaining solvents were discharged as waste to the process sewer system. Additionally, significant quantities of chlorinated solvents were inadvertently spilled during handling and storage.

A ROD addressing OU3 was completed in June 1992.

OU4:

The Gunsite 720 Rubble Pit is located within SRS and is approximately 305 meters (100 feet) west of South Carolina Highway 125, 168 meters (550 feet) north of SRS Road A-2, and 2.5 kilometers (1.5 miles) from the nearest SRS boundary.

During the period from 1955 to 1960, to defend the SRS in the event of an air attack, the U.S. Army established onsite anti-aircraft artillery gun emplacements at several locations near the perimeter of SRS. The Gunsite 720 was one of those emplacements. In the early 1980s, while work was being performed in the area, nine empty, partially buried drums, labeled "duPont Freon 11" were found at the gunsite. The drums were excavated in July 1987, and placed on a pallet at the gunsite. The drums were excavated in July 1987, and placed on a pallet at the gunsite. The area around the drums was screened during excavation and the liquid (rainwater) that collected in the excavated drums was sampled prior to disposal. No evidence of hazardous substances was found. In October, 1989, the drums were removed from the unit.

A ROD addressing OU4 was completed in March 1997.

OU5:

The Gunsite 113 Access Road Unit is located in the northeast corner of SRS, adjacent to the access road leading to Gunsite 113, and is approximately 91.5 meters (300 feet) east of where SRS Road 8 crosses the SRS facility boundary.

The area appears to have been used as a surface disposal area for

spoil dirt and/or road construction debris. There is no documentation or record of any hazardous substance management, disposal, or any other type of waste disposal at this unit. There is no evidence that any recent disposal activities have occurred in this area or that disposal activities were more widespread. Also, there is no evidence of any burning or excavation at this waste unit.
A ROD addressing OU5 was completed in March 1997.

OU6:
The F-Area HWMF (basins F-1, F-2, and F-3) operated from 1955 until November 1988. During that time, the facility received waste effluents from F-Area chemical separation facilities processes such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads. The three basins had a combined maximum operating capacity of 20.5 million gallons of wastewater.
These basins were closed by dewatering, physically and chemically stabilizing the remaining sludges and placing a protective multi-layer cover system over them to reduce rainwater contact with basin bottoms.
Closure of the F-Area HWMF was begun in 1989 and completed in January 1991. The F-Area HWMF was certified closed in February 1991. Closure activities specifically included removal of standing water remaining in the basin; stabilization of the basin sludge with a layer of granite, limestone and blast furnace slag; construction of a low permeability cap over the basin; and restoration of the area.
A ROD addressing OU6 was completed in September 1993.

OU7:
The H-Area HWMF is a source specific operable unit within the H-Area Fundamental Study Area. The H-Area HWMF consists of three unlined, earthen surface impoundments located in the center of SRS, southwest of Road E and north of road 4 approximately 6 miles from the nearest site boundary.
The H-Area HWMF operated from 1955 until November 1988. The original H-Area HWMF consisted of basins H-1, H-2, and H-3 and operated from 1955 to 1962. In 1962 H-3 was replaced by H-4. At the time of closure, the H-Area HWMF had a combined maximum operating capacity of 26.5 million gallons of wastewater. The H-Area HWMF received waste effluents from H-Area chemical separation facilities processes such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads.
The four basins were closed by dewatering, physically and chemically stabilizing the remaining sludges and placing a protective multi-layer cover system over them to reduce rainwater contact with

basin bottoms.

OU8:
The F-Area HWMF is a source specific operable unit within the F-Area Fundamental Study Area. The F-Area HWMF is located in the center of SRS, Southwest of Road E and North of Road 4 approximately 16 miles from the nearest plant boundary. The F-Area HWMF consisted of three unlined earthen basins that had a combined maximum operating capacity of 20.5 million gallons of waste water during operation. It received waste effluents from F-Area chemical separations facilities such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads. Significant amounts of nitrates and caustics were received.
A ROD addressing OU8 was completed in April 1995.

OU9:
The H-Area HWMF consists of a series of three hydraulically connected unlined basins (H-1, H-2, and H-4). Basin H-4 was built in 1962 to replace basin H-3. Wastewater flow to the basins was terminated on November 7, 1988 in accordance with the requirements of RCRA. The H-Area HWMF received waste effluents from H-Area chemical separations facilities such as nitric acid recovery unit, waste storage system evaporator overheads, and general purpose overheads. The waste stream contained hazardous constituents and low levels of radionuclides.
A ROD addressing OU9 was completed in April 1995.

OU10:
The Fire Department Hose Training Facility (FDHTF) is located approximately 200 meters (700 feet) northeast of the intersection of Roads C and 6 and approximately six meters (20 feet) west and downgradient of a heat exchanger storage pad. The FDHTF is a source control and groundwater operable unit. The FDHTF was built between 1975 and March 1979 and operated by the SRS Fire Department between 1979 and 1982 to train personnel in fighting waste oil fires. Training exercises typically included pouring burnable oil into the unit, igniting the oil, and then having the fire department extinguish the fire with water from fire hydrants located adjacent to the unit. No known hazardous wastes were placed in the unit.
The SRS Fire Department discontinued use of the FDHTF and recommended the facility for cleanup and closure in March 1982. Available documentation indicates cleanup activities occurred on November 21, 1982 during which 14 loads of oil-contaminated soil were excavated from an area approximately 6 by 6 by 1 meter and

transported to the sanitary landfill. However, the date of this cleanup activity could not be verified.
A ROD addressing OU10 was completed in August 1998.

OU11:
The Central Shops Burning/Rubble Pit (631-6G) (BRP6G)is located in the Central Shops Area near the center of the SRS. It operated from 1951 through 1955 for the disposal and burning of waste materials. The unit consisted of a shallow unlined excavation, approximately 3m (10 feet) deep. Materials believed to be disposed of in the pit included waste oils, rags, paper, cardboard, plastics, degreasers, wood, rubber, and drummed organic solvents. These materials were periodically burned in the pit, usually on a monthly basis. The volume of waste disposed of at BRP6G was not recorded.
A ROD addressing OU11 was completed in May 1997.

OU12:
The M-Area West unit is located west of the M-Area Production Facility on a dirt road approximately 1.8 kilometers north of Silverton Road. There are no structures of any type located at or near M-Area West. The only nearby man-made feature is a dirt access road located about 30 to 40 feet west of the waste areas.
The unit consists of two small areas. Several drums and other small innocuous debris were found on the land surface adjacent to a dirt road approximately 1 kilometer west of the M-Area production facility. The total waste at the unit consisted of six empty 55-gallon drums, four 1-gallon cans and a 1-gallon glass jar. The cans and the jar were originally contained in one of the larger drums. With the exception of a crushed drum and small amounts of metal debris, all other materials were removed from the site in 1992.
There is no documented information available regarding past hazardous or non-hazardous waste disposal activities at M-Area West. Markings on the drums found at the unit suggest that they once contained oil and solvents, and that they are approximately 37 years old. There is no evidence that any recent disposal activity has occurred or that the disposal activity was more widespread. Also, there is no evidence of any burning or excavation at this waste unit.
A ROD addressing OU12 was completed in September 1995.

OU13:
The Silverton Road Waste Unit (SRWU) is located in the northwestern part of SRS in Aiken County, approximately 1.5 miles southwest of A/M Area. The SRWU was first used before construction of the SRS. Municipal, agricultural, and commercial trash, rubbish, garbage, debris, and refuse probably constituted the waste stream until the early 1950s. After procurement by the federal

government, the SRWU land continued to be used as an open dump for disposal of metal shavings, 55-gallon drums, cardboard drums, tires, lumber, etc. No records of waste disposal activities were kept. In 1974, the disposal of waste at the SRWU ceased, and the area was bulldozed, graded, covered with soil, and planted with grasses.
A ROD addressing OU13 was completed in March 1997.

OU14:
The F-Area Burning /Rubble Pits (FBRP) comprise a source unit located within the SRS, approximately 3000 feet west of F-Area and 1100 feet north of SRS Road C. Between 1951 and 1973, SRS used Pits 231-F and 231-1F to burn a variety of wastes which were considered non-hazardous at that time. Some of these waste materials (degreasers and solvents) are now considered to be hazardous based on ingestion or possible dermal contact. Waste was usually burned on a monthly basis. The chemical composition and volumes of the disposed waste are unknown, but waste materials burned included paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents.
A ROD addressing OU14 was completed in March 1997.

OU15:
The D-Area Burning/Rubble Pits (DBRP) are located in the western part of the SRS in Barnwell County, approximately 2600 feet west of D Area and 1.6 miles west of State Highway. Between 1951 and 1973, burning pits were used at SRS to burn a variety of hazardous and non-hazardous waste. The chemical composition and volumes of the disposed waste are unknown. Combustible materials, which were burned monthly, included paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents. No known or suspected radioactive materials were allowed in the burning pits. Burning of waste in the SRS pits was discontinued by October 1973. A layer of soil was then placed over the residue in the pits and they were subsequently used as rubble pits.
A ROD addressing OU15 was completed in March 1997.

OU16:
The Old F-Area Seepage Basin (OFASB) is located within the SRS, approximately 600 feet north of F Area and one mile east of Road C and is located in Aiken County. The Savannah River and associated swamps are located approximately six miles west of the basin. The OFASB is designated as Building Number 904-49G and covers a total area of 1.3 acres.
Between November 1954 and mid-May 1955, 9 to 14 million gallons of wastewater were discharged to the basin which served as an unlined seepage basin for the purpose of reducing radioactive

substance concentrations. Wastewater included overhead condensates from evaporators, laundry washwaters, non-reactor cooling water from F and H Areas, and possibly other chemicals.
A ROD addressing OU16 was completed in May 1997.

OU17:
The L-Area Oil and Chemical Basin (LAOCB) and L-Area Acid Caustic Basin (LAACB) are located south of L-Area in an area of low to moderate relief. They are situated on the southern flank of a hill approximately 300 feet south of the L-Area perimeter fence and 1,250 feet north of L Lake.
The LAOCB was designed and constructed as an unlined seepage basin in 1961 for the purpose of disposing of small volumes of wastes that were not appropriate for discharge to local streams, regular seepage basins, or the 200-Area waste management system. The exact quantity of waste water discharged to the LAOCB basin is not documented. Liquid wastes consisting of small volumes of slightly radioactive oil and chemical wastewater were sent to the LAOCB from throughout SRS, but came primarily from the reactor areas. Wastes were transported to the drainage pad in tank trucks, metal drums, skid tanks, and other containers. The Hot Shop (Building 717-G) discharged decontaminated wastewater containing radionuclides, detergents, and spent degreasing solvents through the pipeline to the basin.
A ROD addressing OU17 was completed in March 1997.

OU18:
The Burma Road Rubble Pit (BRRP) is located approximately one-half mile southwest of F-Area Separations Facility and one-tenth mile southwest of C Road. The BRRP is between Upper Three Runs Creek and Four Mile Creek.
The BRRP consists of two unlined earthen pits dug into surficial soil and filled with various waste materials. A small circular area of disturbed soil was detected adjacent to these pits and is considered to have been used as a source of backfill for the pits. It has been determined that the BRRP source control OU does not contribute contamination to the area groundwater or surrounding soils.
A ROD describing OU18 was completed in August 1998.

OU20:
The K-Area Bingham Pump Outage Pit (KBPOP) is situated in the Tobacco Road formation which extends from ground surface to a depth of 95 feet below ground surface. Between 1957 and 1958, miscellaneous construction debris generated by major modifications and repairs to the primary and secondary reactor cooling water systems was buried in the KBPOP. There were no pumps buried and

no liquid waste was disposed of in the KBPOP.
A ROD addressing OU20 was completed in March 1998.

OU23:
The F-Area Retention Basin (FRB) is located outside and south of the F-Area perimeter fence, approximately 1035 meters (3397 feet) from Fourmile Branch. The FRB, with an area of 0.6 acres, was designed and operated as an unlined, temporary container for potentially contaminated cooling water from the F-Area Canyon Facility and stormwater drainage from the F-Area Tank Farm. Cooling water from the Canyon Facility generally had low levels of radioactivity, while water from the Tank Farm is believed to have had only trace quantities of nonradionuclide chemicals. The quantities of water released to the retention basin and the level of various constituents contained within the water are unknown.
A ROD addressing OU23 was completed in September 1998.

OU27:
The D-Area Oil Seepage Basin is located on the Ellenton Plain, the highest of three terraces between the Savannah River to the west and the Aiken Plateau to the east. Construction of the D-Area Oil Seepage Basin trenches began in 1952. Employee interviews indicated the basin was used in the disposal of waste oil originating from D-Area Powerhouse operations to dispose of nonburnable waste and for the routine burning of office and cafeteria waste. Unknown amounts and types of waste were disposed into the basin. Records of the contents of the disposed drums do not exist. To date, there is no evidence to indicate the presence of radionuclides in the drums. Furthermore, employee interviews have indicated that no radionuclides were disposed within the trenches. In 1975, the D-Area Oil Seepage Basin was removed from service and backfilled with soil. Approximately one foot of standing liquid, plus an unknown number of 55-gallon drums possibly containing waste oil, remained in the basin when it was backfilled. The basin remains inactive and is covered with natural vegetation, including bushes and grasses, and is surrounded by trees.
RODs addressing OU27 were completed in March 1995 and August 1998.

OU29:
The TNX Area is a pilot scale test facility for the SRTC. The pilot scale facilities are used to provide technical support to various SRS production areas. From 1953 to August 1988, wastewater generated by research performed in the TNX Area was disposed of in seepage basins. In August 1988, wastewater was rerouted to the TNX Effluent Treatment Facility.

A ROD addressing OU29 was completed in November 1994.

OU32:
The Burial Ground Complex (BGC) is an area which occupies approximately 195 acres in the central part of SRS between F and H Separation Areas, on a nearly flat divide between Upper Three Runs Creek to the north and Four Mile Creek to the south.
The BGC includes the Old Radioactive Waste Burial Ground (ORWBG) and other OUs such as the Mixed Waste Management Facility (MWMF), the Low Level Radioactive Waste Disposal Facility (LLRWDF), Solvent Tanks S1-S22 (located in the ORWBG and currently being characterized), Solvent Tanks S23-S30, and Solvent Tank S32.
The ORWBG comprises a disposal area for solid radioactive waste produced at the SRS, as well as shipments from other U.S. DOE and Department of Defense facilities. The ORWBG has contributed to localizedshallow aquifer groundwater contamination. The plume of groundwater contamination from the ORWBG seeps into the old F-Area effluent stream which flows into Four Mile Creek which in turn flows into the Savannah River. Other RCRA/CERCLA units within the BGC are undergoing characterization and investigation to determine the impacts to the environment.
The ORWBG began receiving waste in 1952 and was filled in 1972. Examples of materials disposed of at the Old Radioactive Waste Burial Ground (ORWBG) include the incidental waste from laboratory and production operations, contaminated equipment, lead, spent deionizer resins, spent lithium-aluminum targets, irradiated process oil from pumps in the tritium facilities and reactor areas, mercury from gas pumps in tritium facilities, cadmium, scintillation fluid, and shipments from off-site.
A ROD addressing OU32 was completed in June 1996.

OU33:
The mixed waste management facility (MWMF) operated from 1969 until March 11, 1986. During that time, this facility, which comprises approximately 58 acres, received low-level radioactive waste materials produced at SRS. Some of these materials are classified as mixed waste containing both hazardous and radioactive components under the RCRA. These trenches were closed by precompacting and placing a protective multi-layer cover system over them to reduce rainwater contact with trench bottoms.
RCRA preventive actions at the MWMF were conducted pursuant to the requirements of RCRA. In 1985 a RCRA Closure Plan was submitted, and closure of the MWMF was begun in 1988 and completed in December 1990. The MWMF was certified closed in 1991. Closure activities specifically included precompaction,

construction of a low permeability cap over the trenches, and restoration of the area.
A ROD addressing OU33 was completed in September 1994.

OU34:
The Tank 105-C HWMF was installed in 1961 as part of an off-line heat exchanger repair program and was used as a temporary holding tank for liquid solution. Sumps from the heat exchanger cleaning area drained into Tank 105-C. Oil in the tank was probably attributable to oil leaks into these sumps. The reacted or spent oxalic acid solution that resulted from the rinsing process was pumped into an above ground neutralization tank in the stack area of the reactor building.
In October 1990, a RCRA Closure Plan was submitted to the SCDHEC. SRS received approval of the closure plan on January 16, 1991, with no revision required. Closure activities specifically included the neutralization of waste to a pH of less than 12.5, removal of as much waste as reasonably possible, and shipment of removed waste to an onsite storage/disposal facility. Any remaining waste and the tank void were stabilized with concrete.
A ROD addressing OU34 was completed in September 1994.

OU35:
Par Pond is a 2640-acre man-made reservoir located northeast of P Area and east of R Area in the eastern portion of SRS. The southern shore of the reservoir lies approximately 1.5 miles from the eastern SRS boundary. The southern shore of the reservoir lies approximately 200 feet north of Road B. Par Pond discharges through controlled releases into Lower Three Runs Creek, which in turn discharges into the Savannah River. The length of Lower Three Runs Creek from the outfall of Par Pond to the Savannah River is approximately 20 miles.
Par Pond was built to augment the cooling water requirements of both P and R Reactors. During the 1950s, an effluent pathway was constructed from R Reactor to Par Pond. The pathway consisted of the R Canal and Pond B. Releases in the form of process leaks, purges, and makeup cooling water have contaminated Par Pond with cesium-137 and other radioactive and non-radioactive contaminants. Mercury has been detected in fish from the Savannah River and SRS waterbodies since the analyses began in 1971, with comparable concentrations measured in onsite and offsite fish.
A ROD describing OU35 was completed in February 1995.

OU41:
OU41 contains the P-Area CP R/O Basin (P-CRPB). The P-CRPB is located approximately 330 feet southeast of the limited area fence

surrounding P Area in northwestern Barnwell County.
A ROD addressing OU41 was completed in September 1998.

OU42:
OU42 contains the C-Area CP R/O Basin (C-CRPB). The C-CPRB is located approximately 700 feet southeast of the limited area fence surrounding C Area in northwestern Barnwell County.
A ROD addressing OU42 was completed in September 1998.

OU45:
The Grace Road Site is located approximately 1.3 kilometers south of B-Area and about 244 meters east of the intersection of Grace Road and SRS Road 2. It consists of numerous drums and cans, concrete slabs, brick foundations, and miscellaneous debris. The unit also contained numerous drums and cans varying in size from ? gallon cans to 55-gallon drums and various car parts. Most of the debris was on the surface or partially buried in scattered locations across the unit. Markings on a few of the smaller drums and cans indicated that they once contained oil and grease. There is no evidence that any recent disposal activity has occurred or that the disposal activity was more widespread. Also, there is no evidence of any burning or excavation at this waste unit.
Between February and May 1992, all the debris, drums and concrete slabs were removed from the Grace Road Site. The items removed were either used at soil erosion control areas or were disposed of in the sanitary landfill. No records of any type of waste management activity have been found for the Grace Road Site.
A ROD addressing OU45 was completed in March 1997.

OU51:
The Motor Shops Seepage Basin (716-A) (MSSB) is located in A Area south of the railroad tracks near the automotive shop in Aiken County. A small drainage feature runs through the area approximately 91 meters (300 feet) to the east of the MSSB.
The MSSB was constructed and placed in service in 1977 to receive liquid waste from the 716-A Motor Shops oil/water separator. The MSSB was designed and constructed as an unlined seepage basin. The wastewater flowed into the basin from the northwest through two influent pipes from the Motor Shop and seeped naturally into the soil beneath the basin. Effluent discharges from the Motor Shops included wastewater with trace amounts of engine oil, grease, kerosene, ethylene glycol, and soapy water.
A ROD addressing OU51 was completed in June 1998.

OU52:
The K-Area CP R/O Basin (K-CPRB). The K-CPRB is located

approximately 500 feet west of the limited area fence surrounding K Area in northwestern Barnwell County.
A ROD addressing OU52 was completed in September 1998.

OU54:
The F-Area CP R/O Basin (F-CPRB) is located approximately 50 feet southeast of the limited area fence surrounding F Area in southwestern Aiken County.
A ROD addressing OU54 was completed in September 1998.

Remedy: The selected remedy for the Fire Department Hose Training Facility (FDHTF) is No Action. The previous soil removal activities conducted outside of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) at the FDHTF have eliminated the need to perform additional remedial action. Other remedial alternatives for this unit were not considered because the baseline risk assessment (BRA) showed that all of the constituents of concern (COCs) were eliminated because the risks indicated for the site were not attributed to activities performed at the FDHTF.

The risk levels developed in the BRA considered both the future residential and future industrial use scenarios. The uncertainty analysis performed in the BRA eliminated all human health and ecological COCs which meant that no remedial goal options (RGOs) were developed. There will be no post-Record of Decision (ROD) documents since No Action is the preferred alternative for the FDHTF operable unit (OU). The South Carolina Department of Health and Environmental Control (SCDHEC) has modified the Savannah River Site (SRS) Resource Conservation and Recovery Act (RCRA) permit to incorporate No Action as the selected remedy.

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $0

Text: Full-text ROD document follows on next page.

EPA 541-R98-059

<IMG SRC 980590>

United States Department of Energy

Savannah River Site

Record of Decision

Remedial Alternative Selection for the

Fire Department Hose Training Facility (904-113G)

Operable Unit (U)

WSRC-RP-97-171
Revision 1
April 1998

<IMG SRC 98059A>

Record of Decision for the Fire Department Hose Training Facility (904-113G)
WSRC-RP-97-171
Operable Unit (U)
Revision 1
Savannah River Site, April 1998
Disclaimer

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Westinghouse Savannah River Company
Aiken, South Carolina

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION
FOR THE FIRE DEPARTMENT HOSE TRAINING FACILITY (904-113G)
OPERABLE UNIT (U)

WSRC-RP-97-171
Revision 1
April 1998

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U. S. Department of Energy Under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

Record of Decision for the Fire Department Hose Training Facility (904-113G)
WSRC-RP-97-171
Operable Unit (U)
Revision 1
Savannah River Site, April 1998

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Declaration 1

DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

Fire Department Hose Training Facility (904-113G)
Savannah River Site
Aiken, South Carolina

The Fire Department Hose Training Facility (904-113G) (FDHTF) Operable Unit is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) solid waste management unit/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS).

Statement of Basis and Purpose

This decision document presents the selected remedial alternative for the FDHTF located at the SRS in Aiken, South Carolina. The selected alternative was developed in accordance with RCRA, CERCLA, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan. This decision is based on the Administrative Record File for this specific RCRA/CERCLA unit.

Description of the Selected Remedy

The selected remedy for FDHTF is No Action. The previous soil removal activities conducted outside of CERCLA at the FDHTF have eliminated the need to perform additional remedial action. Other remedial alternatives for this unit were not considered because the Baseline Risk Assessment (BRA) showed that all of the constituents of concern (COCs) were eliminated because the risks indicated for the site were not attributed to activities performed at the FDHTF.

The risk levels developed in the BRA considered both the future residential and future industrial use scenarios. The uncertainty analysis performed in the BRA eliminated all human health and ecological COCs which meant that no remedial goal options (RGOs) were

developed. There will be no post-Record of Decision documents since No Action is the preferred alternative for the FDHTF operable unit. The South Carolina Department of Health and Environmental Control has modified the SRS RCRA permit to incorporate No Action as the selected remedy.

Declaration Statement

Based on the FDHTF RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report

and the Baseline Risk Assessment, no action is necessary at the FDHTF to ensure the protection of human health and the environment. Since the FDHTF poses no risk to human health and the environment, and no action is needed, the CERCLA Section 121 requirements are not applicable. The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is meant to be a permanent solution, final action, for the FDHTF operable unit.

Section 300.430(f)(ii) of the National Oil and Hazardous Substances Pollution Contingency Plan requires that Five-Year Review of Record of Decision be performed if hazardous substances, pollutants, or contaminants remain at the unit. The three Parties have determined that a Five-Year Review of Record of Decision for the FDHTF operable unit will not be performed. The remedial action for this unit (No Action) results in no hazardous substances, pollutants, or contaminants remaining in the soils of the FDHTF operable unit.

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DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION
FOR THE FIRE DEPARTMENT HOSE TRAINING FACILITY (904-113G)
OPERABLE UNIT (U)

WSRC-RP-97-171
Revision 1
April 1998

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the

U. S. Department of Energy Under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

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Acronyms

BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response. Compensation, and Liability Act
COC	Constituent of Concern
COPC	Constituent of Potential Concern
DOE	U. S. Department of Energy
ELCR	Excess Lifetime Cancer Risk
EPA	Environmental Protection Agency
FDHTF	Fire Department Hose Training Facility (940-113G)
FFA	Federal Facility Agreement
HI	Hazard Index
HQ	Hazard Quotient
PCB	Polychlorinated Biphenyl
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RGO	Remedial Goal Option
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulations
SRS	Savannah River Site
SVOC	Semi-Volatile Organic Compounds
SWMU	Solid Waste Management Unit
TPH	Total recoverable Petroleum Hydrocarbon
USC	Unit Specific Constituents
VOC	Volatile Organic Compound
WSRC	Westinghouse Savannah River Company

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I. SITE AND OPERABLE UNIT NAME, LOCATION, AND DESCRIPTION

Savannah River Site (SRS) occupies approximately 800 square kilometers (310 square miles) of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. SRS is a secured U.S. Government facility with no permanent residents. SRS is located approximately 40 kilometers (25 miles) southeast of Augusta, Georgia, and 32 kilometers (20 miles) south of Aiken, South Carolina.

SRS is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense.

The Fire Department Hose Training Facility (940-113G) (FDHTF) is located approximately 200 m (700 ft) northeast of the intersection of Roads C and 6 and approximately 6 m (20 ft) west and downgradient of a heat exchanger storage pad (Laydown Area, 745-N) (Figures 1 and 2). The FDHTF is a source control and groundwater operable unit which is included in the Fourmile Branch watershed (Figure 3). The FFA lists FDHTF as a RCRA/CERCLA unit, requiring evaluation using an investigation/assessment process that integrates and combines the RFI process with the CERCLA Remedial Investigation (RI) to determine the actual or potential impact to human health and the environment.

II. OPERABLE UNIT HISTORY AND COMPLIANCE HISTORY

Operable Unit History

The FDHTF was built between 1975 and March 1979 and operated by the SRS Fire Department between 1979 and 1982 to train personnel in fighting waste oil fires. The training facility consisted of an approximately 6 by 12 m (20 by 40 ft) unlined shallow pit surrounded by an approximately 0.5 m (1.5 ft) high asphalt dike. Training exercises typically included pouring burnable oil into the unit, igniting the oil, and then having the fire department extinguish the fire with water from fire hydrants located adjacent to the unit. No known hazardous wastes were placed in the unit.

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The SRS Fire Department discontinued use of the FDHTF and recommended the facility for cleanup and closure in March 1982. Available documentation indicates cleanup activities occurred on November 21, 1982 during which 14 loads of oil-contaminated soil were excavated from an area approximately 6 by 6 by 1 m (20 by 20 by 3 ft) and transported to the sanitary landfill. The date of this cleanup activity could not be verified, however, an aerial photograph from 1983 shows the FDHTF still present. An additional aerial photograph from June 1984 shows the FDHTF pit had been removed and the area excavated. The excavated area is approximately 10 to 12 m (30 to 40 ft) wide by 15 to 18 m (50 to 60 ft) long and the pit dikes and visible contaminated soils are removed. An additional area 3 to 5 m (10 to 15 ft) wide by 10 to 12 m (30 to 40 ft) long, visible on the north side of the main excavation, is either an additional remediated area, a pile of the excavated material, or material intended for backfill. The photographs indicate that either existing documentation is incorrect (11/21/82 is actually 11/21/83) or that a more extensive excavation took place between July 1983 and June 1984. Subsequent inspections during 1985 indicated that an additional area approximately 1 m by 1 m (3 by 3 ft), of visibly contaminated soil was placed here from an unknown source. This area was also excavated to a depth of approximately 0.6 m (2 ft) and the soil removed from the site in a manner similar to the 1982/84 cleanup activities.

SRS Compliance History

At SRS, waste materials regulated under RCRA are managed in accordance with the requirements of RCRA. Certain SRS activities have required treatment, storage, disposal or post-closure permits under RCRA. Non-regulated units, called solid waste management units (SWMU), include any activity where hazardous constituents may remain uncontrolled and may potentially release to the environment. Investigation and potential corrective action for these SWMU(s) are mandated under RCRA 3004(u). On September 5, 1995, SRS received a hazardous waste permit from SCDHEC which includes corrective action requirements. Specifically, part V of the permit mandates that SRS establish and implement a RCRA Facility Investigation (RFI) Program to fulfill the requirements specified in Section 3004(u) of RCRA.

Hazardous substance, as defined by CERCLA, are also present in the environment at the SRS. On December 21, 1989, SRS was included on the National Priorities List. This inclusion created a need to integrate the established RFI Program with CERCLA requirements to

provide for a focused environmental program. In accordance with Section 120 of CERCLA, DOE has negotiated a Federal Facility Agreement (FFA, 1993) with the EPA and SCDHEC to coordinate remedial activities at SRS into one comprehensive strategy which fulfills these dual regulatory requirements.

The RFI/RI/BRA for the Fire Department Hose Training Facility (904-113G) was completed in 1997. The results of this report indicate that there is no impact (or potential impact) to human health or the environment from the FDHTF. The previous soil removal activities at the FDHTF have eliminated the need to perform additional remedial action. Therefore, No Action is warranted. No other alternatives were considered.

According to EPA guidance, if there is no current or potential threat to human health and the environment and No Action is warranted, the CERCLA 121 requirements are not triggered. This means that there is no need to evaluate other alternatives or the No Action alternative against the nine criteria specified under CERCLA.

The remedy selected satisfies both the CERCLA and RCRA 3004(u) requirements. The SCDHEC has modified the SRS RCRA permit to incorporate the selected remedy.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Both RCRA and CERCLA require that the public be given an opportunity to review and comment on the draft permit modification and proposed remedial alternative. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternatives for addressing the FDHTF soils and groundwater. The Administrative Record File must be established at or near the facility at issue. The SRS Public Involvement Plan (DOE, 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS Public Involvement Plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act. SCHWMR R.61-79.124 and Section 117(a) of CERCLA, as amended, required the advertisement of the draft permit modification and notice of any proposed remedial action and provided the public an

opportunity to participate in the selection of the remedial action. The Statement of Basis/Proposed Plan for the Fire Department Hose Training Facility (940-113G) (WSRC, 1997b), which is part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the FDHTF.

The FFA Administrative Record File, which contains the information pertaining to the selection of the response action, is available at the EPA office and at the following locations:

U. S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Asa H. Gordon Library
Savannah State University
Tompkins Road
Savannah, Georgia 31404
(912) 356-2183

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

Reese Library
Augusta State University
2500 Walton Way
Augusta, Georgia 30910
(706) 737-1744

The public was notified of the public comment period through mailings of the SRS Environmental Bulletin, a newsletter sent to approximately 3500 citizens in South Carolina and Georgia, through notices in the Aiken Standard, the Allendale Citizen Leader, the Augusta Chronicle, the Barnwell People-Sentinel, and The State newspapers. The public comment period was also announced on local radio stations.

The 45-day public comment period for the SB/PP and the draft RCRA permit modification began on December 10, 1997 and ended on January 23, 1998. No comments from the public were received during this period. Therefore, a Responsiveness Summary will not be required as part of Appendix A of this Record of Decision.

IV. SCOPE AND ROLE OF OPERABLE UNIT WITHIN THE SITE STRATEGY

The overall strategy for addressing the FDHTF was to: (1) characterize the waste unit by delineating the nature and extent of contamination and identifying the media of concern (perform the RFI/RI); (2) perform a baseline risk assessment to evaluate media of concern,

COCs, exposure pathways, and characterize potential risks; and (3) evaluate and perform a final action to remediate, as needed, the identified media of concern.

The FDHTF is a source control and groundwater operable unit which is included in the Fourmile Branch watershed. There are no surface waters present near the unit, but a small wet weather conveyance northwest of the unit runs in a northerly direction. An unnamed tributary of Fourmile Branch is located approximately 460 m (1,500 ft) to the north, northeast of the FDHTF.

The SRS has recently concluded a surface and subsurface soil investigation at the FDHTF. Based upon preliminary characterization results, SCDHEC and EPA concurred with DOE's proposal to separate the operable unit into two operable units (i.e., the Ford Building Waste Site and the Fire Department Hose Training Facility). SCDHEC and EPA also agreed that the investigation at the FDHTF adequately characterized contamination within that unit and along potential migration pathways. This ROD will propose a final remedial action for the operable unit at the FDHTF.

V. SUMMARY OF OPERABLE UNIT CHARACTERISTICS

Media Assessment

The soil and groundwater sampling activities conducted in 1996 at the FDHTF and background locations (Figure 4) provided data on the types and extent of constituents present and supplemented soil gas surveys conducted in 1986 and 1992. The primary source of contamination at the FDHTF would be the soil impacted by oils and associated fuels burned at the facility. This soil was removed during 1982/84 cleanup activities.

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A Conceptual Site Model was prepared which shows the potential human health and ecological receptors and exposure pathways to assist in determining what samples were needed during characterization. This Conceptual Site Model is shown in Figure 5.

During the 1996 site characterization the surface soil was sampled from 0 to 0.3 m (0 to 1 ft) and subsurface soil in the interval from 0 to 1.2 m (0 to 4 ft) at 5 locations in the FDHTF. Samples received analysis for a full analytical suite: metals/inorganics, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and pesticides/ polychlorinated biphenyls (PCBs)/dioxins and furans. Past records and activities did not

indication that radionuclides had ever been disposed of at the FDHTF, so samples were only tested for radionuclide indicators and were not speciated. Manganese and two SVOCS, benzo(a)pyrene and benzo(g,h,i)perylene, were identified as unit specific constituents (USCs) in the surface soil (0-1 ft). No VOCs, pesticides, PCBs, dioxins, furans or radionuclides were identified as USCs for surface soils (0-1').

Eight metals were identified as USCs in the subsurface soil (0-4 ft): aluminum, arsenic, beryllium, chromium, iron, manganese, sodium, and vanadium. Two SVOCs, benzo(a)pyrene and benzo(g,h,i)perylene, were identified as USCs in the subsurface soil. The SVOCs were not detected deeper than 0.3 m (1.0 ft). No VOCs, pesticides, PCBs, dioxins, furans or radionuclides were identified as USCs for subsurface soils.

Seven metals were identified as USCs in the deep soil (1.2 to 4.0 m [4 to 13 ft]): aluminum, arsenic, beryllium, chromium, iron, sodium, and vanadium. No VOCs, SVOCs, pesticides, PCBs, dioxins, furans or radionuclides were identified as USCs for the deep soils at FDHTF Tables 1 through 4 summarize the contaminants found in the background, 0-1 ft deep, 0-4 ft deep, and > 4 ft deep soil samples.

The historical groundwater monitoring data has resulted in an analytical suite refined to aluminum and total recoverable petroleum hydrocarbons (TPH). No TPHs have been detected during the periodic monitoring program, so groundwater sampling was not conducted in the 1996 investigation.

The groundwater migration pathway evaluation determined that no constituents are present in the soil in quantities sufficient to migrate through the soil to cause concentrations above acceptable

levels. Previous groundwater monitoring data do not indicate that the groundwater has been impacted by the FDHTF or any other source of contaminants. The constituents present in the soil of the FDHTF at concentrations above two times their average background concentration were screened against EPA generic soil screening levels using a dilution attenuation factor (DAF) of 20 to identify those which would require vadose zone transport modeling. The use of the generic DAF of 20 is based on the unit source being less than 0.5 acres and the fact that the groundwater is not near the surface (i.e., depth to groundwater is approximately 50 feet). No constituent is present in the FDHTF soil at an average concentration exceeding its generic screening level with a DAF of 20.

The results of the FDHTF characterization study are summarized in Tables 1 through 4.

Table 1 lists the data for the background soil samples. Tables 2 through 4 contain the data for the 0 to 1 ft, 0 to 4 ft, and greater than 4 ft deep soil intervals, respectively.

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Table 1. Unit Specific Background Soil Concentrations at the Fire Department Hose Training Facility

Analyte (Units)	Surface Bkgd (0-1 ft)	2X Surface Bkgd	Subsurface Bkgd (0-4 ft)	2X Subsurface Bkgd	Deep Soil Bkgd (>4 ft)	2X Deep Bkgd
Metals/Inorganics (mg/kg)						
Aluminum	6300	12600	5890	11800	4700	9400
Antimony	0.663	1.33	0.579	1.16	0.801	1.6
Arsenic	3.26	6.52	2.87	5.74	3.52	7.04
Barium	12.9	25.8	13.3	26.6	5.73	11.5
Beryllium	0.103	0.206	0.0972	0.194	0.0754	0.151
Cadmium	0.27	0.54	0.307	0.614	0.64	1.28
Calcium	155	310	152	304	88.4	177
Chromium	14.2	28.4	12.5	25	15.9	31.8
Cobalt	0.512	1.02	0.49	0.98	0.232	0.464
Copper	11.2	22.4	6.95	13.9	4.15	8.3
Cyanide	0.16	0.32	0.183	0.366	0.181	0.362
Iron	11200	22400	10500	21000	18200	36400
Lead	7.68	15.4	6.04	12.1		

6.38 12.8
Magnesium 78.7 157 79.4 159
74.3 149
Manganese 21.7 43.4 19.7 39.4
2.42 4.84
Mercury 0.0435 0.087 0.0412 0.0824
0.035 0.07
Nickel 1.94 3.88 1.66 3.32
0.844 1.69
Potassium 71 142 69.1 138
48.1 96.2
Selenium ND ND 0.489 0.978
1.74 3.48
Sodium 35.2 70.4 29.8 59.6
29.9 59.8
Vanadium 30.4 60.8 27.2 54.4
67.7 135
Zinc 6.28 12.6 4.52 9.04
2.17 4.34
SVOCS (µg/kg)
Di-n-octyl phthalate ND ND ND ND
229 458
Phenol ND ND ND ND
44.9 89.8

* The background concentration is the mean of all results above the detection limit for samples from stations FBFDB-01, FBFDB-02, FBFDB-03, FDFDB-04 and FBFDB-05. "ND" indicates that the analyte was not detected in any background samples in that depth interval.

Table 1. Unit Specific Background Soil Concentrations at the Fire Department Hose Training Facility (Continued)

Analyte (Units) Surface Bkgd 2X Subsurface Bkgd 2X Subsurface Deep Soil 2X
(0-1 ft) Surface (0-4 ft) Bkgd Bkgd Deep Bkgd
Bkgd
(>4 ft)

Radionuclides (pCi/g)
Actinium-228 1.07 2.14 1.14 2.28
1.28 2.56
Americium-241 0.865 1.73 0.795 1.59

					0.842	1.68
Antimony-124	0.06	0.12	0.06	0.12	ND	ND
Antimony-125	ND	ND	ND	ND	0.15	0.3
Barium-133	ND	ND	ND	ND	0.07	0.14
Cesium-134	ND	ND	ND	ND	0.06	0.12
Cesium-137	0.175	0.35	0.175	0.35	ND	ND
Cobalt-60	ND	ND	0.06	0.12	ND	ND
Europium-152	0.33	0.66	0.34	0.68	0.302	0.604
Europium-155	0.263	0.526	0.377	0.754	0.253	0.506
Gross Alpha	14.7	29.4	16.7	33.4	18.1	36.2
Iodine-129	5.05	10.1	5.05	10.1	ND	ND
Lead-212	1.47	2.94	1.48	2.96	1.55	3.1
Manganese-54	ND	ND	ND	ND	0.06	0.12
Neptunium-239	ND	ND	ND	ND	0.87	1.74
Non-volatile Beta	14.6	29.2	13.7	27.4	16.9	33.8
Plutonium-238	0.32	0.64	0.23	0.46	0.295	0.59
Potassium-40	1.16	2.32	1.26	2.52	1.65	3.3
Promethium-146	ND	ND	ND	ND	0.05	0.1
Promethium-147	ND	ND	ND	ND	1.12	2.24
Radium-226	0.22	0.44	0.273	0.546	0.257	0.514
Radium-228	1.69	3.38	1.36	2.72	2.83	5.66
Ruthenium-106	ND	ND	ND	ND	2.1	4.2
Strontium-90	ND	ND	0.47	0.94	0.78	1.56
Technetium-99	0.215	0.43	0.148	0.296	0.176	0.352
Thorium-228	1.44	2.88	1.37	2.74	1.56	3.12
Thorium-232	0.967	1.93	1.08	2.16	1.45	2.9
Thorium-234	1.49	2.98	1.35	2.7	1.63	3.26
Tin-113	ND	ND	ND	ND		

0.08 0.16
Uranium-235 ND ND 0.13 0.26
0.14 0.28
Yurium-88 ND ND 0.05 0.1
ND ND
Zinc-65 ND ND ND ND
0.08 0.16

* The background concentration is the mean of all results above the detection limit for samples from stations FBFDB-01, FBFDB-02, FBFDB-03, FDFDB-04 and FBFDB-05. "ND" indicates that the analyte was not detected in any background samples in that depth interval.

Table 2. Summary statistics for Analytes Detected in Soil from 0 to 1 ft Deep from the Fire Department Hose Training Facility

Analyte (Units)	Freq. of Detection	Minimum Detected	Mean Result	Maximum Detected	Human Health Criteria	Human Health Criteria	>Human 2X Bkgd Maximum Detect > 2X Bkgd	Unit Specific Contaminant Source
Metals/Inorganics (mg/kg)								
Aluminum	5 / 5	1670	3690	5110	RBC*0.1	7800	12600	
Antimony	1 / 5	0.556	1.58	0.556	RBC*0.1	3.1	1.33	
Arsenic	4 / 5	1.2	3.01	3.7	RBC	0.43	YES	6.52
Barium	5 / 5	9	13.5	19.4	RBC*0.1	550	25.8	
Beryllium	3 / 5	0.0558	0.0719	0.107	RBC	0.15	0.206	
Cadmium	3 / 5	0.051	0.0847	0.119	RBC*0.1	3.9	0.54	
Calcium	5 / 5	78.8	156	302	RDA	1000000	310	
Chromium	5 / 5	2.5	9.02	15	RBC*0.1	39	28.4	
Cobalt	5 / 5	0.405	0.61	0.822	RBC*0.1	470	1.02	
Copper	4 / 5	4.3	4.12	5.2	RBC*0.1	310	22.4	

Cyanide 1 / 5 0.091 0.338 0.091 RBC*0.1
160 0.32
Iron 5 / 5 1480 6820 11100 RBC*0.1
2300 YES 22400
Lead 5 / 5 4.7 9.58 12.9 RBC*0.1
40 15.4
Magnesium 5 / 5 41.9 72 93.6 RDA
1000000 157
Manganese 5 / 5 28 37.1 65.3 RBC*0.1
39 YES 43.4 YES YES
Mercury 1 / 5 0.03 0.0607 0.03 RBC*0.1
0.78 0.087
Nickle 5 / 5 0.74 1.73 3.3 RBC*0.1
160 3.88
Potassium 5 / 5 54.8 74.3 90.3 RDA
393273 142
Silver 3 / 5 0.267 0.715 1.9 RBC*0.1
39 ND YES
Sodium 5 / 5 33.5 54.9 69.1
NA YES 70.4
Vanadium 5 / 5 3.6 17 29.9 RBC*0.1
55 60.8
Zinc 5 / 5 2.5 10.7 22.8 RBC*0.1
2300 12.6 YES

Table 2. Summary Statistics for Analytes Detected in Soil from 0 to 1 ft Deep from the Fire Department Hose Training Facility (Continued)

Analyte (Units) Freq. of Minimum Mean Maximum Human
Human >Human 2X Bkgd Maximum Unit
Detection Detected Result Detected Health
Health Health Detect Specific
Criteria
Criteria Criteria > 2X Bkgd Contaminant
Source

SVOCs (µg/kg)
Benzo(a)anthrace 1 / 5 94.6 296 94.6 RBC
880 ND YES
ne
Benzo(a)pyrene 1 / 5 144 306 144 RBC
88 YES ND YES YES
Benzo(b)flourant 1 / 5 317 340 317 RBC
880 ND YES
hene

Benzo(g,h,i,)peryl	1 / 5	121	301	121	NA	YES	ND	YES	YES	ene
Benzo(k)flourant	1 / 5	219	321	219	RBC	8800	ND	YES		hene
Benzoic acid	1 / 5	60.3	1390	60.3	RBC*0.1	31000000	ND	YES		
Bis(2-ethylhexyl)	1 / 5	465	233	465	RBC	46000	ND	YES		phthalate
Chrysene	1 / 5	180	313	180	RBC	88000	ND	YES		
Flouranthene	1 / 5	112	299	112	RBC*0.1	310000	ND	YES		
Indeno(1,2,3-	1 / 5	125	302	125	RBC	880	ND	YES		c,d)pyrene
Pyrene	1 / 5	99.8	297	99.8	RBC*0.1	230000	ND	YES		
VOCs (µg/kg)										
Dichloromethane	1 / 5	6.84	4.7	6.84	RBC	85000	ND	YES		(methylene chloride)
Toluene	1 / 5	2.36	2.57	2.36	RBC*0.1	1600000	ND	YES		

1 Mean includes all results with no detects set to one half the sample quantitation limit except for radionuclides which were included at the full reported value.

ND indicates an analyte that was not detected in the background samples for this depth class.

NA indicates an analyte that does not have a human health screening criteria.

Table 3. Summary Statistics for Analytes Detected in Soil from 0 to 4 ft Deep from the Fire Department Hose Training Facility

Analyte (Units)	Freq. of Detection	Minimum Detected	Mean Result	Maximum Detected	Human Health Criteria	Human Health Criteria	>Human Criteria	2X Bkgd > 2X Bkgd	Maximum Detect	Unit Specific Contaminant	Source

Metals/Inorganics
mg/kg)

Aluminum	10 / 10	1670	5730	12500	RBC*0.1	7800	YES	11800	YES	YES
Antimony	3 / 10	0.549	1.56	1.4	RBC*0.1	3.1		1.16	YES	
Arsenic	9 / 10	1.2	3.4	7.3	RBC	0.43	YES	5.74	YES	YES
Barium	10 / 10	9	19.5	41	RBC*0.1	550		26.6	YES	
Beryllium	8 / 10	0.0558	0.104	0.201	RBC	0.15	YES	0.194	YES	YES
Cadium	7 / 10	0.051	0.165	0.638	RBC*0.1	3.9		0.614	YES	
Calcium	10 / 10	78.1	247	735	RDA	1000000		304	YES	
Chromium	10 / 10	2.5	14.3	45.8	RBC*0.1	39	YES	25	YES	YES
Cobalt	10 / 10	0.405	0.699	1	RBC*0.1	470		0.98	YES	
Copper	7 / 10	4.3	4.25	8.1	RBC*0.1	310		13.9		
Cyanide	2 / 10	0.091	0.365	0.115	RBC*0.1	160		0.366		
Iron	10 / 10	1480	12600	44000	RBC*0.1	2300	YES	21000	YES	YES
Lead	10 / 10	3.8	8.07	12.9	RBC*0.1	40		12.1	YES	
Magnesium	10 / 10	41.9	117	248	RDA	1000000		159	YES	
Manganese	10 / 10	8	31.2	65.3	RBC*0.1	39	YES	39.4	YES	YES
Mercury	3 / 10	0.02	0.0594	0.052	RBC*0.1	0.78		0.0824		
Nickel	10 / 10	0.74	1.98	3.6	RBC*0.1	160		3.32	YES	
Potassium	10 / 10	54.8	109	224	RDA	393273		138	YES	
Selenium	1 / 10	2.1	5.28	2.1	RBC*0.1	39		0.978	YES	
Silver	4 / 10	0.11	0.583	1.9	RBC*0.1	39		ND	YES	
Sodium	10 / 10	25.9	58.8	89.8		NA	YES	59.6	YES	YES
Vanadium	10 / 10	3.6	27.9	84.6	RBC*0.1	55	YES	54.4	YES	YES
Zinc	10 / 10	2.5	7.35	22.8	RBC*0.1	2300		9.04	YES	

Table 3. Summary Statistics for Analytes Detected in Soil from 0 to 4 ft Deep from the Fire Department Hose Training Facility (Continued)

Analyte (Units)	Freq. of Detection	Minimum Detected	Average Detect	Maximum Result	Maximum Detected	Human Health Criteria	Human Health Criteria	>Human Bkgd	2X Bkgd	Unit Specific Contaminant	Human Health Criteria	Source
SVOCs (µg/kg)												
Benzo(a)anthracene	1 / 10	94.6	246	94.6	RBC	880	ND	YES				
Benzo(a)pyrene	1 / 10	144	251	144	RBC	88	YES	ND	YES	YES		
Benzo(b)flouranthene	1 / 10	317	268	317	RBC	880	ND	YES				
Benzo(g,h,i)perylene	1 / 10	121	249	121		NA	YES	ND	YES	YES		
Benzo(k)flouranthene	1 / 10	219	259	219	RBC	8800	ND	YES				
Benzoic Acid	1 / 10	60.3	1190	60.3	RBC*0.1	31000000	ND	YES				
Bis(2-ethylhexyl) phthalate	2 / 10	386	233	465	RBC	46000	ND	YES				
Chrysene	1 / 10	180	255	180	RBC	88000	ND	YES				
Di-n-butyl phthalate	1 / 10	194	234	194	RBC*0.1	780000	ND	YES				
Di-n-octyl phthalate	2 / 10	39.9	252	335	RBC*0.1	160000	ND	YES				
Flouranthene	1 / 10	112	248	112	RBC*0.1	310000	ND	YES				
Indeno(1,2,3-c,d) pyrene	1 / 10	125	249	125	RBC	880	ND	YES				
Pyrene	2 / 10	90.2	235	99.8	RBC*0.1	230000	ND	YES				
VOCs (µg/kg)												
Dichloromethane (methylene chloride)	2 / 10	6.84	5.47	9.55	RBC	85000	ND	YES				
Toluene	1 / 10	2.36	2.79	2.36	RBC*0.1	1600000	ND	YES				

1 Mean includes all results with nondetects set to one half the sample quantitation limit except for radionuclides which were included at the full reported value.

ND indicates an analyte that was not detected in the background for this depth class.
NA indicates an analyte that does not have a human health screening criteria.

Table 4. Summary Statistics for Analytes Detected in Soil Samples from > 4 ft Deep from the Fire Department Hose Training Facility

Analyte (Units)	Freq. of Detection	Minimum Detected	Average Result	Maximum Detected	Human Health Criteria Source	Human Health Criteria	>Human Health Criteria	2X Maximum Background	Unit Detect	Specific >2X Bkgd	Contaminant
Metals/Inorganics (mg/kg)											
Aluminum	15/15	2960	7170	12600	RBC*0.1	7800	YES	9400	YES	YES	
Antimony	9/15	0.482	1.31	1.9	RBC*0.1	3.1		1.6	YES		
Arsenic	12/15	1.4	5.06	11.1	RBC	0.43	YES	7.04	YES	YES	
Barium	15/15	2.4	7.67	26.9	RBC*0.1	550		11.5	YES		
Beryllium	11/15	0.0695	0.12	0.201	RBC	0.15	YES	0.151	YES	YES	
Cadmium	14/15	0.169	0.455	0.938	RBC*0.1	3.9		1.28			
Calcium	15/15	44.1	188	1190	RDA	1000000		177	YES		
Chromium	15/15	4.9	22.9	59.4	RBC*0.1	39	YES	31.8	YES	YES	
Cobalt	11/15	0.163	0.365	0.538	RBC*0.1	470		0.464	YES		
Copper	15/15	3.4	6.59	13	RBC*0.1	310		8.3	YES		
Cyanide	4/15	0.104	0.387	0.306	RBC*0.1	160		0.362			
Iron	15/15	10200	33400	76200	RBC*0.1	2300	YES	36400	YES	YES	
Lead	15/15	6.4	11.9	24.6	RBC*0.1	40		12.8	YES		

Magnesium	15/15	44.8	142	574	RDA	1000000		149	YES	
Manganese	15/15	1.2	11.8	32.8	RBC*0.1	39		4.84	YES	
Mercury	2/15	0.02	0.0717	0.03	RBC*0.1	0.78		0.07		
Nickel	15/15	0.27	1.17	2.9	RBC*0.1	160		1.69	YES	
Potassium	15/15	39.8	98.8	198	RDA	393273		96.2	YES	
Selenium	8/15	1.4	4.32	5.5	RBC*0.1	39		3.48	YES	
Sodium	15/15	27.5	65.5	86.8		NA	YES	59.8	YES	YES
Vanadium	15/15	28.4	80.3	166	RBC*0.1	55	YES	135	YES	YES
Zinc	9/15	2.2	6.15	5.2	RBC*0.1	2300		4.34	YES	

Table 4. Summary Statistics for Analytes Detected in Soil Samples from >4 ft Deep from the Fire Department Hose Training Facility (Continued)

Analyte (Units)	Freq. of Maximum Detection	Minimum Detected	Average Result	Maximum Detected	Human Health Criteria Source	Human Health Criteria	>Human Background	2X Detect	>2X	Specific Contaminant	Bkgd
SVOCs (µg/kg)											
Benzoic acid	4/15	44.6	756	84.7	RBC*0.1	31000000	ND	YES			
Bis(2-ethylhexyl) phthalate	3/15	63.5	178	110	RBC	46000	ND	YES			
Di-n-octyl phthalate	8/15	69	234	462	RBC*0.1	160000	458	YES			

VOCs (µg/kg)

Acetone	1/15	17.5	6.91	17.5	RBC*0.1	780000	ND YES
Dichloromethane (methylene chloride)	3/15	10.5	5.79	13.2	RBC	85000	ND YES

1 Mean includes all results with nondetects set to one half the sample quantitation limit except for radionuclides which were included at the full reported value.
ND indicates an analyte that was not detected in the background sample for this depth class.
NA indicates an analyte that does not have a human health screening criteria.

VI. SUMMARY OF OPERABLE UNIT RISKS

As a component of the remedial investigation process, a baseline risk assessment was prepared for the FDHTF. The baseline risk assessment consists of human health and ecological risk assessments. Summary information for the human health and ecological risk assessments follows.

HUMAN HEALTH RISK ASSESSMENT

The human health risk assessment characterizes both the potential risk from exposure to carcinogenic substances and adverse health effects from noncarcinogens to human receptors exposed to unit-related constituents under current and future land use conditions (Figure 6). Figure 6 indicates the future land use for N-Area (Central Shops) as recommended by the Citizens Advisory Board which was based on current nuclear industrial areas with a buffer. The risks listed in this section were derived from the BRA (WSRC, 1997a) which used the data obtained from the RF/RI characterization.

The BRA designates the Constituents of Potential Concern (COPCs) based on a conservative screen against background concentrations and the relative potential of the chemicals to cause toxic or carcinogenic effects. Constituents which have concentrations in soil which produce a threshold risk less than the risk-based concentration levels are screened from further analysis. Threshold risk is defined as constituent concentrations that exceed either a cancer risk of 1×10^{-6} or a hazard quotient (HQ) of 1. An HQ of 0.1 was actually used for screening within the BRA to account for potential additive effects for noncarcinogenic constituents. Three land use assumptions were made to describe the human receptors that may be exposed to unit-

related constituents. Potential receptors are expected to differ for the current and future land use
scenarios. The possible receptor under the current land use scenario includes the known on-unit worker. The possible receptors under the future land use scenario include the on-unit industrial worker and the on-unit resident (adult and child).

Based on the results of the risk assessment, COPCs that contribute significantly to a pathway having a significant human cancer risk or human noncarcinogenic hazard or are determined to pose unacceptable ecological risk are designated as preliminary constituents of concern (COCs). The preliminary COCs are further defined as either primary or secondary COCs.

Final COCs are developed through an uncertainty analysis to inform decision-makers about the relative significance of the preliminary COCs, and to help focus on risk decisions.

Preliminary Human Health primary COCs are constituents in a total exposure pathway (media/receptor/route) with a cumulative noncancer hazard greater than 3 or a cumulative ELCR greater than 1 x 10 -4. Primary COCs have a constituent-specific noncancer hazard greater than or equal to 0.1 or a cancer risk greater than 1 x 10 -6.

Preliminary Human Health secondary COCs are chemicals in a total exposure pathway (media/receptor/route) with a cumulative noncancer hazard between 1 and 3 or a cumulative Excess Lifetime Cancer Risk (ELCR) between 1 x 10 -6 and 1 x 10 -4. Secondary COCs have a constituent-specific noncancer hazard greater than or equal to 0.1 or a cancer risk greater than or
equal to 1 x 10 -6.

Carcinogenic risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of pathway-specific exposure to cancer-causing contaminants. The risk to an individual resulting from exposure to non-radioactive chemical carcinogens is expressed as the increased probability of cancer occurring over the course of a 70 year lifetime. Cancer risks are related to the EPA target risk range of one in ten thousand (1 x 10 -4) to one in one million (1 x 10 -6) for incremental cancer risk at National Priorities List
sites. Risk levels greater than 1 x 10 -6 require a risk management decision where specific actions to reduce risk may be considered while cancer risk levels below 1 x 10 -6 are considered to be insignificant.

Non-carcinogenic effects are also evaluated to identify a level at which there may be concern for potential non-carcinogenic health effects. The hazard quotient, which is the ratio of the exposure dose to the reference dose (RfD), is calculated for each contaminant. Hazard quotients are summed for each exposure pathway to determine the specific hazard index (HI) for each exposure scenario. If the HI exceeds unity (1.0), the potential exists that adverse health effects might occur.

The following sections discuss the excess lifetime cancer risk (ELCR) and combined HI values

that were determined in the BRA for current workers, future industrial workers, and the future residential child/adult. Figure 7 shows these values graphically. Tables 5 through 8

<IMG SRC 98059H>

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Table 5. RME Risk Characterization Summary: FDHTF Surface Soil (0 to 1 foot)

		Current		Future			
Medium	Exposure Route	Noncancer HI On-Unit Worker	Cancer Risk On-Unit Worker	Noncancer HI Industrial Resident	Noncancer HI Industrial Worker	Cancer Risk Industrial Resident	Cancer Risk Industrial Worker
Soil	Ingestion	3E-05	9E-10	3E-02	1E-03	2E-06	2E-07
	Dermal/External	4E-05	3E-09	3E-03	1E-03	1E-06	7E-07
	Inhalation	4E-06	3E-14	8E-04	2E-04	2E-11	7E-12
Leafy Vegetables	Ingestion	NA	NA	1E-01	NA	3E-12	NA
Tuberous Vegetables	Ingestion	NA	NA	2E-01	NA	1E-05	NA
Fruits	Ingestin	NA	NA	2E-01	NA	6E-13	NA
Combined Hazard Index:		7E-05		5E-01	3E-03		
Combined Cancer Risk:			4E-09			1E-05	9E-07

NA - pathway not evaluted
Note: Risks are not attributable to unit related COCs.

Table 6. RME Risk Characterization Summary: FDHTF Surface Soil (0 to 4 foot)

Medium	Exposure Route	Current Noncancer HI On-Unit Worker	Current Cancer Risk On-Unit Worker	Future Noncancer HI Industrial Resident	Future Noncancer HI Industrial Worker	Future Cancer Risk Industrial Resident	Future Cancer Risk Industrial Worker
Soil	Ingestion	NA	NA	2E+00	9E-02	2E-05	2E-06
	Dermal/External	NA	NA	2E-01	9E-02	5E-06	2E-06
	Inhalation	NA	NA	8E-04	2E-04	7E-08	3E-08
Leafy Vegetables	Ingestion	NA	NA	3E-01	NA	1E-05	NA
Tuberous Vegetables	Ingestion	NA	NA	4E-01	NA	2E-05	NA
Fruits	Ingestin	NA	NA	6E-01	NA	2E-05	NA
Combined Hazard Index:		0E+00		4E+00	2E-01		
Combined Cancer Risk:			0E+08			8E-05	4E-06

NA - pathway not evaluted
0E+00 - pathway evaluated but no risks could be calculated due to lack of EPA-approved toxicity values
Note: Risks are not attributable to unit related COCs.

Table 7. RME Risk Characterization Summary: FDHTF Background Surface Soil (0 to 1 foot)

Medium	Exposure Route	Current Noncancer HI On-Unit Worker	Current Cancer Risk On-Unit Worker	Future Noncancer HI Industrial Resident	Future Noncancer HI Industrial Worker	Future Cancer Risk Industrial Resident	Future Cancer Risk Industrial Worker

Worker							
Soil	Ingestion	3E-05	9E-10	1E+00	5E-02	2E-05	2E-06
	Dermal/External	4E-05	3E-09	1E-01	5E-02	4E-06	2E-06
	Inhalation	4E-06	3E-14	7E-04	1E-04	1E-08	5E-09
Leafy Vegetables	Ingestion	NA	NA	3E-01	NA	1E-05	NA
Tuberous Vegetables	Ingestion	NA	NA	3E-01	NA	1E-05	NA
Fruits	Ingestin	NA	NA	4E-01	NA	3E-05	NA
Combined Hazard Index:		7E-05		2E+00	1E-01		
Combined Cancer Risk:			4E-09			7E-05	4E-06

NA - pathway not evaluted
Note: Risks are not attributable to unit related COCs.

Table 8. RME Risk Characterization Summary: FDHTF Background Surface Soil (0 to 4 foot)

		Current			Future		
Medium	Exposure Route	Noncancer HI On-Unit Worker	Cancer Risk On-Unit Worker	Noncancer HI Industrial Resident	Noncancer HI Industrial Worker	Cancer Risk Industrial Resident	Cancer Risk Industrial Worker
Soil	Ingestion	NA	NA	1E+00	5E-02	1E-05	1E-06
	Dermal/External	NA	NA	1E-01	5E-02	3E-06	2E-06
	Inhalation	NA	NA	7E-04	1E-04	1E-08	4E-09
Leafy Vegetables	Ingestion	NA	NA	2E-01	NA	1E-05	NA
Tuberous Vegetables	Ingestion	NA	NA	3E-01	NA	8E-06	NA
Fruits	Ingestin	NA	NA	4E-01	NA	2E-05	NA
Combined Hazard Index:		0E+00		2E+00	1E-01		
Combined Cancer Risk:			0E+00			5E-05	3E-

06

NA - pathway not evaluted
0E+00 - pathway evaluated but no risks could be calculated due to lack of EPA-approved toxicity values
Note: Risks are not attributable to unit related COCs.

Table 9. Health-Based COCs for Soil and Produce Fire Department Hose Training Facility

Media	0 -1 ft Soil Interval	0-4 ft Soil Interval
Soil	ELCR	Risk/Hazard
Current On-Unit Worker	--	--
Hypothetical Industrial Worker		Arsenic (ELCR = 2 x 10 -6)
	--	Beryllium (ELCR = 1 x 10 -6)
Hypothetical On-Unit Resident	--	Arsenic (HQ = 0.3)
		Arsenic (ELCR = 1 x 10 -5)
		Beryllium (ELCR = 3 x 10 -6)
	--	Iron (HQ = 2)
	--	Vanadium (HQ = 0.3)
	Benzo(a)pyrene (ELCR = 3 x 10 -6)	Benzo(a)pyrene (ELCR = 2 x 10 -6)
Produce		
Hypothetical Resident	Benzo(a)pvrene (ELCR = 1 x 10 -5)	Arsenic (ELCR = 4 x 10 -6)
		Benzo(a)pyrene (ELCR = 1 x 10 -5

Note: ELCR = excess lifetime cancer risk, HQ = Hazard Quotient

ECOLOGICAL RISK ASSESSMENT

The ecological BRA for the FDHTF evaluated the likelihood of harmful effects to ecological receptors from exposure to contaminants in soil. The receptors in the FDHTF food web that were evaluated include terrestrial plants, earthworms, meadow voles, short-tailed shrews, American robins, and red-tailed hawks. These receptors serve as assessment endpoints for

the risk to plant and animal populations and ecosystems at FDHTF.

The evaluation of ecological risk was conducted according to relevant EPA headquarters, US EPA Region IV, SCDHEC, and Westinghouse Savannah River Company guidance. The assessment methods follow the EPA Framework for Ecological Risk Assessments (EPA, 1992b) and draft Ecological Risk Assessment Guidance for Superfund (EPA, 1994b).

Ecological Constituents of Potential Concern (COPCs) were identified from among constituents detected at FDHTF, and incomplete exposure pathways were eliminated. The risk from COPCs in FDHTF surface soil was evaluated only for those pathways resulting in ingestion of soil or those food items exposed directly or indirectly to soil. COPCs are those

constituents whose maximum measured concentrations exceeded a toxicity screening value for ecological receptors and 2X the background mean concentration.

Based on field reconnaissance, the principal ecological communities at FDHTF were characterized as maintained grassy fields with scattered mature trees. Most receptors, exposure classes, and/or species evaluated in the ecological risk assessment were observed at the unit or potentially reside or forage there. No threatened, endangered and sensitive species are expected to be exposed to COPCs in surface soil at FDHTF.

Six assessment endpoints representing environmental values to be protected in accordance with two policy goals were evaluated at the FDHTF. The risks to the FDHTF populations and ecosystems were evaluated by estimating the risk to populations of the six indicator receptors [terrestrial vegetation, earthworms, meadow vole (proxy for herbivorous mammals), short-tailed shrew, American robin, and red-tailed hawk] according to ecological relevance, susceptibility, accessibility to prediction or measurement, and relevance to policy goals.

For the evaluation of risk to the FDHTF populations and ecosystems, decision rules are stated in terms of HQs. HQs compare estimates of exposure based on site measurements (e.g., RME concentrations of COPCs in the source media [surface and subsurface soil]) to measures of effect (e.g., test concentrations associated with levels of adverse effect on ecological receptors).

Measured concentrations of ecological COPCs in surface soil are used to estimate the RME concentrations and doses for ecological receptors. Published toxicity-benchmark data are used to derive COPC concentrations associated with levels of adverse effect on ecological receptors at the FDHTF.

HQs for current and future exposure of ecological receptors to COPCs in surface and

subsurface soil were calculated and used to estimate risk. No HQs exceeded 1.0 in surface soil (0 - 0.3 m [0 - 1.0 ft]); therefore, there are no ecological risks for current conditions. The five metals (aluminum, cadmium, chromium, selenium, and vanadium) exceeding an HQ of 1.0 are the COPCs associated with future conditions at the FDHTF.

The weight-of-evidence analysis and evaluation of uncertainty for ecological COPCs with HQs exceeding 1.0 resulted in rejection of all five metals as sources of significant risk to ecological receptors at the exposure unit.

UNCERTAINTY

The risk and hazard to the current worker, future on-unit industrial worker, and the future on-unit resident are summarized below. Preliminary COCs identified during the risk assessment are evaluated through an uncertainty analysis to determine final COCs. Remedial Goal Options (RGOs) are developed for the list of final COCs which become the basis of and the focus for remediation.

Under the current land use, no primary or secondary preliminary COCs were identified for the surface soil. Under future industrial land use, arsenic, beryllium, iron, vanadium, and benzo(a)pyrene were identified as secondary preliminary COCs for subsurface soils. Following the uncertainty analysis, no constituents were retained as final COCs and no RGOs were developed. Key uncertainties for each preliminary COC are summarized below.

Current Worker

The current worker is not at risk while working at this unit because the ELCR risk is below 1×10^{-6} and the HI is below 1.

Future Industrial Worker

Arsenic and beryllium were identified as secondary COCs for the future industrial worker for the 0 to 4-foot soil depth interval. Although arsenic and beryllium were identified as preliminary COCs following the risk assessment, there is uncertainty that the concentration terms used to calculate unit risk are more representative of background risk. Arsenic was detected 9 out of 10 times in unit subsurface soils with a concentration range of 1.2 to 7.3 mg/kg. Comparatively, arsenic was detected in background subsurface 10 out of 10 times with concentrations ranging from 0.82 to 6.9 mg/kg. The exposure point concentration for arsenic in unit subsurface soils is 6.0 mg/kg, while the background exposure point concentration is 5.32 mg/kg.

Beryllium in subsurface soils was detected 8 out of 10 times at the unit with concentrations ranging from 0.06 to 0.20 mg/kg, while beryllium was detected 10 out of 10 times in the background with a concentration range of 0.05 to 0.20 mg/kg. The exposure point concentration for beryllium in unit subsurface soils is 0.15 mg/kg, while the background exposure point concentration is 0.13 mg/kg.

The unit data and background data demonstrate that there is no difference between unit and background concentrations of arsenic and beryllium. The similar concentration terms further demonstrate that the risk for both the unit and background would not be significantly different. Therefore, neither arsenic nor beryllium were retained as a final COCs.

Future Residential Child/Adult

The residential scenario was evaluated separately for the 0 to 0.3 m (0 to 1 ft) and the 0 to 1.2 m (0 to 4 ft) soil intervals. Benzo(a)pyrene was identified as a secondary preliminary COC for both soil intervals. For subsurface soils (0 to 4 ft), arsenic, beryllium, iron, and vanadium were identified as secondary preliminary COCs. The uncertainty associated with each preliminary COC is discussed in further detail below.

Arsenic and Beryllium

As discussed for the future industrial worker, the unit data and background data demonstrate that there is no difference between unit and background concentrations of arsenic and beryllium. The similar concentration terms further demonstrate that the risk for both the unit and background for the future resident would not be significantly different. Therefore, neither arsenic nor beryllium were retained as final COCs.

Iron

Iron is a naturally occurring element that is abundantly distributed in soils. Iron was detected in subsurface soils in both the unit and background samples 10 out of 10 times. Concentrations of iron in unit subsurface soils ranged from 1480 mg/kg to 44,000 mg/kg and 1700 mg/kg to 22,700 mg/kg in background subsurface soils (Tables 10 and 11). The maximum detected value for both the unit and background subsurface soils was used for the

exposure point concentration. Similarly, exposure to iron in both the unit and background subsurface soils would result in the designation of iron as a secondary COC. The designation of iron as a secondary COC is based on the use of a provisional toxicity value for iron, which is extremely conservative. The USFDA daily value for iron is 18 mg/day which corresponds to a recommended daily dose of 0.26 mg/kg/day. In order to ingest this amount of iron from soil, the concentration of iron would have to be on the order of 180,000 mg/kg. The exposure point concentration for subsurface soil for the unit (44,000 mg/kg) and background (22,700 mg/kg) are both more than an order of magnitude lower than 180,000 mg/kg, indicating that iron in the soil is very unlikely to be of concern at the FDHTF. Therefore, iron was not retained as a final COC.

Table 10. Summary Statistics for Soil Background Concentrations from 0 to 1 ft in the FDHTF

Analyte (Units)	Proportion Detected	Minimum Detection Limit	Maximum Detection Limit	Minimum Detect	Average Result	Maximum Detect	Dist. Type	95% UCL	Exposure Concentration
Total Metals and Cyanide (mg(kg)									
Aluminum	5/ 5	11	21.9	1410	6300	9900	N	9520	9520
Antimony	3/ 5	3.04	4.12	0.442	1.11	0.798	D	1.71	0.798
Arsenic	5/ 5	12	13.1	0.821	3.26	6.9	L	22.8	6.9
Barium	5/ 5	1.19	1.29	5.1	12.9	26.6	L	35.3	26.6
Beryllium	5/ 5	0.325	0.461	0.0529	0.103	0.204	L	0.252	0.204
Cadmium	5/ 5	0.419	0.47	0.0737	0.27	0.444	N	0.398	0.398
Calcium	5/ 5	14	19.8	63.6	155	219	N	215	215
Chromium	5/ 5	0.838	1.06	2.7	14.2	27	L	158	27

Cobalt	4/ 5	0.866	1.04	0.244	0.44	0.749	D	0.672	0.672		
Copper	5/ 5	0.734	1.18	1	11.2	30.7	L	2090	30.7		
Cyanide	3/ 5	0.83	0.9	0.11	0.268	0.223	D	0.414	0.223		
Iron	5/ 5	23.7	25.8	1700	11200	22700	N	19400	19400		
Lead	5/ 5	6.39	6.94	3.6	7.68	14.6	L	19	14.6		
Magnesium	5/ 5	9.42	10.2	23.2	78.7	144	N	121	121		
Manganese	5/ 5	0.217	0.235	7.5	21.7	47.9	L	75.5	47.9		
Mercury	4/ 5	0.146	0.158	0.02	0.0502	0.094	D	0.0817	0.0817		
Nickel	5/ 5	1.84	2.07	0.708	1.94	2.9	N	2.8	2.8		
Potassium	5/ 5	72.6	78.8	32.3	71	118	L	150	118		
Sodium	3/ 5	140	152	12.8	50.3	79	D	82.7	79		
Vanadium	5/ 5	0.758	0.823	4.3	30.4	59.3	L	938	59.3		
Zinc	5/ 5	17.4	18.9	1.5	6.28	13.4	L	44.8	13.4		

* Average result includes all results with nondetects set to one half the sample quantification limit except for radionuclides which were included at the full reported value

Population Distribution Codes:

D Fewer than 5 or 50% detects. Treated as normal
L Log-normal distribution
N Normal distribution
Z Population includes zero or negative results, treated as normal
X Signifcantly different from normal and log-normal. Use arithmetic mean and t-distribution for 95% UCL
N/A Statistics not calculated because less than 2 samples

Table 11. Summary Statistics for Soil Background Concentrations from 0 to 4 ft in the FDHTF

Analyte (Units)	Proportion	Minimum	Maximum	Minimum	Average	Maximum	Dist.	95%	Exposure

	Detected	Detection Limit	Detection Limit	Detect	Result	Detect	Type	UCL	Concentration
Total Metals and Cyanide (mg(kg)									
Aluminum	10/ 10	11	21.9	1410	5890	9900	N	7630	7630
Antimony	5/ 10	2.82	4.12	0.442	1.15	0.798	N	1.52	0.798
Arsenic	10/ 10	11.1	13.1	0.821	2.87	6.9	L	5.32	5.32
Barium	10/ 10	1.1	1.29	5.1	13.3	26.6	L	20.4	20.4
Beryllium	10/ 10	0.299	0.461	0.0529	0.0972	0.204	L	0.133	0.133
Cadmium	9/ 10	0.39	0.47	0.0737	0.284	0.662	L	0.605	0.605
Calcium	10/ 10	13	19.8	50.4	152	219	N	185	185
Chromium	10/ 10	0.779	1.06	2.7	12.5	27	L	25.7	25.7
Cobalt	9/ 10	0.797	1.04	0.221	0.456	0.756	N	0.576	0.576
Copper	10/ 10	0.682	1.18	1	6.95	30.7	L	24.2	24.2
Cyanide	5/ 10	0.8	0.9	0.11	0.304	0.289	X	0.383	0.289
Iron	10/ 10	21.8	25.8	1700	10500	22700	L	25100	22700
Lead	10/ 10	5.88	6.94	2.8	6.04	14.6	L	8.51	8.51
Magnesium	10/ 10	8.67	10.2	23.2	79.4	144	N	101	101
Manganese	10/ 10	0.199	0.235	2.6	19.7	47.9	L	49.7	47.9
Mercury	9/ 10	0.14	0.158	0.02	0.0448	0.094	L	0.0681	0.0681
Nickel	10/ 10	1.69	2.07	0.708	1.66	2.9	L	2.37	2.37
Potassium	10/ 10	66.7	78.8	32.3	6.91	118	L	99.3	99.3
Selenium	1/ 10	10.4	12.2	0.489	5.23	0.489	D	6.21	0.489
Sodium	7/ 10	129	152	12.8	41.9	79	X	59.3	59.3
Vanadium	10/ 10	0.697	0.823	4.3	27.2	59.3	L	67.1	59.3
Zinc	9/ 10	16	18.9	1.4	4.87	13.4	L	10.2	10.2

* Average result includes all results with nondetects set to one half the sample quantification limit except for radionuclides which were included at the full reported value

Population Distribution Codes:
D Fewer than 5 or 50% detects. Treated as normal
L Log-normal distribution
N Normal distribution
Z Population includes zero or negative results, treated as normal
X Signifcantly different from normal and log-normal. Use arithmetic mean and t-distribution for 95% UCL

Vanadium

Vanadium is a naturally occurring metal which is abundant in soils at SRS. Vanadium was detected in subsurface soils in both the unit and background samples 10 out of 10 times. Concentrations of vanadium ranged from 3.6 mg/kg to 84.6 mg/kg in unit soils and 4.3 mg/kg to 59.3 mg/kg in background soils (Tables 10 and 11). The exposure point concentration for vanadium in subsurface soils for the unit and background is 84.6 mg/kg and 59.3 mg/kg, respectively. Vanadium was only considered a secondary COC because it slightly exceeds an HQ of 0.1 in unit soils. The HQ for ingestion of vanadium in unit soils is 0.16, while the HQ for ingestion of vanadium in background soils is 0.11. Based on the frequency of detection in both the unit and background soils, and the similar concentration ranges and hazard quotients, it is highly unlikely that vanadium is unit related and should be of concern at the FDHTF. Therefore, vanadium was not retained as a final COC.

Benzo(a)pyrene

Although benzo(a)pyrene was retained as a secondary preliminary COC for both surface (0-1') and subsurface soils (0-4'), it was only detected once in surface soils. Because of the single detection of benzo(a)pyrene, heterogeneous distribution and limited data should be considered. The FDHTF is a small area approximately 20 by 40 feet in size. According to site records, contaminated soils were removed from the facility in 1982 and 1984, thereby removing the primary source of contamination. A total of five borings were drilled within the boundaries of the unit which provided a sufficient number of samples for the small area of concern to characterize the unit and adequately define the risk to human health and the environment. Benzo(a)pyrene was detected in 1 out of 5 surface soil samples, 1 out of 10 subsurface soil samples, and 1 out of 25 all-depth samples. Because the exposure point concentration is the single observed value, the risk of 3×10^{-6} for the unlikely residential land use is based on the maximum detected concentration value. It is highly unlikely that benzo(a)pyrene should be of concern for the FDHTF because potential hot spots were addressed by representative sampling and because of the low (<5%) frequency of detection.

Therefore, benzo(a)pyrene was not retained as a final COC.

Other Uncertainties

Food chain exposures and risk were projected in the BRA by means of uptake (partitioning) models. Uncertainty is inherent in each step of the food chain uptake models. Such models are based on studies of plant and animal uptake of constituents into the receptor of interest and are thus reliant upon a set of conditions that were present in the study environment. Precipitation and other weather-related factors, the chemistry of the soil and water, and other factors that existed in the uptake study may or may not relate well to the conditions present at the waste unit. The uncertainties resulting from the use of food chain uptake models are likely to be considerable. Because of the assumptions and uncertainties associated with the food chain pathway, the risk from produce is only considered when inclusion of the produce risk would determine whether the constituent is a final COC following the uncertainty analysis. Because no final COCs were retained for the FDHTF, RGOs for risk from produce were not considered.

Ecological Uncertainties

There are uncertainties in the parameters used to estimate exposure for the ecological risk evaluation, but reported values for receptors' ingestion rates, size and home range, soil-to-plant uptake factors, and soil-to-animal bioaccumulation factors are unlikely to be biased and should not severely or consistently over- or underestimate exposure. Exposure may be overestimated for some contaminants because the fraction available for absorption by animals may be overestimated. Extrapolation from studies involving laboratory doses to exposures at FDHTF is a major source of uncertainty in the estimate of risk to ecological receptors because the availability of the contaminant under test conditions may be greater than it is to receptors living in field conditions.

Conclusions

No human health primary or secondary preliminary COCs were identified under current land use assumptions. Secondary preliminary COCs were identified for the hypothetical industrial worker and on-unit resident. Due to the elimination of the preliminary human health COCs (arsenic, benzo(a)pyrene, beryllium, iron, and vanadium) through the uncertainty analysis

process, no soil RGOs were developed for the FDHTF. No ecological RGOs were developed because there are no final ecological COCs.

Site-Specific Considerations

Site-specific considerations, based on the conclusions of the BRA and RFI/RI, which suggest no potential for significant risk include:

1) FDHTF originally contained soil that may have been contaminated with flammable liquids. Stained soils were removed in an earlier removal action.

2) The levels of surface soil contamination recognized during characterization are generally very low. The contaminants present are generally within the background levels of soil in the area.

3) The groundwater monitoring program indicates that there has not been significant impact from the waste materials in the pits.

4) The BRA did not determine any COCs after the uncertainty analysis and, therefore, no RGOs were prepared.

Remedial Action Objectives

Remedial action objectives specify unit-specific contaminants, media of concern, potential exposure pathways, and remediation goals. Remediation goals are developed based upon ARARs or risk-based concentrations. After the uncertainty analysis, the BRA determined that there are no unit-specific contaminants. Therefore, there are no remedial action objectives. No Action will be protective of human health and the environment.

VII. THE SELECTED REMEDY

According to the EPA guidance document Guidance on Preparing Superfund Decision Documents (EPA, 1989), if there is no current or potential threat to human health or the environment and no action is warranted, the CERCLA 121 requirements are not triggered.

This means that there is no need to evaluate other alternatives or the no action alternative

against the nine criteria specified under CERCLA.

Under the No Action alternative, no treatment will be performed, no institutional controls or engineering controls will be implemented, and no cost is associated with implementing the alternative. According to CERCLA regulations, Section 121, if no action is the preferred alternative, then no applicable or relevant and appropriate requirements are associated with the alternative.

Based on the FDHTF RCRA RFI/RI/BRA Report, the FDHTF poses no significant risk to human health and the environment. Therefore, No Action has been selected as the remedial alternative which satisfies the CERCLA criteria. The No Action alternative is the final action for the FDHTF operable unit. This solution is meant to be permanent and effective in both the short and long term and is applicable to all media evaluated (soil, groundwater, etc.). The No Action Decision is the least cost option with no capital, operating, or monitoring costs, and is protective of human health and the environment.

This proposal is consistent with EPA guidance and is an effective use of risk management-principles. The Statement of Basis/Proposed Plan provided for involvement with the community through a document review process and a public comment period.

The selected remedy is protective of human health and the environment and complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action. There is no irreversible and irretrievable loss of resources at the FDHTF.

VIII. EXPLANATION OF SIGNIFICANT CHANGES

The SB/PP and draft permit modification provided for involvement with the community through a document review process and a public comment period. There were no significant changes made to either the RCRA permit modification or the Record of Decision based on comments received during the public comment period. Comments that were received during the 45-day public comment period are addressed in Appendix A of this ROD and are available with the final RCRA permit.

IX. RESPONSIVENESS SUMMARY

No comments were received from the public during the public comrnent period. Therefore, a Responsiveness Summary is not included in Appendix A.

X. REFERENCES

DOE (U.S. Department of Energy), 1994. Public Involvement, A Plan for Savannah River Site. Savannah River Operations Office, Aiken South Carolina.

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EPA (U. S. Environmental Protection Agency), 1989. Guidance on Preparing Superfund Decision documents. Office of Solid Waste and Emergency Response - OSWER Directive 9355.3-02, Washington, DC, July 1989.

FFA, 1993. Federal Facility Agreement for the Savannah River Site, Administrative Docket No. 89-05-FF, (Effective Date: August 16, 1993).

WSRC, 1997a. RCRA Facility Investigation Remedial Investigation Report With Baseline Risk Assessment for the Fire Department Hose Training Facility (904-113G) (U). WSRC-RP-96-863, Revision 1, Westinghouse Savannah River Company, Aiken, South Carolina (April, 1997).

WSRC, 1997b. Statement of Basis/Proposed Plan for the Fire Department Hose Training Facility (904-113G) Operable Unit (U), WSRC-RP-97-170, Revision 1, Westinghouse Savannah River Company, Aiken, South Carolina (October, 1997).

Table 4. Summary Statistics for Analytes Detected in Soil Samples from > 4 ft Deep from the Fire Department Hose Training Facility

Analyte (Units)	Freq. of Detection	Minimum Detected	Average Result	Maximum Detected	Human Health Criteria Source	Human Health Criteria	>Human Health Criteria	2X Maximum Background > 2X Bkgd	Unit Detect Specific Contaminant	Contaminant
Metals/Inorganics (mg/kg)										
Aluminum	15 / 15	2960	7170	12600	RBC*0.1	7800	YES	9400	YES	YES
Antimony	9 / 15	0.482	1.31	1.9	RBC*0.1	3.1		1.6	YES	
Arsenic	12 / 15	1.4	5.06	11.1	RBC	0.43	YES	7.04		

YES	YES									
Barium	15 / 15	2.4	7.67	26.9	RBC*0.1	550			11.5	
YES										
Beryllium	11 / 15	0.0695	0.12	0.201	RBC	0.15	YES		0.151	
YES	YES									
Cadmium	14 / 15	0.169	0.455	0.938	RBC*0.1	3.9			1.28	
Calcium	15 / 15	44.1	188	1190	RDA	1000000			177	
YES										
Chromium	15 / 15	4.9	22.9	59.4	RBC*0.1	39	YES		31.8	
YES	YES									
Cobalt	11 / 15	0.163	0.365	0.538	RBC*0.1	470			0.464	
YES										
Copper	15 / 15	3.4	6.59	13	RBC*0.1	310			8.3	
YES										
Cyanide	4 / 15	0.104	0.387	0.306	RBC*0.1	160			0.362	
Iron	15 / 15	10200	33400	76200	RBC*0.1	2300	YES		36400	
YES	YES									
Lead	15 / 15	6.4	11.9	24.6	RBC*0.1	40			12.8	
YES										
Magnesium	15 / 15	44.8	142	574	RDA	1000000			149	
YES										
Manganese	15 / 15	1.2	11.8	32.8	RBC*0.1	39			4.84	
YES										
Mercury	2 / 15	0.02	0.0717	0.03	RBC*0.1	0.78			0.07	
Nickel	15 / 15	0.27	1.17	2.9	RBC*0.1	160			1.69	
YES										
Potassium	15 / 15	39.8	98.8	198	RDA	393273			96.2	
YES										
Selenium	8 / 15	1.4	4.32	5.5	RBC*0.1	39			3.48	
YES										
Sodium	15 / 15	27.5	65.5	86.8		NA	YES		59.8	
YES	YES									
Vanadium	15 / 15	28.4	80.3	166	RBC*0.1	55	YES		135	
YES	YES									
Zinc	9 / 15	2.2	6.15	5.2	RBC*0.1	2300			4.34	
YES										

Table 4. Summary Statistics for Analytes Detected in Soil Samples from > 4 ft Deep from the Fire Department Hose Training Facility (Continued)

Analyte	Freq. of	Minimum	Average	Maximum	Human	Human	>Human	2X

Maximum (Units)	Unit Detection	Detected	Result	Detected	Health Criteria	Health Criteria	Health Criteria	> 2X Background	Detect Contaminant	Specific Contaminant Bkgd
SVOCs (µg/kg)										
Benzoic acid	4 / 15	44.6	756	84.7	RBC*0.1	31000000		ND	YES	
Bis(2-ethylhexyl) phthalate	3 / 15	63.5	178	110	RBC	46000		ND	YES	
Di-n-octyl phthalate	8 / 15	69	234	462	RBC*0.1	160000		485	YES	
VOCs (µg/kg)										
Acetone	1 / 15	17.5	6.91	17.5	RBC*0.1	780000		ND	YES	
Dichloromethane (methylene chloride)	3 / 15	10.5	5.79	13.2	RBC	85000		ND	YES	

1 Mean includes all results with nondetects set to one half the sample quantitation limit except for radionuclides which were included at the full reported value.
ND indicates an analyte that was not detected in the background samples for this depth class.
NA indicates an analyte that does not have a human health screening criteria.

VI. SUMMARY OF OPERABLE UNIT RISKS

As a component of the remedial investigation process, a baseline risk assessment was prepared for the FDHTF. The baseline risk assessment consists of human health and ecological risk assessments. Summary information for the human health and ecological risk assessments follows.

HUMAN HEALTH RISK ASSESSMENT

The human health risk assessment characterizes both the potential risk from exposure to carcinogenic substances and adverse health effects from noncarcinogens to human receptors exposed to unit-related constituents under current and future land use conditions (Figure 6).

Figure 6 indicates the future land use for N-Area (Central Shops) as recommended by the Citizens Advisory Board which was based on current nuclear industrial areas with a buffer. The risks listed in this section were derived from the BRA (WSRC, 1997a) which used the data obtained from the RFI/RI characterization.

The BRA designates the Constituents of Potential Concern (COPCs) based on a conservative screen against background concentrations and the relative potential of the chemicals to cause toxic or carcinogenic effects. Constituents which have concentrations in soil which produce a threshold risk less than the risk-based concentration levels are screened from further analysis.

Threshold risk is defined as constituent concentrations that exceed either a cancer risk of 1×10^{-6} or a hazard quotient (HQ) of 1. An HQ of 0.1 was actually used for screening within the BRA to account for potential additive effects for noncarcinogenic constituents. Three land use assumptions were made to describe the human receptors that may be exposed to unit-related constituents. Potential receptors are expected to differ for the current and future land use scenarios. The possible receptor under the current land use scenario includes the known on-unit worker. The possible receptors under the future land use scenario include the on-unit industrial worker and the on-unit resident (adult and child).

Based on the results of the risk assessment, COPCs that contribute significantly to a pathway having a significant human cancer risk or human noncarcinogenic hazard or are determined to pose unacceptable ecological risk are designated as preliminary constituents of concern (COCs). The preliminary COCs are further defined as either primary or secondary COCs.

Final COCs are developed through an uncertainty analysis to inform decision-makers about the relative significance of the preliminary COCs, and to help focus on risk decisions.

Preliminary Human Health primary COCs are constituents in a total exposure pathway

(media/receptor/route) with a cumulative noncancer hazard greater than 3 or a cumulative ELCR greater than 1 x 10 -4. Primary COCs have a constituent-specific noncancer hazard greater than or equal to 0.1 or a cancer risk greater than 1 x 10 -6.

Preliminary Human Health secondary COCs are chemicals in a total exposure pathway (media/receptor/route) with a cumulative noncancer hazard between 1 and 3 or a cumulative Excess Lifetime Cancer Risk (ELCR) between 1 x 10 -6 and 1 x 10 -4. Secondary COCs have a constituent-specific noncancer hazard greater than or equal to 0.1 or a cancer risk greater than or equal to 1 x 10 -6.

Carcinogenic risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of pathway-specific exposure to cancer-causing contaminants. The risk to an individual resulting from exposure to non-radioactive chemical carcinogens is expressed as the increased probability of cancer occurring over the course of a 70 year lifetime. Cancer risks are related to the EPA target risk range of one in ten thousand (1 x 10 -4) to one in one million (1 x 10 -6) for incremental cancer risk at National Priorities List sites. Risk levels greater than 1 x 10 -6 require a risk management decision where specific actions to reduce risk may be considered while cancer risk levels below 1 x 10 -6 are considered to be insignificant.

Non-carcinogenic effects are also evaluated to identify a level at which there may be concern for potential non-carcinogenic health effects. The hazard quotient, which is the ratio of the exposure dose to the reference dose (RfD), is calculated for each contaminant. Hazard quotients are summed for each exposure pathway to determine the specific hazard index (HI) for each exposure scenario. If the HI exceeds unity (1.0), the potential exists that adverse health effects might occur.

The following sections discuss the excess lifetime cancer risk (ELCR) and combined HI values that were determined in the BRA for current workers, future industrial workers, and the future residential child/adult. Figure 7 shows these values graphically. Tables 5 through 8

show the Reasonable Maximum Exposure (RME) risk characterization summaries for the surface soil (0-1'), subsurface soils (0-4'), background surface soil (0-1'), and background subsurface soil (0-4').

Current Worker

The current worker was evaluated at the 0 to 0.3 m (0 to 1 ft) soil interval only. The total excess lifetime cancer risk level for the current worker is 4×10^{-9} and the hazard index is 7×10^{-5}. Therefore, the current worker is not at risk while working at this unit.

Future Industrial Worker

The future industrial worker was evaluated at the 0 to 0.3 m (0 to 1 ft) and 0 to 1.2 m (0 to 4 ft) soil intervals. For the 0 to 0.3 m (0 to 1 ft) soil interval, the total excess lifetime cancer risk is 9×10^{-7} and the hazard index is 3×10^{-3}. Therefore, the future industrial worker will not be at risk while working at the unit based on the evaluation of the surface soils. For the 0 to 1.2 m (0 to 4 ft) soil interval, the total excess lifetime cancer risk is 4×10^{-6} and the hazard index is 0.2. The pathways which contribute the most to this receptor are soil ingestion and dermal contact, each showing a cancer risk of 2×10^{-6}. The secondary COCs for these pathways are arsenic (84% of the risk for the ingestion pathway) and beryllium (54 percent of the risk for the dermal contact pathway).

Future Residential Child/Adult

The residential scenario was evaluated at the 0 to 0.3 m (0 to 1 ft) and the 0 to 1.2 m (0 to 4 ft) soil intervals. At the 0 to 0.3 m (0 to 1 ft) soil interval, the total excess lifetime cancer risk is 1×10^{-5} and the hazard index is 0.5. The secondary COC is benzo(a)pyrene, from ingestion of produce (risk of 1×10^{-5}).

For the 0 to 1.2 m (0 to 4 ft) soil interval, the total excess lifetime cancer risk is 8×10^{-5} and the hazard index is 4. The pathways which significantly contribute to this receptor are ingestion (2×10^{-5}), dermal exposure (5×10^{-6}), and the ingestion of produce (5×10^{-5}). In the ingestion pathway, the cancer secondary COCs are arsenic (which contributes 84% of the risk) and benzo(a)pyrene. The hazard index for the ingestion pathway is 2.4 and the

secondary COCs are iron (which contributes to 78% of the hazard); arsenic and vanadium. The combined risk for the ingestion of produce is 5 x 10 -5, the secondary COCs are arsenic and benzo(a)pyrene, of which arsenic contributes 98% of the risk. A summary of the human health risks for soil and produce for the various land use scenarios is given in Table 9.

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 08/14/1998
Operable Unit: 27
ROD ID: EPA/541/R-98/114

Media: Groundwater, Sediment, Soil, Surface Water

Contaminant: Base Neutral Acids, Inorganics, Metals, PAH, PCBs, Pesticides, Petroleum Hydrocarbon, VOC

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. SRS is a secured U.S. government facility with no permanent residents. SRS is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina.

SRS is owned by the Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided nuclear materials for the space program and for medical, industrial, and research efforts. Chemical and radioactive wastes are by-products of nuclear material production processes. The entire SRS facility was placed on the National Priorities List (NPL) in December 1989.

Operable Unit (OU1):
The M-Area Hazardous Waste Management Facility (HWMF) is a source-specific operable unit within the A/M Area Fundamental Study Area. The M-Area HWMF includes an unlined surface impoundment (settling basin), a portion of an inactive process sewer line, drainage and seepage areas, and a Carolina bay known as Lost Lake. The nearest plant boundary is approximately 5800 feet northwest of the M-Area HWMF.
The M-Area settling basin was constructed in 1958 to settle out metals discharged from M-Area manufacturing operations. The basin dimensions were approximately 330 feet by 280 feet by 17 feet with a volumetric capacity of approximately eight million gallons. Overflow from the settling basin was directed to a natural seepage area and ultimately to Lost Lake. In July 1985, a permitted wastewater treatment facility was placed in operation and discharges to the settling basin were discontinued.
A Record of Decision (ROD) addressing OU1 was completed in June 1992.

OU2:
The Metallurgical Laboratory HWMF is a source-specific operable unit within the A/M Area fundamental Study Area. The Metallurgical Laboratory HWMF includes an abandoned portion of a process sewer line, a seepage basin, a drainage outfall, and a Carolina bay. The nearest plant boundary is located approximately three-fourths of a mile to the northwest of this operable unit.
The Metallurgical Laboratory was used for corrosion testing on stainless steels and nickel-based alloys. This testing required degreasing and cleaning metal parts, etching sample identification information on the parts, and photographing the samples. No radioactive materials were known to have been discharged to the HWMF. During periods of heavy rainfall, wastewater and surface water overflowed a drainage outfall at the Metallurgical Laboratory Basin into the adjacent Carolina Bay. A RCRA closure plan for the basin and sewer line portions of the Metallurgical Laboratory HWMF was submitted and approved in June 1991. The intent of the closure plan is to ensure the basin and sewer line portions of the Metallurgical Laboratory HWMF will be closed in a manner that controls, minimizes, or eliminates post-closure migration of hazardous constituents and decomposition products to the vadose zone, groundwater, surface waters, or atmosphere.
A ROD addressing OU2 was completed in June 1992.

OU3:
The A/M Area, located in the northwest portion of SRS, contains nuclear fuel fabrication buildings, office buildings, and research

areas. The A/M Area groundwater is a media-specific operable unit within the A/M Area Fundamental Study Area. As a result of past waste disposal practices, the groundwater beneath A/M Area has been contaminated with organic solvents, primarily trichloroethylene (TCE) and tetrachloroethylene (perchloroethylene; PCE). Total plume size beneath the A/M Area, as currently defined, is approximately 1200 acres. The contamination in the A/M Area groundwater and the overlying unsaturated zone appears to be associated with releases from the following A/M Area source units: the A-014 Outfall, the M-Area Settling Basin/Lost Lake (M-Area HWMF), and the M-Area HWMF Process Sewer, and the 321-M Solvent Storage Area.
From 1952 to 1981, an estimated 13 million pounds of chlorinated solvents were used in the A/M Area to degrease fuel and target tubes used in SRS reactors. An estimated 50 to 90 percent of the solvents evaporated during degreasing operations. The remaining solvents were discharged as waste to the process sewer system. Additionally, significant quantities of chlorinated solvents were inadvertently spilled during handling and storage.
A ROD addressing OU3 was completed in June 1992.

OU4:
The Gunsite 720 Rubble Pit is located within SRS and is approximately 305 meters (100 feet) west of South Carolina Highway 125, 168 meters (550 feet) north of SRS Road A-2, and 2.5 kilometers (1.5 miles) from the nearest SRS boundary.
During the period from 1955 to 1960, to defend the SRS in the event of an air attack, the U.S. Army established onsite anti-aircraft artillery gun emplacements at several locations near the perimeter of SRS. The Gunsite 720 was one of those emplacements. In the early 1980s, while work was being performed in the area, nine empty, partially buried drums, labeled "duPont Freon 11" were found at the gunsite. The drums were excavated in July 1987, and placed on a pallet at the gunsite. The drums were excavated in July 1987, and placed on a pallet at the gunsite. The area around the drums was screened during excavation and the liquid (rainwater) that collected in the excavated drums was sampled prior to disposal. No evidence of hazardous substances was found. In October, 1989, the drums were removed from the unit.
A ROD addressing OU4 was completed in March 1997.

OU5:
The Gunsite 113 Access Road Unit is located in the northeast corner of SRS, adjacent to the access road leading to Gunsite 113, and is approximately 91.5 meters (300 feet) east of where SRS Road 8 crosses the SRS facility boundary.

The area appears to have been used as a surface disposal area for spoil dirt and/or road construction debris. There is no documentation or record of any hazardous substance management, disposal, or any other type of waste disposal at this unit. There is no evidence that any recent disposal activities have occurred in this area or that disposal activities were more widespread. Also, there is no evidence of any burning or excavation at this waste unit.
A ROD addressing OU5 was completed in March 1997.

OU6:
The F-Area HWMF (basins F-1, F-2, and F-3) operated from 1955 until November 1988. During that time, the facility received waste effluents from F-Area chemical separation facilities processes such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads. The three basins had a combined maximum operating capacity of 20.5 million gallons of wastewater.
These basins were closed by dewatering, physically and chemically stabilizing the remaining sludges and placing a protective multi-layer cover system over them to reduce rainwater contact with basin bottoms.
Closure of the F-Area HWMF was begun in 1989 and completed in January 1991. The F-Area HWMF was certified closed in February 1991. Closure activities specifically included removal of standing water remaining in the basin; stabilization of the basin sludge with a layer of granite, limestone and blast furnace slag; construction of a low permeability cap over the basin; and restoration of the area.
A ROD addressing OU6 was completed in September 1993.

OU7:
The H-Area HWMF is a source specific operable unit within the H-Area Fundamental Study Area. The H-Area HWMF consists of three unlined, earthen surface impoundments located in the center of SRS, southwest of Road E and north of road 4 approximately 6 miles from the nearest site boundary.
The H-Area HWMF operated from 1955 until November 1988. The original H-Area HWMF consisted of basins H-1, H-2, and H-3 and operated from 1955 to 1962. In 1962 H-3 was replaced by H-4. At the time of closure, the H-Area HWMF had a combined maximum operating capacity of 26.5 million gallons of wastewater. The H-Area HWMF received waste effluents from H-Area chemical separation facilities processes such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads.
The four basins were closed by dewatering, physically and chemically stabilizing the remaining sludges and placing a protective

multi-layer cover system over them to reduce rainwater contact with basin bottoms.

OU8:
The F-Area HWMF is a source specific operable unit within the F-Area Fundamental Study Area. The F-Area HWMF is located in the center of SRS, Southwest of Road E and North of Road 4 approximately 16 miles from the nearest plant boundary. The F-Area HWMF consisted of three unlined earthen basins that had a combined maximum operating capacity of 20.5 million gallons of waste water during operation. It received waste effluents from F-Area chemical separations facilities such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads. Significant amounts of nitrates and caustics were received.
A ROD addressing OU8 was completed in April 1995.

OU9:
The H-Area HWMF consists of a series of three hydraulically connected unlined basins (H-1, H-2, and H-4). Basin H-4 was built in 1962 to replace basin H-3. Wastewater flow to the basins was terminated on November 7, 1988 in accordance with the requirements of RCRA. The H-Area HWMF received waste effluents from H-Area chemical separations facilities such as nitric acid recovery unit, waste storage system evaporator overheads, and general purpose overheads. The waste stream contained hazardous constituents and low levels of radionuclides.
A ROD addressing OU9 was completed in April 1995.

OU10:
The Fire Department Hose Training Facility (FDHTF) is located approximately 200 meters (700 feet) northeast of the intersection of Roads C and 6 and approximately six meters (20 feet) west and downgradient of a heat exchanger storage pad. The FDHTF is a source control and groundwater operable unit. The FDHTF was built between 1975 and March 1979 and operated by the SRS Fire Department between 1979 and 1982 to train personnel in fighting waste oil fires. Training exercises typically included pouring burnable oil into the unit, igniting the oil, and then having the fire department extinguish the fire with water from fire hydrants located adjacent to the unit. No known hazardous wastes were placed in the unit.
The SRS Fire Department discontinued use of the FDHTF and recommended the facility for cleanup and closure in March 1982. Available documentation indicates cleanup activities occurred on November 21, 1982 during which 14 loads of oil-contaminated soil

were excavated from an area approximately 6 by 6 by 1 meter and transported to the sanitary landfill. However, the date of this cleanup activity could not be verified.
A ROD addressing OU10 was completed in August 1998.

OU11:
The Central Shops Burning/Rubble Pit (631-6G) (BRP6G)is located in the Central Shops Area near the center of the SRS. It operated from 1951 through 1955 for the disposal and burning of waste materials. The unit consisted of a shallow unlined excavation, approximately 3m (10 feet) deep. Materials believed to be disposed of in the pit included waste oils, rags, paper, cardboard, plastics, degreasers, wood, rubber, and drummed organic solvents. These materials were periodically burned in the pit, usually on a monthly basis. The volume of waste disposed of at BRP6G was not recorded.
A ROD addressing OU11 was completed in May 1997.

OU12:
The M-Area West unit is located west of the M-Area Production Facility on a dirt road approximately 1.8 kilometers north of Silverton Road. There are no structures of any type located at or near M-Area West. The only nearby man-made feature is a dirt access road located about 30 to 40 feet west of the waste areas.
The unit consists of two small areas. Several drums and other small innocuous debris were found on the land surface adjacent to a dirt road approximately 1 kilometer west of the M-Area production facility. The total waste at the unit consisted of six empty 55-gallon drums, four 1-gallon cans and a 1-gallon glass jar. The cans and the jar were originally contained in one of the larger drums. With the exception of a crushed drum and small amounts of metal debris, all other materials were removed from the site in 1992.
There is no documented information available regarding past hazardous or non-hazardous waste disposal activities at M-Area West. Markings on the drums found at the unit suggest that they once contained oil and solvents, and that they are approximately 37 years old. There is no evidence that any recent disposal activity has occurred or that the disposal activity was more widespread. Also, there is no evidence of any burning or excavation at this waste unit.
A ROD addressing OU12 was completed in September 1995.

OU13:
The Silverton Road Waste Unit (SRWU) is located in the northwestern part of SRS in Aiken County, approximately 1.5 miles southwest of A/M Area. The SRWU was first used before construction of the SRS. Municipal, agricultural, and commercial trash, rubbish, garbage, debris, and refuse probably constituted the

waste stream until the early 1950s. After procurement by the federal government, the SRWU land continued to be used as an open dump for disposal of metal shavings, 55-gallon drums, cardboard drums, tires, lumber, etc. No records of waste disposal activities were kept. In 1974, the disposal of waste at the SRWU ceased, and the area was bulldozed, graded, covered with soil, and planted with grasses.
A ROD addressing OU13 was completed in March 1997.

OU14:
The F-Area Burning /Rubble Pits (FBRP) comprise a source unit located within the SRS, approximately 3000 feet west of F-Area and 1100 feet north of SRS Road C. Between 1951 and 1973, SRS used Pits 231-F and 231-1F to burn a variety of wastes which were considered non-hazardous at that time. Some of these waste materials (degreasers and solvents) are now considered to be hazardous based on ingestion or possible dermal contact. Waste was usually burned on a monthly basis. The chemical composition and volumes of the disposed waste are unknown, but waste materials burned included paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents.
A ROD addressing OU14 was completed in March 1997.

OU15:
The D-Area Burning/Rubble Pits (DBRP) are located in the western part of the SRS in Barnwell County, approximately 2600 feet west of D Area and 1.6 miles west of State Highway. Between 1951 and 1973, burning pits were used at SRS to burn a variety of hazardous and non-hazardous waste. The chemical composition and volumes of the disposed waste are unknown. Combustible materials, which were burned monthly, included paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents. No known or suspected radioactive materials were allowed in the burning pits. Burning of waste in the SRS pits was discontinued by October 1973. A layer of soil was then placed over the residue in the pits and they were subsequently used as rubble pits.
A ROD addressing OU15 was completed in March 1997.

OU16:
The Old F-Area Seepage Basin (OFASB) is located within the SRS, approximately 600 feet north of F Area and one mile east of Road C and is located in Aiken County. The Savannah River and associated swamps are located approximately six miles west of the basin. The OFASB is designated as Building Number 904-49G and covers a total area of 1.3 acres.
Between November 1954 and mid-May 1955, 9 to 14 million gallons of wastewater were discharged to the basin which served as an

unlined seepage basin for the purpose of reducing radioactive substance concentrations. Wastewater included overhead condensates from evaporators, laundry washwaters, non-reactor cooling water from F and H Areas, and possibly other chemicals.
A ROD addressing OU16 was completed in May 1997.

OU17:
The L-Area Oil and Chemical Basin (LAOCB) and L-Area Acid Caustic Basin (LAACB) are located south of L-Area in an area of low to moderate relief. They are situated on the southern flank of a hill approximately 300 feet south of the L-Area perimeter fence and 1,250 feet north of L Lake.
The LAOCB was designed and constructed as an unlined seepage basin in 1961 for the purpose of disposing of small volumes of wastes that were not appropriate for discharge to local streams, regular seepage basins, or the 200-Area waste management system. The exact quantity of waste water discharged to the LAOCB basin is not documented. Liquid wastes consisting of small volumes of slightly radioactive oil and chemical wastewater were sent to the LAOCB from throughout SRS, but came primarily from the reactor areas. Wastes were transported to the drainage pad in tank trucks, metal drums, skid tanks, and other containers. The Hot Shop (Building 717-G) discharged decontaminated wastewater containing radionuclides, detergents, and spent degreasing solvents through the pipeline to the basin.
A ROD addressing OU17 was completed in March 1997.

OU18:
The Burma Road Rubble Pit (BRRP) is located approximately one-half mile southwest of F-Area Separations Facility and one-tenth mile southwest of C Road. The BRRP is between Upper Three Runs Creek and Four Mile Creek.
The BRRP consists of two unlined earthen pits dug into surficial soil and filled with various waste materials. A small circular area of disturbed soil was detected adjacent to these pits and is considered to have been used as a source of backfill for the pits. It has been determined that the BRRP source control OU does not contribute contamination to the area groundwater or surrounding soils.
A ROD describing OU18 was completed in August 1998.

OU20:
The K-Area Bingham Pump Outage Pit (KBPOP) is situated in the Tobacco Road formation which extends from ground surface to a depth of 95 feet below ground surface. Between 1957 and 1958, miscellaneous construction debris generated by major modifications and repairs to the primary and secondary reactor cooling water

systems was buried in the KBPOP. There were no pumps buried and no liquid waste was disposed of in the KBPOP.
A ROD addressing OU20 was completed in March 1998.

OU23:
The F-Area Retention Basin (FRB) is located outside and south of the F-Area perimeter fence, approximately 1035 meters (3397 feet) from Fourmile Branch. The FRB, with an area of 0.6 acres, was designed and operated as an unlined, temporary container for potentially contaminated cooling water from the F-Area Canyon Facility and stormwater drainage from the F-Area Tank Farm. Cooling water from the Canyon Facility generally had low levels of radioactivity, while water from the Tank Farm is believed to have had only trace quantities of nonradionuclide chemicals. The quantities of water released to the retention basin and the level of various constituents contained within the water are unknown.
A ROD addressing OU23 was completed in September 1998.

OU27:
The D-Area Oil Seepage Basin is located on the Ellenton Plain, the highest of three terraces between the Savannah River to the west and the Aiken Plateau to the east. Construction of the D-Area Oil Seepage Basin trenches began in 1952. Employee interviews indicated the basin was used in the disposal of waste oil originating from D-Area Powerhouse operations to dispose of nonburnable waste and for the routine burning of office and cafeteria waste. Unknown amounts and types of waste were disposed into the basin. Records of the contents of the disposed drums do not exist. To date, there is no evidence to indicate the presence of radionuclides in the drums. Furthermore, employee interviews have indicated that no radionuclides were disposed within the trenches. In 1975, the D-Area Oil Seepage Basin was removed from service and backfilled with soil. Approximately one foot of standing liquid, plus an unknown number of 55-gallon drums possibly containing waste oil, remained in the basin when it was backfilled. The basin remains inactive and is covered with natural vegetation, including bushes and grasses, and is surrounded by trees.
RODs addressing OU27 were completed in March 1995 and August 1998.

OU29:
The TNX Area is a pilot scale test facility for the SRTC. The pilot scale facilities are used to provide technical support to various SRS production areas. From 1953 to August 1988, wastewater generated by research performed in the TNX Area was disposed of in seepage basins. In August 1988, wastewater was rerouted to the TNX

Effluent Treatment Facility.
A ROD addressing OU29 was completed in November 1994.

OU32:
The Burial Ground Complex (BGC) is an area which occupies approximately 195 acres in the central part of SRS between F and H Separation Areas, on a nearly flat divide between Upper Three Runs Creek to the north and Four Mile Creek to the south.
The BGC includes the Old Radioactive Waste Burial Ground (ORWBG) and other OUs such as the Mixed Waste Management Facility (MWMF), the Low Level Radioactive Waste Disposal Facility (LLRWDF), Solvent Tanks S1-S22 (located in the ORWBG and currently being characterized), Solvent Tanks S23-S30, and Solvent Tank S32.
The ORWBG comprises a disposal area for solid radioactive waste produced at the SRS, as well as shipments from other U.S. DOE and Department of Defense facilities. The ORWBG has contributed to localizedshallow aquifer groundwater contamination. The plume of groundwater contamination from the ORWBG seeps into the old F-Area effluent stream which flows into Four Mile Creek which in turn flows into the Savannah River. Other RCRA/CERCLA units within the BGC are undergoing characterization and investigation to determine the impacts to the environment.
The ORWBG began receiving waste in 1952 and was filled in 1972. Examples of materials disposed of at the Old Radioactive Waste Burial Ground (ORWBG) include the incidental waste from laboratory and production operations, contaminated equipment, lead, spent deionizer resins, spent lithium-aluminum targets, irradiated process oil from pumps in the tritium facilities and reactor areas, mercury from gas pumps in tritium facilities, cadmium, scintillation fluid, and shipments from off-site.
A ROD addressing OU32 was completed in June 1996.

OU33:
The mixed waste management facility (MWMF) operated from 1969 until March 11, 1986. During that time, this facility, which comprises approximately 58 acres, received low-level radioactive waste materials produced at SRS. Some of these materials are classified as mixed waste containing both hazardous and radioactive components under the RCRA. These trenches were closed by precompacting and placing a protective multi-layer cover system over them to reduce rainwater contact with trench bottoms.
RCRA preventive actions at the MWMF were conducted pursuant to the requirements of RCRA. In 1985 a RCRA Closure Plan was submitted, and closure of the MWMF was begun in 1988 and completed in December 1990. The MWMF was certified closed in

1991. Closure activities specifically included precompaction, construction of a low permeability cap over the trenches, and restoration of the area.
A ROD addressing OU33 was completed in September 1994.

OU34:
The Tank 105-C HWMF was installed in 1961 as part of an off-line heat exchanger repair program and was used as a temporary holding tank for liquid solution. Sumps from the heat exchanger cleaning area drained into Tank 105-C. Oil in the tank was probably attributable to oil leaks into these sumps. The reacted or spent oxalic acid solution that resulted from the rinsing process was pumped into an above ground neutralization tank in the stack area of the reactor building.
In October 1990, a RCRA Closure Plan was submitted to the SCDHEC. SRS received approval of the closure plan on January 16, 1991, with no revision required. Closure activities specifically included the neutralization of waste to a pH of less than 12.5, removal of as much waste as reasonably possible, and shipment of removed waste to an onsite storage/disposal facility. Any remaining waste and the tank void were stabilized with concrete.
A ROD addressing OU34 was completed in September 1994.

OU35:
Par Pond is a 2640-acre man-made reservoir located northeast of P Area and east of R Area in the eastern portion of SRS. The southern shore of the reservoir lies approximately 1.5 miles from the eastern SRS boundary. The southern shore of the reservoir lies approximately 200 feet north of Road B. Par Pond discharges through controlled releases into Lower Three Runs Creek, which in turn discharges into the Savannah River. The length of Lower Three Runs Creek from the outfall of Par Pond to the Savannah River is approximately 20 miles.
Par Pond was built to augment the cooling water requirements of both P and R Reactors. During the 1950s, an effluent pathway was constructed from R Reactor to Par Pond. The pathway consisted of the R Canal and Pond B. Releases in the form of process leaks, purges, and makeup cooling water have contaminated Par Pond with cesium-137 and other radioactive and non-radioactive contaminants. Mercury has been detected in fish from the Savannah River and SRS waterbodies since the analyses began in 1971, with comparable concentrations measured in onsite and offsite fish.
A ROD describing OU35 was completed in February 1995.

OU41:
OU41 contains the P-Area CP R/O Basin (P-CRPB). The P-CRPB is

located approximately 330 feet southeast of the limited area fence surrounding P Area in northwestern Barnwell County.
A ROD addressing OU41 was completed in September 1998.

OU42:
OU42 contains the C-Area CP R/O Basin (C-CRPB). The C-CPRB is located approximately 700 feet southeast of the limited area fence surrounding C Area in northwestern Barnwell County.
A ROD addressing OU42 was completed in September 1998.

OU45:
The Grace Road Site is located approximately 1.3 kilometers south of B-Area and about 244 meters east of the intersection of Grace Road and SRS Road 2. It consists of numerous drums and cans, concrete slabs, brick foundations, and miscellaneous debris. The unit also contained numerous drums and cans varying in size from ? gallon cans to 55-gallon drums and various car parts. Most of the debris was on the surface or partially buried in scattered locations across the unit. Markings on a few of the smaller drums and cans indicated that they once contained oil and grease. There is no evidence that any recent disposal activity has occurred or that the disposal activity was more widespread. Also, there is no evidence of any burning or excavation at this waste unit.
Between February and May 1992, all the debris, drums and concrete slabs were removed from the Grace Road Site. The items removed were either used at soil erosion control areas or were disposed of in the sanitary landfill. No records of any type of waste management activity have been found for the Grace Road Site.
A ROD addressing OU45 was completed in March 1997.

OU51:
The Motor Shops Seepage Basin (716-A) (MSSB) is located in A Area south of the railroad tracks near the automotive shop in Aiken County. A small drainage feature runs through the area approximately 91 meters (300 feet) to the east of the MSSB.
The MSSB was constructed and placed in service in 1977 to receive liquid waste from the 716-A Motor Shops oil/water separator. The MSSB was designed and constructed as an unlined seepage basin. The wastewater flowed into the basin from the northwest through two influent pipes from the Motor Shop and seeped naturally into the soil beneath the basin. Effluent discharges from the Motor Shops included wastewater with trace amounts of engine oil, grease, kerosene, ethylene glycol, and soapy water.
A ROD addressing OU51 was completed in June 1998.

OU52:

The K-Area CP R/O Basin (K-CPRB). The K-CPRB is located approximately 500 feet west of the limited area fence surrounding K Area in northwestern Barnwell County.
A ROD addressing OU52 was completed in September 1998.

OU54:
The F-Area CP R/O Basin (F-CPRB) is located approximately 50 feet southeast of the limited area fence surrounding F Area in southwestern Aiken County.
A ROD addressing OU54 was completed in September 1998.

Remedy: The selected remedy for the deep soils is No Further Action, since remedial action objectives (RAOs) have been achieved by the Interim Remedial Action (IRA) and biovent testing.

The selected remedy for shallow soil, surface water, and sediment is No Action, because no chemicals of concern (COCs) were identified for them in the Baseline Risk Assessment (BRA).

The selected remedy for D-Area Oil Seepage Basin (OSB) groundwater is Natural Attenuation/Groundwater Mixing Zone (GWMZ) with Institutional Controls. Under this remedy, natural attenuation mechanisms would continue to reduce contaminant concentrations in the groundwater to acceptable levels.

Results from a bioventing study, conducted after the IRA at the unit, indicate that the source of groundwater contamination (i.e. the D-Area OSB soil) was abated as a result of the combined IRA and biovent test and no longer contributes to groundwater contamination. Evidence indicating that natural attenuation processes are occurring in the D-Area OSB groundwater was presented in the Resource Conservation Recovery Act Facility Investigation/ Remedial Investigation/Baseline Risk Assessment (RFI/RI/BRA)Report for the unit.

A GWMZ application has been approved as part of this alternative. A GWMZ variance for the D-Area OSB is an appropriate part of the natural attenuation remedies. Implementation of this alternative will involve installation of nine new wells and monitoring of a total of twelve groundwater wells. Institutional controls area also required to prevent unauthorized exposure to the contaminated media at the D-Area OSB.

Estimated Capital Cost: $142,000
Estimated O&M Costs: $299,000
Estimated Present Worth Cost: $391,000

Text: Full-text ROD document follows on next page.

EPA541-R98-114

<IMG SRC 981140>

<IMG SRC 98114A>

<IMG SRC 98114B>

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW
ATLANTA, GEORGIA 30303-8909

AUG 14 1998

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

4WD-FFB

Mr. Brian T. Hennessey, FFA Project Manager
Environmental Restoration Division
SRS Project Manager
U.S. Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

SUBJ: Record of Decision
Remedial Alternative Selection for the
D-Area Oil Seepage Basin,
Rev. 1 (WSRC-RP-97-402), dated August 1998

Dear Mr. Hennessey:

The Environmental Protection Agency (EPA) has completed its review of the subject document and has
no additional comments. Accordingly, this letter provides EPA approval of the Rev. 1 Record of Decision for the D-Area Oil Seepage Basin operable unit.

If you have any questions regarding this matter, please contact me at (404) 562-8547.

<IMG SRC 98114C>

cc: Keith Collinsworth, SCDHEC
Ben Gould, DOE-SRS
Sandra Carrol, ERD-WSRC (Signed Original)

<IMG SRC 98114D>

United States Department of Energy

Savannah River Site

Record of Decision

Remedial Alternative Selection for the

D-Area Oil Seepage Basin (631-G)(U)

WSRC-RP-97-402

Revision 1, Final

August 1998

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

Prepared for the U. S. Department of Energy under Contract No. DE-AC09-96SR18500

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Printed in the United States of America

Prepared for
U.S. Department of Energy
By
Westinghouse Savannah River Company
Aiken, South Carolina

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

D-Area Oil Seepage Basin (631-G)

WSRC-RP-97-402
Revision 1, Final
August 1998
Savannah River Site
Aiken, South Carolina

Prepared by:
Westinghouse Savannah River Company
for the
U. S. Department of Energy Under Contract DE-AC09-96SR18500
Savannah River Operations Office

DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

D-Area Oil Seepage Basin (Building Number 631-G)
Savannah River Site
Aiken, South Carolina

The D-Area Oil Seepage, Basin (D-Area OSB) Operable Unit (OU) is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Unit/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS).

Statement of Basis and Purpose

This decision document presents the selected remedial alternative for the D-Area OSB located at SRS south of Aiken, South Carolina. The selected alternative was developed in accordance with CERCLA, as amended, RCRA, and to the extent practicable, the National Oil and Hazardous Substances Contingency Plan (NCP). This decision based on the Administrative Record File for this specific RCRA/CERCLA unit.

Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

Since remedial action objectives (RAOs) for deep soils have been achieved by the interim remedial action (IRA) and biovent testing. No Further Action is the selected remedy for this medium (WSRC, 1997b, c, d, and e). No Action is the selected remedy for shallow soil, surface water and sediment, because no constituents of concern (COCs) were identified for them in the RCRA Facility Investigation/ Remedial Investigation/ Baseline Risk Assessment (RFI/RI/BRA). For these reasons, development of remedial alternatives for these media is not warranted.

The selected remedy for D-Area OSB groundwater is Alternative GW-2: Natural Allenuation/Groundwater Mixing Zone (GWMZ) with Institutional Controls. Under this remedy, natural attenuation mechanisms such as biodegradation, flushing, volatilization, adsorption, and hydrolysis would continue to reduce contaminant concentrations in the groundwater to acceptable levels. Results from a bioventing study, conducted after the IRA at the unit, indicate that the source of groundwater contamination (i.e., the D-Area OSB soil) was abated as a result of the combined IRA and biovent test and no longer contributes to groundwater contamination. Evidence indicating that natural attenuation processes are occurring in the D-Area OSB groundwater was presented in the RFI/RI/BRA Report (WSRC, 1997a) for the unit. This evidence included: (1) decreased dissolved oxygen levels in the groundwater, indicating that microorganisms are utilizing the contaminants as a carbon source and the oxygen within the groundwater to produce energy, (2) elevated chemical oxygen demand, chloride, and sulfate levels downgradient, (3) depressed pH levels in contaminated areas, and (4) presence of breakdown products.

Herbert et al., 1984, report that natural attenuation is selected as a preferred remedial option when the following site-specific conditions exist:

- Groundwater is unsuitable for consumptive use.
- Contaminants degrade quickly or are not at highly toxic concentrations.
- There is low potential for exposure.
- Active restoration is not feasible due to complex hydrogeologic conditions.
- There is low projected demand for future groundwater use.
- The unit is in close proximity to a surface water discharge area, with dilution to levels that are protective of human health and the environment.

Based on the information presented in the RFI/RI/BRA report for the D-Area OSB, the conditions at the D-Area OSB would be conducive to natural attenuation. Specific findings from that report include:

- The source of contamination at the D-Area OSB was removed during the IRA in conjunction with the biovent testing and is no longer contributing to groundwater contamination.
- Naturally occurring mechanisms will continue to reduce contaminant concentrations.
- There are no receptors of groundwater at the D-Area OSB; therefore, the potential for exposure is low.
- The aquifer is limited in thickness and yield and the groundwater it contains is not

targeted for residential or

commercial use; therefore, projected demand for future groundwater use is low.

· Modeling indicates that contaminant concentrations in the D-Area OSB groundwater would be reduced to below

maximum contaminant levels (MCLs) prior to reaching Fourmile Branch; therefore dilution in the surface water

body is not necessary to achieve MCLs.

The time required to degrade the unit-specific contaminants was conservatively estimated through groundwater modeling. The modeling indicates that all contaminant concentrations in groundwater would be reduced below their respective MCLs within approximately 10 years, which is well within the time-frame that the U.S. Department of Energy (DOE) plans to maintain control of the SRS.

A GWMZ application, defined under South Carolina Regulations R.61-68, has been approved by the SCDHEC as part of this alternative. Based on area characteristics and evidence presented in the GWMZ Application (WSRC, 1998c), a GWMZ variance for the D-Area OSB is an appropriate part of natural attenuation remedies.

Mixing zones are appropriate for situations where the source of groundwater contamination has been removed and where contaminant concentrations are being reduced by natural processes. Under these regulations, certain concentration limits above MCLs, known as mixing zone concentration limits (MZCLs), will be established within the designated mixing zone, where the plume will migrate while it dissipates. MCLs, which are protective limits for drinking water, will be established at the compliance boundary downgradient of the plume. Plume monitoring wells will be installed within the plume and at the compliance boundary, and would be sampled periodically to monitor compliance with permitted MCLs and MZCLs. Intermediate wells will be installed at other locations within the mixing zone to monitor plume behavior between the plume wells and compliance boundary wells as an early warning mechanism if plume behavior does not match predictions.

The mixing zone application has demonstrated that RAOs will be met, MZCLs will be achieved throughout the groundwater aquifer, and MCLs will be achieved at the compliance boundary as described in the approved GWMZ application. Implementation of this alternative will involve installation of nine new wells and monitoring of a total of 12 groundwater wells, as described in the GWMZ application.

The D-Area OSB is in an industrial use zone, as identified in Figure 3.3 of the SRS FFA Implementation Plan
(WSRC, 1996e), for both current and anticipated future land use. Although the remediation decisions for this unit
were based on the industrial use scenario, the groundwater remedy will achieve the more protective residential use
scenario. The D-Area OSB currently meets unrestricted land use criteria for soils, sediment and surface water.
Groundwater beneath thc unit exceeds the MCLs. Although institutional controls are included in all of the
alternatives (except the no-action alternative), the DOE has recommended that residential use of SRS land in the
vicinity of D Area be prohibited (DOE, 1996); therefore, future residential use and potential residential water usage
in this area is unlikely. Modeling of groundwater transport processes as part of the evaluation of the remedial
alternatives indicates that MCLs for the contaminants of concern will be achieved in all areas of the D-Area OSB
groundwater after approximately 10 years. Upon confirmation that MCLs have been achieved, institutional controls
at the unit will no longer be required.

Per the EPA Region-IV Land Use Controls (LUCs) Policy, a LUC Assurance Plan (LUCAP) for SRS and a LUC
Implementation Plan (LUCIP) for the D-Area OSB will be developed and submitted to the regulators for approval
The LUCAP will be submitted under separate cover, whereas the LUCIP will be submitted with the Remedial Design
Work Plan/Remedial Design Report/Remedial Action Work Plan (RDWP/RDR/RAWP) in accordance with the post-
ROD document schedule provided in Figure 18. The LUCIP details how SRS will implement, maintain, and monitor
the land use control elements of the D-Area OSB ROD to insure that the remedy remains protective of human health

The LUC objective necessary to ensure the protectiveness of the preferred alternative is:

· Prevent unauthorized access to the D-Area OSB contaminated groundwater plume.

The institutional controls required to prevent unauthorized exposure to the contaminated media at the D-Area OSB
include the following:

· controlled access to the D-Area OSB through existing SRS security gates and perimeter fences and the site

use/site clearance programs

· signs posted in the area to indicate that groundwater in the vicinity of the unit has been contaminated by

hazardous materials

· notification of groundwater contamination to any future landowner through deed notification, as required under

CERCLA Section 120(h)

A certified survey plat of the site will be prepared by a registered land surveyor and will be included with the post ROD documents. If D-Area OSB is transferred to non-Federal ownership prior to remediation of the groundwater to the MCLs for the COCs, reevaluation of the need for deed restrictions would be performed through an amended ROD with Environmental Protection Agency (EPA) and South Carolina Department of Health (SCDHEC) approval. The survey plat will be reviewed and updated, as necessary, at the time the site is transferred and will be recorded with the appropriate county recording agency. The D-Area OSB is located in Aiken County.

This selected remedy is intended to be the final action for the D-Area OSB, and is intended to be permanent and effective in both the long and short terms. This remedy is considered to be the least cost option that is still protective of human health and the environment. The state regulatory authority, the SCDHEC, will modify the SRS RCRA permit to incorporate the selected remedy.

The Rev. 0 of the post-ROD document, the combined RDWP/RDR/RAWP, will be submitted to the U.S. EPA and SCDHEC within approximately 180 calendar days after the issuance of the ROD. The RDWP/RDR/RAWP will

contain a conceptual Corrective Action Plan Strategy, a summary description of the scope of work for the remedial action design, an implementation/submittal schedule for subsequent post-ROD documents, and an anticipated field activities start date. The regulatory review period, SRS revision period, and Final regulatory review and approval period will be 90, 60, and 30 calendar days, respectively.

Statutory Determinations

Based on the D-Area OSB RFI/RI Report and BRA (WSRC, 1997a), D-Area OSB grounwater poses no significant risk to the environment but poses significant risk to human health. Therefore, monitoring of the existing groundwater constituents, consistent with the GWMZ application, is necessary.

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technology to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment to

reduce toxicity, mobility, or volume as a principal element. Section 300.430(f)(4)(ii) of the NCP requires that a five-year review of the ROD be performed if hazardous substances, pollutants, or contaminants remain at the waste unit. Since hazardous substances will remain at the unit above health-based standards during the remediation time frame indicated in the groundwater mixing zone application (approximately 10 years), the three FFA Parties below have determined that a five-year review of the ROD for the D-Area OSB will be performed to ensure continued protection of human health and the environment until the MCLs are attained in the groundwater.

Date T.F. Heenan; Assistant Manager for Environmental Quality
U.S. Department of Energy , Savannah River Operations Office

Date Richard D. Green; Division Director
Waste Management Division
U.S. Environmental Protection Agency - Region IV

Date R. Lewis Shaw; Deputy Commissioner
Environmental Quality Control
South Carolina Department of Health and Environmental Control

DECISION SUMMARY

REMEDIAL ALTERNATIVE SELECTION (U)

D-Area Oil Seepage Basin (631-G)

WSRC-RP-97-402

Revision 1, Final

August 1998

Savannah River Site

Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company

for the

U.S. Department of Energy Under Contract DE-AC09-96SR18500

Savannah River Operations Office

Aiken, South Carolina

Record of Decision for the
D-Area Oil Seepage Basin(631-G)(U)
Savannah River Site

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A. Responsiveness Summary 99

LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
BRA	Baseline Risk Assessment
CAB	Citizen's Advisory Board
CERCLA	Comprehensive Environmental Response, Compensation, and Liability ACE
CFR	Code of Federal Regulations
CMS	Corrective Measures Study
COC	constituent of concern
COPC	constituent of potential concern
CSM	conceptual site model
D-Area OSB	D-Area Oil Seepage Basin
DCE	dichloroethene
DOE	U.S. Department of Energy
DQO	Data Quality Objectives
DRO	diesel range organics
EPA	U.S. Environmental Protection Agency
ERA	Ecological Risk Assessment
ER&WM	Environmental Remediation and Waste Management
ESC	Expedited Site Characterization
FFA	Federal Facility Agreement
FRR	Final Remediation Report
FS	Feasibility Study
ft	feet/foot
GWMZ	Groundwater Mixing Zone
Hc	Henry's Law coefficient
HI	hazard index
HQ	hazard quotient
IRA	interim remedial action

LUC	land use control
LUCAP	land use control assurance plan
LUCIP	land use control implementation plan
km	kilometer
m	meter

MCL	maximum contaminant level
MEPAS	Multimedia Environmental Pollutant Assessment System
mi	mile
µg/kg	micrograms per kilogram
µg/l	microgram per liter
MLSSL	mass-limited soil screening level
msl	mean sea level
MZCL	mixing zone concentration limit
NCP	National Oil and Hazardous Substances Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
Ou	Operable Unit
PCE	tetrachloroethene
PCOC	Preliminary COC
PCR	post-construction report
PP	Proposed Plan
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RDR	Remedial Design Report
PDWP	Remedial Design Work Plan

RFI	RCRA Facility Investigation
RGO	remedial goal option
RI	CERCLA Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SAFER	Streamlined Approach for Environmental Restoration
SB	Statement of Basis
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulations
SRS	Savannah River Site
SSL	soil screening level
TCE	trichloroethene
TPH	total petroleum hydrocarbons

USC	unit-specific constituent
VOC	volatile organic compound
WSRC	Westinghouse Savannah River Company

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I. SAVANNAH RIVER SITE (SRS) AND OPERABLE UNIT (OU) NAME, LOCATION DESCRIPTION, AND PROCESS HISTROY

SRS Location, Description, and Process History

The SRS occupies approximately 777 square kilometers (km) [310 square miles (mi)] of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina (Figure 1). SRS is a secured U.S. Government facility with no permanent residents. SRS is located approximatelv 40 km (25 mi) southeast of Augusta, Georgia, and 32 km (20 mi) south of Aiken, South Carolina.

SRS is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. Chemical and radioactive wastes are by-products of nuclear material production processes.

OU Name, Location, Description, and Process History

The Federal Facility Agreement (FFA) (WSRC, 1993a) lists the D-Area Oil Seepage Basin (D-Area OSB). Building Number 631-G, as a Resource Conservation and Recovery Act (RCRA)/Comprehensive Environmental Compensation and Liability Act (CERCLA) unit requiring further evaluation using an investigation/assessment process that integrates and combines the RCRA Facility Investigation (RFI) process with the CERCLA Remedial Investigation (RI) to determine the actual or potential impact to human health and the environment. Information regarding the D-Area OSB can be found in the RFI/RI Report and Baseline Risk Assessment (BRA) (WSRC, 1997a), the Corrective Measures Study/Feasibility Study Report (CMS/FS) (WSRC, 1998a), and the Statement of Basis/Proposed Plan (SB/PP) (WSRC, 1998b).

The D-Area OSB is located within SRS, in a clearing between roads A-4.4 and A-4.5, approximately 1.6 km (1 mi) north of the coal-fired D-Area Powerhouse, and approximately 3.1 km (1.9 mi) from the nearest SRS boundary (Figures 2 and 3). The D-Area OSB is on the Ellenton Plain along the Savannah River at an elevation of 46 meters (m)[150 feet (ft)]above mean sea level (msl). The water table ranges from approximately 1 to 5 m (4 to 16 ft) below ground surface in the area of the D-Area OSB. Surface drainage is to the southwest, toward the Savannah River, which is at an elevation of 26 m (85 ft) msl [20 m (65 ft) below the basin elevation].

The D-Area OSB is designated as Building Number 631-G and has the approximate dimensions of 117 m (383 ft) long by 33 m (108 ft) wide and 2.5 m (8 ft) deep. During an interim remedial action (IRA) conducted at the unit, the trenches were found to be continuous, without noticeable berms, and were constructed as a series of adjacent trenches along the back half of the clearing (Figure 3).

The D-Area OSB unit is located in a cleared, rectangular-shaped area adjacent to an unimproved road in D Area (Figure 4). The location of the former seepage basin is currently not discernible because the unit has been backfilled ans leveled. The only evidence of the unit's prior existence is the four orange balls marking the corners of the unit, a perimeter fence, and the presence of multiple monitoring wells and piezometers located at or near the unit. The terrain is flat, with no discernible slope or relief, and is surrounded by a mature forest of hardwoods and softwoods. The forested conditions provide dense cover for wildlife, and, in combination with the boggy conditions prevailing in the adjacent wetlands, create access problems for equipment and personnel involved in unit investigation activities.

The closest surface water feature is a Carolina bay, a natural wetland located adjacent to the unit to the west. The Carolina bay appears to be dry during the summer months or periods of little or no precipitation, but may contain surface water during wet seasons. Unimproved dirt road A-4.4, located immediately north of the waste unit. bisects the Carolina bay. Aerial photographs indicate that the road was in existence during the early 1950s. Other wetlands exist approximately 76 m (250 ft) to the south of the unit~ beyond dirt road A-4.5.

The major local surface water drainage system is the Savannah River and associated swamps, located approximately 2.6 km 0.6 mi) to the west of the basin. Upper Three Runs Creek, a tributary to the Savannah River, is located 2.7 km (1.7 mi) to the north-northwest, and Fourmile Branch, another tributary, is 2.7 km (1.7 mi) to the south-southeast (Figure 1). The local surface drainage at the unit is to the south-southwest, toward a wetland area and runoff ditch. These wetlands discharge into another unnamed ditch, which traverses D Area and eventually leads to the Savannah River.

The D-Area OSB was constructed in 1952 as a series of unlined trenches for disposal of waste oil products, from D Area and other areas at SRS, which were unacceptable for incineration in the 400-D powerhouse boilers. As the trenches filled, the waste oils along with general office and cafeteria waste were occasionally ignited. The practice of open burning was a common practice at SRS until 1973 when it was stopped site-wide. In 1975 the basin was removed from service and was backfilled with soil.

The basin remained inactive and covered with natural vegetation, including bushes and grasses, until 1996, when an IRA was implemented. During the IRA, the trench area was excavated and drums and debris were

removed along
with any obviously contaminated soils. The remaining soils were returned to the excavation in "last out, first in" order.

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At the close of the IRA, the contractor installed two horizontally oriented, perforated pipes along the length of the
former waste unit for technology testing (bioventing) purposes. These pipes were used to force fresh air, nutrients
and tracers into the soils at a depth of about 2.4 m (8 ft) in order to volatilize the

constituents in the soil, enhance the aerobic degradation of the constituents in both the soil and groundwater, and monitor the effectiveness of the treatment program (WSRC, 1997b, c, d, e).

H. SITE AND OU COMPLIANCE HISTORY

SRS Operational History

The primary mission of SRS has been to produce tritium (3 H), plutonium-239 (239 Pu), and other special nuclear materials for our nation's defense programs. Production of nuclear materials for the defense programs was discontinued in 1988. SRS has provided nuclear materials for the space program, as well as for medical, industrial. and research efforts up to the present. Chemical and radioactive wastes are by-products of nuclear material production processes. These wastes have been treated, stored, and in some cases, disposed at SRS. Past disposal practices have resulted in soil and groundwater contamination.

SRS Compliance History

Waste materials handled at SRS are regulated and managed under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities have required federal operating or post-closure permits under RCRA. SRS received a hazardous waste permit from the South Carolina Department of Health and Environmental Control (SCDHEC); the permit was most recently renewed on September 5, 1995. Part IV of the permit mandates that SRS establish and implement an RFI Program to fulfill the requirements specified in Section 3004(u) of the federal permit.

On December 21, 1989, SRS was included on the National Priorities List (NPL). Sites included on the NPL fall under the jurisdiction of CERCLA. This inclusion created a niid to intergrate the established RFI Program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA, DOE has negotiated a FFA (WSRC, 1993a) with the U.S. Environmental Protection Agency (EPA) and SCDHEC to coordinate remedial activities at SRS into one comprehensive strategy that fulfills these dual regulatory requirements.

OU Compliance History

As previously stated, the D-Area OSB is listed in the FFA as a RCRA/CERCLA unit requiring further evaluation to determine the actual or potential impact to human health and the environment. An RFI/RI characterization and BRA were conducted for the unit between 1995 and 1996. The results of the RFI/RI and BRA were presented in the

RFI/RI Report and BRA (WSRC, 1997a). The RFI/RI Report and BRA were submitted in accordance with the FFA and the approved implementation schedule, and were approved by EPA and SCDHEC in August 1997. SRS submitted the Revision D Interim Action Proposed Plan for the D-Area OSB, which EPA and SCDHEC recieved November 26, 1993. The three Parties issued the Interim Action Record of Decision in March 1995. SRS prepared and submitted the D-Area OSB Interim Action Post-Construction Report to EPA and SCDHEC on November 8, 1996. SCDHEC approved the report on January 7, 1997, and EPA approved it on February 27, 1997. The CMS/FS (WSRC, 1998a), SB/PP (WSRC, 1998b), and Groundwater Mixing Zone Application (WSRC,1998c) were submitted to Epa and SCDHEC in accordance with the FFA and the approved implementation schedule, and were approved by them on April 1, 1998.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Both RCRA and CERCLA require that the public be given an opportunity to review and comment on the draft permit modification and proposed remedial alternative. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA. These requirements include establishment of a Administrative Record File to document the investigation and selection of the remedial alternatives for addressing the D-Area OSB soils and groundwater. The Administrative Record File must be established at or near the facility at issue. The SRS Public Involvement Plan (DOE,1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS Public Involvement Plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act (NEPA). SCHWMR R.61-79.124 and Section 117a, of CERCLA, as amended, require advertisement of the draft permit modification and notice of any proposed remedial action and provide the public an opportunity to participate in the selection of the remedial action. The Statement of Basis/Proposed Plan for the D-Area Oil Seepage Basin (WSRC, 1998b), a part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the D-Area OSB. The Administrative Record File is available at the EPA office and at the following locations:

U.S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

Similar information is available through the repositories listed below:

Reese Library
Augusta State University
2500 Walton Way
Augusta, Georgia 30910

Asa H. Gordon Library
Savannah State University
Tompkins Road
Savannah, Georgia 31404
(912) 356-2183

The public was notified of the public comment period through mailings of the SRS Environmental Bulletin, a newsletter sent to approximately 3500 citizens in South Carolina and Georgia, through notices in the Aiken Standard, the Allendale Citizen Leader, the Augusta Chronicle, the Barnwell People-Sentinel, and The State newspapers. The public comment period was also announced on local radio stations.

The 45-day public comment period began on May 1, 1998 and ended on June 14, 1998. However, no public comments were received during this period. The Environmental Remediation and Waste Management (ER&WM) Program subcommittee of the SRS Citizen's Advisory Board (CAB) was given a briefing on the preferred alternatives on May 6, 1998. The ER&WM subcommittee was supportive of the preferred alternative and made a motion to the full CAB at the May 18, 1998 meeting to accept the preferred alternative. This motion was accepted with no opposition. The subcommittee also commended the site's successful use of the bioventilation system in the remediation of the unit's subsurface soil. The Responsiveness Summary, provided in Appendix A of this Record of Decision (ROD), and the final RCRA permit will indicate that no comments were received.

IV. SCOPE AND ROLE OF THE OU WITHIN THE SITE STRATEGY

RCRA/CERCLA Programs at SRS

RCRA/CERCLA units (including the D-Area OSB) at SRS are subject to a multi-stage remedial investigation process that integrates the requirements of RCRA and CERCLA as outlined in the RFI/RI Program Plan (WSRC, 1993b). The RCRA/CERCLA processes are summarized on Figure 5. Figure 5 illustrates the investigation and

characterization of potentially impacted environmental media (such as soil, sediment, surface water, and groundwater) comprising the waste unit and surrounding areas; the evaluation of risk to human health and the local ecological community; the screening of possible remedial actions to identify the selected technology that will protect human health and the environment; implementation of the selected alternative; documentation that the remediation has been performed competently; and evaluation of the effectiveness of the technology. The steps of this process are iterative in nature, and include decision points that involve concurrence between DOE (as owner/manager), EPA and SCDHEC (as regulatory oversight), and the public. The RCRA/CERCLA process as applied to the D-Area OSB is outlined below.

RFI/RI Work Plan

Prior experience in the Superfund program has identified a strong need for streamlining the remediation process (EPA, 1989a). To address this need, DOE has developed the Streamlined Approach for Environmental Restoration (SAFER) (Daily et al., 1992). DOE Headquarters identified the D-Area OSB as a plot project for the implementation of SAFER and elected to design the D-Area OSB RFI/RI Work Plan using SAFER methodologies.

The SAFER program combines elements of two recognized processes developed for managing uncertainty at different points in the environmental restoration process: the data quality objectives (DQO) prccess, developed by the Quality Assurance Management Staff of EPA (Neptune et al., 1990) and the Observaional Approach (OA). which is rooted in management of uncertainty in traditional geotechnical engineering applications (Peck, 1969). The OA provides a framework for managing uncertainty throughout the environmental restoration process while the DQO precess focuses on establishing the quality and quantity of data required to help make decisions at various points in the environmental restoration process. Description of the DQO process is found in Data Quality Objectives Processfor Superfund, Interim Final (EPA, 1993).

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The SAFER method incorporates the DQO and OA processes to achieve the following:

- enhanced emphasis on planning
- linkage of data collection to decision-making needs
- explicit recognition and management of uncertainty
- direct and efficient application of information gained as planning and remediation proceed
- early convergence on a remedy
- informing and soliciting input from key stakeholders (regulators and public)

SAFER emphasizes the use of decision rules to quantitatively define data adequacy in the RFI/RI process. Each decision rule provides a quantitative statement defining what quantity and quality of data provide adequate information upon which decisions can be based. Inherent in the idea of the decision rule is the understanding that there will be uncertainty in the decision-making process. The goal is to identify data adequacy that provides acceptable uncertainty in making decisions while managing the residual uncertainty. The objective of the decision rule is to establish the linkage between the problem at the unit, its remedial objective, and data requirements. This will be done iteratively, first based on preliminary understanding and then modified as more information is obtained.

Federal, state, and local regulatory agencies are recognized as key stakeholders within the SAFER process. Continuing concurrence with regulatory requirements is an implicit SAFER objective. Data from previous environmental investigations, performed under the existing phased investigation approach, are included in the SAFER design. SAFER's iterative approach allows regulatory concurrence as the investigation proceeds. The SAFER process was implemented at the D-Area OSB as an Expedited Site Characterization (ESC) field effort that sought to accomplish project objectives in a rapid fashion white maintaining data quality.

The initial step in the SAFER process consists of identifying probable conditions at the investigation site and developing a conceptual site model (CSM) based on those conditions. This conceptual model is used to concentrate the unit investigation on the processes, medium(s), constituents, exposure pathways, and potential receptors most likely to be found during the investigation. With the model in mind, a more focused work plan can be developed to fully address each item identified in the model.

Section V provides the unit-specific CSM for the D-Area OSB OU and a summary of the characteristics of the primary and secondary sources and release mechanisms for the unit as determined in the RFI/RI.

Based on the CSM for the D-Area OSB, a detailed sampling and analysis plan was prepared and implemented (WSRC, 1995a, a; 1996a). The unit assessment plan and confirmation sampling plans were designed to characterize the following sources and release and release mechanisms:

- primary source: disposal trenches comprising the D-Area OSB
- primary release mechanisms: deposition and infiltration/percolation
- source media (primary media impacted): surface soil and subsurface soil

· secondary release mechanisms: fugitive dust generation, volatilization, vegetative (biotic) uptake, stormwater

runoff, and leaching into the groundwater

· exposure media (secondary media impacted): air, produce, surface water, sediiment, and groundwater

RFI/RI Characterization Report

The primary purpose of the RFI/RI is to establish unit-specific constituents (USCs) that pose potential risk through various exposure routes and to determine their distribution in the media associated with the unit. As an indicator of unit-specific contamination, the results of the analysis of soil, surface water, and sediment samples at the unit were compared to 2x mean background concentrations, and the groundwater analytical results were compared with EPA primary maximum contaminant levels (MCLs) or 2x mean background concentrations where no MCL exists. Compounds that exceed these comparison levels are called USCs and their nature and extent were evaluated in detail in the RFI/RI.

To address the identified sources and release mechanisms in the CSM, the following RFI/RI unit characterization objectives were identified for the D-Area OSB (WSRC, 1995a):

· enhance and refine the lithologic and hydrogeologic characterizaticn of the subsurface in the vicinity of the D-

Area OSB unit

· establish background concentrations in soil, groundwater, surface water, and sediment

to determine the impact on these media associated specifically with the operation of the D-Area OSB unit

· determine the USCs, if any, released to the various environmental media related to the D-Area OSB

· address aspects of the CSM related to sources, release mechanisms, and exposure media, and/or refine the CSM

based on the data collected

· define the horizontal and vertical extent of contaminants in the impacted media

· assist in determining the feasibility of potential remedial alternatives through the collection of preliminary soil

engineering parameters

· confirm groundwater analytical data generated by the onsite lab during the SAFER process, with analysis

USCs generated by a conventional, offsite laboratory data

BRA

The purpose of a BRA is to develop risk information to assist in the decision-making process for remedial sites (EPA. 1989b). This risk assessment follows the EPA Risk Assessment Guidance for Superfund (EPA, 1989b, c).
According to EPA, 1989b, a BRA should provide the following:

· an analysis of baseline risks and help determine whether there is a need for remedial action

· a basis for determining levels of chemical and radiological constituents that can remain in-situ, on-unit and that

will be adequately protective of human health and the environment

· a basis for comparing potential human health and ecological impacts of various remedial alternatives

· a consistent process for evaluating and documenting risk to public health and the environment

The BRA assesses risks that may result from a release of, and exposure to, chemical contaminants under reasonable maximum exposure (RME) conditions. The assessment uses current and hypothetical future land use scenarios and associated receptors with the assumption that constituent concentrations remain the same as reported in the RFI/RI.
The RME represents the highest exposure that is reasonably expected to occur at the unit.

During the development of a BRA, risk from the unit is quantified, based on unit-specific data, for current and future human and ecological receptors, through the multiple exposure routes identified in the CSM. Carcinogenic risk at or above 1.0 x 10 -6 (one excess human cancer in a population of one million) is considered significant. In addition, if the hazard index (HI) is greater than 1.0 for noncarcinogenic constituents, there is concern that adverse health effects can occur.

The information from the BRA supports identification of those areas where no further action or selected remedial actions are warranted. The BRA also provides the basis for deriving risk-based constituent levels that are protective of human health and environment [remedial goal options (RGOs)] for use in consideration of remedial alternatives.
A summary of the results of the BRA for the D-Area OSB is presented in Section VI.

CMS/FS

The results of the RFI/RI Report and the BRA provide the basis for establishing unit-specific remedial action objectives (RAOs) in the CMS/FS. RAOs for the D-Area OSB were developed to address: unit-specific

contaminants, media of concern, potential exposure pathways, and remediation goals. The RAOs were based on the nature and extent of contamination, threatened resources, human and environmental risk information, and the potential for human and environmental exposure. In addition, the preliminary remediation goals for the D-Area OSB were developed based upon applicable or relevant and appropriate requirements (ARARs) or other information from the RFI/RI Report and the BRA.

The methodologies used to identify and screen relevant technologies for the remediation of the waste unit followed an established remedy selection process developed by the EPA. The goal of this process is to selet corrective measures/remedial actions that are protective of human health and the environment, that maintain protection over time, and that minimize contaminant (or waste) mobility, toxicity, or volume through treatment, when possible [CERCLA 300.430 (a)(1)(I). The selection of a response action for the D-Area waste unit proceeded in a series of steps, as defined in the National Oil and Hazardous Substances Contingency Plan (NCP) of November 20, 1985 (50 FR 47973), and as outlined in Figure 6. In addition, the remedial alternatives were further evaluated against the following nine selection criteria established by the NCP:

- overall protection of human health and the environment
- compliance with ARARs
- long-term effectiveness and permanence
- reduction of toxicity, mobility, or volume through treatment
- short-term effectiveness
- implementability
- cost
- state acceptance
- community acceptance

The results of the CMS/FS conducted for the D-Area OSB are summarized in Section VII, and a summary of the comparative analysis of the alternatives is provided in Section V111.

SB/PP

The culmination of the response action selection process is the SB/PP. The purpose of the SB/PP is to facilitate public participation in the remedy selection process through the solicitation of public review

and comment on all the
remedial alternatives described. The SB/PP presents the lead agency's preliminary recommendation(s) concerning
how best to undertake a remedial action at a particular waste unit. The SB/PP describes all remedial options that

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were considered in detail in the RFI/FS, and explicitly identifies both the preferred alternative for a remedial action
at a waste unit and the preference rationale for that alternative.

The SB/PP directs the public to the RFI/RI, BRA and CMS/FS reports as the primary sources of detailed, unit-
specific information and information on the remedial alternatives analyzed. It also provides information on how the
public can be involved in the remedy selection process. The public is notified of a public comment period through
mailings of the SRS Environmental Bulletin, through notices in the Aiken Standard, the Allendale Citizen Leader, the
Barnwell People - Sentinel, The State, and Augusta Chronicle newspapers, and through announcements on local
radio stations.

ROD

The ROD documents the remedial action plan for a waste unit and consists of three basic components: a
Declaration, a Decision Summary, a Responsiveness Summary. The purpose of the Declaration is to certify that the
remedy selection process was carried out in accordance with the requirements of CERCLA and, to the extent

practicable, the NCP. The Decision Summary is a technical and informational document that provides the public with a consolidated source of information about the history, characteristics, and risks posed by the unit, and includes a summary/evaluation of the cleanup alternatives and the considerations that led to the selected remedy. The Responsiveness Summary presents comments received during the public comment period on the SB/PP, and a response to each comment or criticism that was submitted in writing or orally. The Responsiveness Summary for the D-Area OSB is provided in Appendix A and an explanation of significant changes resulting from public comment on the SB/PP for the unit is provided in Section XI.

SRS received a RCRA hazardous waste permit from SCDHEC, which is renewed every five years. The D-Area OSB is a Solid Waste Management Unit (SWMU) listed on the SRS RCRA Permit because the unit received hazardous substances. Thus, the remedial decision for this SWMU requires a RCRA Permit Modification. No comments were received during the public comment period on the proposed remedial action and the associated draft RCRA permit modification (May 1 through June 14, 1998). This is indicated in the Responsiveness Summary of this ROD (Appendix A) and in the final RCRA Permit. The final RCRA Permit and this ROD document the final decision for this OU.

Post-ROD Documentation

The post-ROD documentation consists primarily of the design documents that are required prior to initiating a remedial action. Specific post-ROD documents include the combined Remedial Design Work Plan/Remedial

Design Report/ and Remedial Action Work Plan (RDWP/RDR/RAWP), and the combined Post-Construction Report and Final Remediation Report (PCR/FRR). A discussion of the schedules that apply to these documents is provided in the SB/PP and in Section XIII of this ROD.

D-Area 0SB Remedial Strategy

The RFI/RI process provides a method of managing the steps athat lead to the ultimate remediation of a specific waste unit. An operable unit (OU) usually consists of the contaminated (sources. soil, groundwater, sediments, surface water, and air) specific to a waste unit and the proposed actions related to their characterization and ultimate remediation, and/or the timing of those actions.

The overall strategy for addressing the D-Area OSB was to: (1) characterize the waste unit by delineating the nature and extent of contamination and identifying the media of concern (perform the RFI/RI); (2)

perform a BRA to evaluate media of concern, constituents of concern (COCs), and exposure pathways, and to characterize potential risks; and (3) evaluate and perform a final action to remediate, as needed, the identified media of concern.

The D-Area OSB is an OU located within the Savannah River Floodplain Swamp watershed. Several OUs within this watershed will be evaluated to determine impacts, if any, to associated streams and wetlands. SRS will manage all OUs to minimize impact to the watershed. Based on characterization and BRA information, the D-Area OSB does not significantly impact the watershed. Upon disposition of all OUs within this watershed, a final, comprehensive evaluation of the watershed will be conducted to determine whether any additional actions are necessary. Based on the BRA and vadose zone modeling after the IRA and biovent testing, the soils at the unit do not warrant further remediation. Additionally, results of the BRA indicated that surface water and sediment at the unit do not require remediation. Groundwater is the only medium identified in the BRA that requires evaluation of remedial alternatives. The D-Area OSB investigation considered all unit-specific groundwater. Based on the investigation of the groundwater, the contamination in the water table aquifer is apparently attributable to the D-Area OSB wastes. The proposed action for the D-Area OSB groundwater, soil, sediment, and surface water is a final action.

V. OU CHARACTERISTICS

A CSM was developed for the D-Area OSB that identifies the primary source, primary contaminated media, migration pathways, exposures pathways, and potential receptors for the unit. The CSM for the D-Area OSB is presented in Figures 7a and 7b and is based on the data that are presented in the RCRA/CERCLA documentation for this unit. The data summary reports (WSRC, 1996b, c, d, e) and the combined RCRA Facility Investigation/

Remedial Investigation Report and Baseline Risk Assessment for the D-Area Oil Seepage Basin (WSRC, 1997a) contain detailed analytical data for all of the environmental media samples taken in the characterization of the D-Area OSB. These documents are available in the Administrative Record File (see Section III).

The primary data used for the RFI/RI and BRA were collected during the ESC Phase I, Phase II, confirmation phase (Phase III), Phase IV, and the post IRA soil sampling conducted during 1995 and 1996. All samples were analyzed in accordance with EPA-approved protocols.

As an indicator of unit-specific contamination, the soil, surface water, and sediment results

were compared to 2x
mean background concentrations, and the groundwater results were compared with EPA Primary MCLs or 2x mean
background concentrations, where no MCL exists. Compounds which exceed these comparison levels are called
USCs (Table 1) and their nature and extent are evaluated in detail in the RFI/RI and BRA Report.

For the analysis of the nature and extent of contamination, soil sample results were grouped into three depth intervals
for both the unit and the background borings in conformance with the depth intervals evaluated in the BRA. These
depth intervals are 0.0 to 0.3 m (0-1 ft), and 0.0 to 1.2 m (0-4 ft) which covered the exposures from surface soil and
subsurface soil, respectively, as evaluated in the BRA. Analyses were also conducted on samples from a deep soil
interval, extending below 1.2 m (4 ft) to evaluate the nature and extent of contamination in the deep soil for the unit.
All goundwater samples collected and analyzed were taken from the uppermost aquifer and were evaluated as a
single group. Additional physical and hydraulic analyses regarding the effects of the local weak aquitards on the
movement of groundwater and contaminants were also conducted.

Primary Sources and Release Mechanisms

The primary source for the contamination of the various media is waste oils disposed in the D-Area OSB, a series of
unlined trenches constructed to, a depth of 1.2 to 3.7 m (4 to 12 ft) (Figure 3). These wastes were deposited directly
into the deeper soil, greater than 1.2 m (4 ft) deep, and even into the local groundwater, when the water table was
close to the surface. The waste: oils disposed of in the D-Area OSB originated in D Area and other areas at SRS. and
were disposed of in the D-Area OSB because they were unacceptable for incineration in the 400-D powerhouse
boilers. The D-Area OSB has been out of service since 1975, when it was backfilled with soil.

The primary release mechanisms are deposition (contaminants deposited directly into the soils) and
infiltration/percolation (contaminants migrating vertically and laterally into the pore spaces of the soils).

Secondary source media impacted by waste disposal activities at the D-Area OSB include surface soils and
subsurface soils within the basin and the basin perimeter. Secondary release mechanisms for surface soil include:
fugitive dust generation, volatilization, biotic uptake, and stormwater runoff. Respective secondary media impacted
for these release mechanisms are: air (dust), air (vapor), biota, and surface water. The secondary release mechanism
for subsurface soil is leaching. The exposure medium for contaminants that leach from soil is groundwater, which
may in turn discharge to and undergo potential chemical constituent exchange with biota, stream

sediment, and
surface water. A detailed sampling and analysis plan was prepared and implemented to investigate these secondary
sources and a complete description of the sampling methods and protocols is provided in the RFI/RI Report and
BRA (WSRC, 1997a).

Media sampled for investigation of this unit included soil (at multiple depths), groundwater (from the uppermost
aquifer), surface water, and sediment (Carolina bay and the adjacent wetland).

Seventy-five compounds were detected at least once above screening levels in the soil, groundwater, surface water,
and sediment associated with the D-Area OSB and have been designated as USCs, as listed on Table 1. Those
compounds detected in soils were 23 metals, 15 volatile organic compounds (VOCs), 3 semi-volatile organic
compounds (SVOCs), 11 pesticides/polychlorinated biphenyls (PCBs), and 5 ligands. The groundwater beneath the
basin and as far downgradient as 320 m (1,050 ft) in the shallow aquifer contained USCs including 15 metals, 4
ligands, 16 VOCs, 4 SVOCs, 5 pesticides/PCBs, and total petroleum hydrocarbons (TPHs). Sediment and surface
water in the Carolina bay and wetlands contained USCs comprised of 8 VOCs, 2 SVOCs. 4 pesticides/PCBs, 15
metals, 1 ligand, and diesel range organics (DROs) and TPHs.

A large fraction of the analytical results above detection limits for this report are estimated ("J"-flagged values, with
concentrations below the sample quantitation levels. The majority of sample results that exceed the quantitation
level exceed it by less than an order of magnitude. Therefore, the data set for this investigation contains mainly low-
levels detections of compounds in both soil and groundwater.

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Table 1
USCs for all Media

	Surface Soil (Post IRA)	Subsurface Soil (Post IRA)	Deep Soil (Post IRA)	Ground-water (Pre IRA)	Surface Water (Pre IRA)	Sediment (Pre IRA)
Volatiles						
Acetone	6/14	11/28	13/30	31/75	5/5	
Benzene	2/14	5/28	9/30	2/79	1/5	
Bromomethane				2/79		
Butonone, 2-(MEK)	1/14	4/28	16/30	4/75		
Carbon Disulfide			5/30	9/75		
Carbon Tetrachloride				6/79		
Chlorobenzene	1/14	1/28	1/30	6/79		
Chloroethane				1/79		
Chloroform	1/14	1/28				
Dichloroethane, 1,1-				1/79		
Dichloroethene, 1,2-(total)			5/30		5/5	
Dichloroethene, 1,2-cis				2/218		
Ethylbenzene		1/28	12/30			
Methylene chloride (Dichloromethane)	14/14	28/28	26/30	1/79		
Styrene		1/28	1/30			
tetrachloroethene (PCE)	9/14	16/28		22/223	7/8	
Toluene			19/30		1/5	
Trichloroethene (TCE)	4/14	7/28	5/30	35/223	2/8	
Trichlorofluoromethane				2/48		
Vinyl Chloride (Chloroethene)			1/30	24/223	4/5	
Xylenes		1/28	15/30			
Semivolatiles						

Bis(2-ethylhexyl)phthalate			2/30	3/26
Benzoic acid	2/14	2/28		
Butylbenzylphthalate				
2/8				
Di-n-butyl phthalate			2/30	15/26
2/5				
Dichlorobenzene, 1,2-				1/26
Dichlorobenzene, 1.4-				1/26
Petroleum Indicators				
Diesel range organics				
3/8				
Total petroleum hydrocarbons (purgeable)				1/14
2/8				
(C4-C12)				
Pesticides/PCBs				
Alpha-BHC	1/14	1/28	1/30	3/80
Beta-BHC	1/14	1/28		
DDD, 4,4'-			1/30	
1/8				
DDE, 4,4'-	7/14	12/28	4/30	
DDT, 4,4'-	3/14	8/28	3/30	
1/8				
Delta-BHC			1/30	1/26
Dieldrin		1/28	4/30	
Endosulfan I				
1/8				
Endrin	1/14	1/28	1/30	2/26
Endrin ketone				
1/8				

Table 1 (continued)
USCs for all Media

	Surface Soil (Post IRA)	Subsurface Soil (Post IRA)	Deep Soil (Post IRA)	Ground-water (Pre IRA)	Surface Water (Pre IRA)	Sediment (Pre IRA)
Pesticide/PCBs (continued)						
Gamma-chlordane				1/80		
Heptachlor epoxide				1/26		
Lindane	1/14	1/28				
PCB-1254			1/30			
PCB-1260	3/14	5/28	4/30			
Metals						
Aluminum			1/30	13/29		
2/5						

Antimony				5/30	
1/8					
Arsenic			2/28	9/30	
1/8					
Barium				12/30	
1/5	1/8				
Beryllium				29/30	4/154
Cadmium		5/14	12/28	10/30	3/154
Calcium		2/14	6/28	30/30	15/29
1/8					
Chromium		6/14	13/28	2/30	
2/5					
Cobalt				23/30	7/154
1/5					
Copper		6/14	12/28	13/30	
1/5					
Iron		4/14	3/28		142/54
1/8					
Lead		7/14	22/28	13/30	
3/5					
Magnesium		3/14	7/28	30/30	20/29
Manganese				19/30	42/154
3/8					
Mercury		7/14	14/28	16/30	
Nickel		1/14	3/28	28/30	1/154
1/5					
Potassium			1/28	30/30	7/29
Selenium		6/14	6/28	8/30	
Silver				3/30	15/154
Sodium				22/30	8/29
Thallium		3/14	5/28	2/30	1/29
2/5					
Vanadium		8/14	7/28		2/154
4/5					
Zinc		6/14	8/28	13/30	11/29
1/5	1/8				
Ligands					
Chemical oxygen demand					4/12
Cyanide		1/14	3/28	7/30	
2/5					
Nitrate as nitrogen		10/14	19/28	10/18	
Nitrogen by Kjeldanl method		14/14	28/28	18/18	
pH					3/12
Sulfate		8/14	17/28	10/18	
Total organic carbon					4/4
total Organic Halogens					2/4
Total phosphates as P)		14/14	28/28	18/18	5/12

Note: The numbers on this table reflect the number of samples exceedling the media-specific screening value over the total
number of samples collected.

(Table page 2 of 2)

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Soil

The analytical data indicate that there has been minimal impact to the surface and subsurface soil media [down to 1.2 m (4.0 ft)] from past disposal activity at the D-Area OSB. This conclusion is supported by the historical record for the unit. The trenches that received the waste oils and other debris were constructed to a depth of 1.2 to 3.7 m (4-12 ft), which resulted in waste placement beneath, rather than into, the shallower soils. The wastes were deposited onto the deeper soil, and even into the local groundwater when the water table was close to the surface. The greatest impact is to the deep >1.2 m (>4 ft) soils into which the waste was deposited.

The principal VOC constituents impacting soil quality at the basin are the chlorinated hydrocarbons [tetrachloroethene (PCE), trichloroethene (TCE), 1,2-dichloroethene (1,2-DCE), and vinyl chloride), which probably represent a degradation series starting with the PCE and TCE deposited in the basin with waste oils and grease (Table 1). The aromatic compounds benzene, toluene, ethylbenzene, and xylene (BTEX), which are commonly associated with petroleum products like gasoline, are also found in the vadose zone soils, but appear to be of secondary importance to the chlorinated hydrocarbons. Three other VOCs (acetone, 2-butanone, and methylene chloride) also appear to be related to waste disposal actions in the basin. The metals chromium, iron, lead, mercury and zinc are distributed throughout the D-Area OSB in a fashion similar to the VOCs and appear to have elevated concentrations within the soils of the trenches, primarily below the surface and subsurface soil horizons.

Groundwater

The principal contaminants found to exceed their respective screening levels in the groundwater (MCLs, where they have been established, and 2x mean background, where no MCL exists) are listed on Table 1 and include compounds from all 7 analyte groups, except dioxins/furans. The pattern developed from a review of the data set is generally consistent with a source of contaminants in the basin and with a plume in the groundwater migrating downgradient from the basin to the south and southwest in the uppermost aquifer.

Three chlorinated hydrocarbons (TCE, PCE, and vinyl chloride) were the most common VOCs detected and had the highest concentrations. The uppermost aquifer contaminant plume outlined by these compounds is at least 320 m (1,050 ft) long by 100 m (300 ft) wide and extends vertically from the water table surface down to at least 12 m (40 ft) in depth. The "green clay" occurs at 12 m (40 ft) bis and is expected to provide a barrier against deeper vertical migration of contaminants. The vertical geometry of the TCE plume is typical of dissolved organic compounds in an aquifer with an internal downward vertical gradient. The source area contains the highest concentrations and narrowest lateral extent with concentrations decreasing and the cross-sectional area increasing with distance from the

source. In general, with the exception of a small portion of the aquifer in the immediate vicinity of the former

trenches. VCCs in the groundwater were found at concentrations below 100 µg/l. A small area called the "hot spot", having an approximate diameter of 6 m (20 ft), contained the highest total :oncentrations of TCE (1.151 µg/l) detected during the investigation.

TCE was the compound detected most frequently above the screening levels (Figures 8 to 11). It was found from the water table aquifer down to the "green clay" (Figure 10). TCE was also the compound detected farthest downgradient [8.11 µg/l (micrograms per liter)] 215 m (780 ft) southwest of the basin. Concentrations detected in the samples ranged from non-detect up to 1,151 µg/l, with an average of 8.0 µg/l. These data indicate that this compound is present in groundwater in a volume approximately 365 m (1,200ft) long by 100 m (300 ft) wide and from the water table surface to 12 m (40 ft) in depth.

PCE was the second most frequently detected VOC at concentrations above screening levels. Concentrations of this compound ranged from below the detection limit up to 84.95 µg/l, with an average of 2.1 µg/l. The PCE plume is smaller than and wholly contained within, the TCE plume.

The third most frequently detected VOC above its screening level was vinyl chloride. It was found throughout the same aquifer zones as the two preceding compounds md is a degradation product of them because it was never used at SRS. The concentrations of vinyl chloride ranged from below the detection limit up to 52.0 µg/l, with an average of 1.1 µg/l. Like the PCE plume, the vinyl chloride plume is contained within the TCE plume.

The isomers of DCE were the fourth most frequently detected VOC above screening levels. This compound can be found in groundwater over a volume approximately 260 m (850 ft) long by 100 m (300 ft) wide and from the surface to 12 m (40 ft) in depth. The lateral extent of zhis compound is the smallest of the four most commonly detected VOCs and lies within the TCE plume shown on Figures 8 to 10.

Benzene was detected in only 13 of 97 groundwater samples (16%), with concentrations ranging from non-detect to 6.2 µg/l. Only two of the analyses exceeded the primary MCL (5.0 µg/l). The distribution of this constituent is primarily localized in the shallow portion of the aquifer immediately beneath the basin.

The SVOCs detected in groundwater samples were primarily bis(2-ethylhexyl) phthalate and di-n-butyl phthalate. Because the concentrations of these compounds were lower in the vicinity of the basin, it

appears that the detected
SVOCs do not originate at the D-Area OSB, but may be a result of sampling or analytical bias. Only one of 14
groundwater samples analyzed for DROs/TPHs contained detectable concentrations. and this sample was from the
western-most disturbed soil area. No dioxins/furans were detected in the 26 samples analyzed, and only 5
pesticides/PCBs were detected at concentrations above their MCLs.

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Groundwater samples were analyzed for metals and 22 were detected at least once at concentrations above their quantition limits. Generally, the metal concentrations are low when compared with background and are within an order of magnitude of the screening levels. The exceptions are iron and manganese, which have their maximum concentrations (392.300 µg/l iron and 66,400 µg/l manganese) in the upper portion of the aquifer immediately below the former trenches. Elevated concentrations of these two metals continue to the southwest of the unit.

Surface Water

Surface water was sampled in the wetlands located downgradient of the D-Area OSB. Six VOCs, 1 SVOC, 10 metals, and cyanide were detected at very low or estimated ("J"-qualified) concentrations. The impact of the detected compounds is not significant when compared to background.

Sediment

Sediment at the unit was sampled from the Carolina bay to the west of the basin and from wetlands to the south. The concentrations of all detected compounds were estimated ("J"-qualifiers) or low when compared to background, and there were no apparent patterns to indicate the source for any of the detected constituents.

Fate and Transport Assessment

The conditions at the D-Area OSB appear to be favorable to the natural breakdown of the organic contaminants through the action of the in-situ bacteria population in the subsurface. Evidence of the degradation of contaminants in both the soil and groundwater are shown below:

SOIL	GROUNDWATER
• Elevated carbon dioxide and methane in downgradient soil gas	• depressed dissolved oxygen
• Depressed oxygen in soil gas	• Enhanced mobility of iron and manganese
• Location of the soil gas anomalies in close proximity to the most contaminated location	• Elevated chemical oxygen demand, chloride and sulfate levels downgradient
• Depressed pH levels in contaminated areas	• Depressed pH levels in contaminated areas
• Bacterial "slime" and noxious odors in one sample	• Presence of breakdown products (DCE and vinyl chloride)
• Presence of breakdown products (DCE and vinyl chloride)	

Soil Leachability Analysis

The soil data set was subjected to analysis by the soil screening level (SSL) process and Multimedia Environmental Pollutant Assessment System (MEPAS) computer model runs to evaluate the potential for constituents in the soil to migrate to the groundwater at levels exceedipg their MCLs or risk-based concentrations (RBCs). Twenty-four constituents failed the SSL screening process (7 VOCs, 4 pesticides, and 13 metals) and were considered to be potentially leachable from the soil to the groundwater.

Following the SSL evaluation, two types of MEPAS computer simulations were ccnducted: a unit-wide evaluation for all 20 compounds and a "hot-spot" evaluation of the three constituents (antimony, methylene chloride (dichloromedme), and dieldrin) that failed the unit-wide test. All three of the remaining constituents failed the second series of "hot spot" runs, indicating that they have the potential to leach to the groundwater at concentrations

exceeding the MCL or RBC, even after removing the sources from the most contaminated area of the trench.

After completion of the RFI/RI report, a supplemental calculation for a mass-limited SSL (MLSSL) was completed for methylene chloride. This supplemental calculation raised the target remediation concentration from 1.0 microgram per kilogram (µg/kg) (the SSL) to 41 µg/kg (the MLSSL). This is well below the maximum concentration in the RFI/RI (2,400 µg/kg) but exceeds the current (post-biovent test) sample results (4 µg/kg) by a factor of 10 (WSRC, 1997b, c). The biovent test cycle has been extremely effective in removing methylene chloride from the basin soils.

Groundwater Transport Analysis

The area in the vicinity of the D-Area OSB is currently listed as industrial future land use (DOE, 1996). Therefore, the potential for utilization of the shallow water table aquifer for potable water uses is minimal, and the only valid exposure scenario to unit groundwater is through the discharge of groundwater from the water table aquifer to the Savannah River or Fourmile Branch.

The estimated flow rates in the aquifer beneath the unit indicate that constituents in the groundwater could have traveled up to 2,350 m (7,700 ft) since the unit was opened in 1952, and up to 1,120 m (3,680 ft) since be basin was closed in 1975 (WSRC, 1997a). The fact that the largest Plume in the groundwater (TCE) extends only 365.8 m (1,200 ft) from the source area (1/3 to 1/6 the distance predicted by groundwater flow) indicates that degradation, volatilization, retardation and other factors are working to reduce the impact of the basin disposal practices on the local groundwater.

VI. SUMMARY OF OU RISKS

As part of the D-Area OSB RFI/RI process a BRA was prepared to evaluate the potential risk to human health and the environment from chemical contaminants identified in investigations at the D-Area OSB. The following sections outline the results of the human health risk characterization and the ecological risk characterization. A complete discussion of the risk assessment methodology, receptor analysis, risk characterizations, and uncertainty within the characterizations can be found in the RFI/RI Report and BRA (WSRC, 1997a).

Unit-specific data from the RFI/RI were used to identify and screen constituents Of potential concern (COPCs). Exposure point concentrations were calculated and used to estimate potential exposures and risks to humans and

wildlife. Carcinogenic risks and hazard indices (HIs), based on a combination of exposure scenarios, locations, and receptors identified in the CSM, were calculated and then compared to EPA risk guidelines (i.e., 1E-04 to 1E-06 carcinogenic risk, HI > 1, and Ecological Effects Quotient (EEQ) > 1]. COPCs were selected as preliminary COCs (PCOCs) and designated as primary or secondary COCs, based on their individual contribution to total media risk or hazard.

Human Health Risk Assessment

To evaluate the risk to human receptors due to the contamination at the D-Area OSB, unit-specific analytical data are used to identify COPCs. Exposure point concentrations are determined for each COPC to estimate the potential exposure for various receptors and exposure scenarios. Receptors were selected based on the current land use and two potential future land uses. Receptors include a current known on-unit worker (researchers and samplers), a hypothetical future on-unit industrial worker, and a hypothetical future on-unit resident (Figure 7a). Environmental media evaluated in the BRA include surface soil, excavated/subsurface soil, "hot spot" soil, surface water (wetland), sediment (wetland and Carolina bay), and groundwater (Figure 7b).

Following the selection of human receptors for evaluation, the cancer risk and the noncancer health hazard were estimated for each COPC and for each pathway/receptor combination, based on EPA guidance (EPA, 1989b).

Carcinogenic risk is defined as the incremental probability of an individual developing cancer over a lifetime as a result of pathway-specific exposure to cancer-causing contaminants (carcinogens). The risk to an individual resulting from exposure to non-radioactive chemical carcinogens is expressed as the increased probability of cancer occurring over the course of a 70-year lifetime. At NPL sites incremental cancer risk is compared to the EPA target risk range of one in ten thousand (1E-04) to one in one million (1E-06).

Noncarcinogenic hazards are also evluated to identify a level at which there may be concern for potential noncarcinogenic health effects. The hazard quotient (HQ), which is the ratio of the exposure dose to the reference dose, is calculated for each contaminant. HQs are summed for each exposure pathway to determine the specific HI for each exposure scenario. If the HI exceeds unity (1.0), there is concern that adverse health hazards might exist.

Current Land Use - Carcinogenic Risks

Under the current land use scenario, human health risks were characterized for the current on-unit worker. Estimated

cancer risks from surface soil ingestion, dermal contact, and particular inhalation were less than 1E-06, indicating no concern for carcinogenic health effects (Table 2).

Future Land Use - Carcinogenic Riskss

The hypothetical future on-unit worker scenario has two exposure routes with carcinogenic risks within the target range of 1E-04 to 1E-06 (Table 2). Ingestion of excavated soil has a risk of 1E-06 primarily due to the ingestion of arsenic and PCB-1260, and ingestion of groundwater has an estimated risk of 5E-05 primarily due to the ingestion of beryllium, bis(2-ethylhexyl)phthalate, and vinyl chloride. The risks for the future worker from all other pathways are less than the EPA point of departure (1E-06).

Several pathways for the future on-unit resident have estimated risks within the target range (Table 2). Ingestion of surface soil and excavated soil have risk values of 1E-06 and 1E-05, respectively. The primary contributor to risk for ingestion of surface soil is PCB-1260. The primary contributors to risk for ingestion of excavated soil are arsenic and PCB-1260. Ingestion of leafy, tuberous, and fruit produce grown in excavated soil has estimated risk values of 2E-06, 1E-06, and 3E-06, respectively. The primary contributor to risk for all of these pathways is arsenic. Dermal contact (3E-06) with groundwater and inhalation of VOCs (1E-05) in groundwater during showering also have estimated risks between 1E-06 and 1E-04. The risk for hypothetical residential exposure to groundwater by ingestion (2E-04) is the only pathway to exceed the target risk range. Beryllium, bis(2-ethylhexyl) phthalate and vinyl chloride are the primary contributors to the risks from ingestion and dermal contact, while groundwater inhalation risk is due to 1,1-DCE, cis-1,2-DCE, and vinyl chloride.

Current Land Use - Noncarcinogenic Hazards

The BRA shows that potential adverse noncarcinogenic health effects are not likely to cccur because sum of the HIs for the current on-unit worker scenario do not exceed a value of 1.0 (Table 2).

Future Land Use - Noncarcinogenic Hazards

Noncarcinogenic HIs for the hypothetical future on-unit worker do not exceed 1.0 for any of the pathways evaluated (Table 2).

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The HIs for hypothetical future resident exposures equal or exceed 1.0 for the ingestion of excavated soil and for the ingestion of groundwater (Table 2). The HI for ingestion of excavated soil is slightly greater

than one and is
primarily a result of thallium, iron, and arsenic concentrations. The HI for groundwater ingestion during childhood
is 4 and the HI for groundwater ingestion during childhood through adulthood is 2. These hazards are due primarily
to thallium and manganese.

Total Pathway Risks and Hazard Indices

Carcinogenic risks and noncarcinogenic hazards associated with the individual exposure pathways for surface soil
(0-1 ft), excavated soil (0-4 ft), surface water, sediment and groundwater have been summed to obtain total pathway
risks and HIs for each receptor (worker and resident). The total risk from surface soil (0-1 foot) and excavated soil
(0 4 ft) were summed with the total risk from surface water, sediment, and groundwater for a total risk from all
exposure pathways across all media for each receptor.

The total pathway risk values for the current known on-unit worker, hypothetical future on-unit worker, and
hypothetical future on-unit resident are 6E-09, 5E-05, and 2E-04. respectively. The risk values that exceeded the
EPA point of departure (1E-06) for the future receptors are a result of exposure to constituents in groundwater.

Total pathway HIs exceeded 1.0 for the future on-unit resident. These HIs were 5 [for pathways excluding excavated
soil (0-4 ft)] and 6 [for pathways excluding surface soil (0-1 ft)]. The noncarcinogenic hazards for the future on-unit
resident were a result of exposure to chemicals in groundwater and exposure to arsenic in excavated soil.

Ecological Risk Assessment (ERA)

The purpose of the ERA component of the BRA is to evaluate the likelihood that adverse ecological effects are
occurring or may occur as a result of exposure of biological organisms to unit-specific chemical constituents. The
specific methodology followed in the ERA for the D-Area OSB consists of a two-tiered evaluation. The first tier of
the process is the selection of ecological COPCs through a screening evaluation. Any analytes that fail the screening
are classified as COPCs and are evaluated in the second tier of the process, the ERA. The ERA is based on more
unit-specific and realistic assumptions than the consistently conservative assumptions used in the screening.
Accordingly, the ERA assesses whether COPCs, identified as having a potential to pose ecological risk in a very
conservative screening, are actually likely to pose risk to assessment endpoints under existing or future conditions at
the unit.

COPCs are identified following qualification and evaluation of data, and screening of inorganics against unit-specific
background levels. Unit-specific soil was grouped into exposure groups in three exposure areas: (1) the area of the

former basin, (2) the Carolina bay to the west, and (3) the wetland area to the south. Soil data from a depth of 0-0.3 m (0-1 ft) are used to estimate COPC exposure point concentrations under current land use conditions at the basin. Subsurface soil samples from a depth of 0-1.3 m (0-4 ft) are used to evaluate future risk, under the assumption of future excavation activity in the basin area associated with a hypothetical future human residential land use scenario. Groundwater data collected at the unit are evaluated under the future scenario by conservatively assuming that current groundwater concentrations of COPCs will discharge to surface water without attenuation or dilution. Sediment data from the Carolina bay and the wetland and surface water data from the wetland are assumed to remain unchanged under future conditions.

Exposure point concentrations for COPC selection are based on the maximum detected concentration for each exposure group. Exposure point concentrations for the ERA are based on the RME concentration, the highest concentration to which a receptor may reasonably be exposed. In selecting COPCs, those analytes that pass toxicity, background, and frequency of detection screenings but have an aquatic bioconcentration factor greater than 300 are re-included as COPCs due to their potential to pose risk through bioaccumulation and/or biomagnification.

The ecological study area at the D-Area OSB includes a variety of habitats, both terrestrial and wetland. No known endangered, threatened, or special concern species exist in the study area. The basin area has been highly impacted physically by previous activities at the unit, and the habitat (mowed field) is low in diversity and productivity. Areas adjacent to the unit include a mesic pine/hardwood forest, a Carolina bay wetland, and a blackgum/sweetgum wetland.

Following the identification of ecological COPCs and the characterization of the ecological communities of the study area, ecological assessment endpoints are selected so as to determine whether relevant policy goals (protection of the environment under CERCLA and protection of wetland surface waters under the Clean Water Act) are being attained at the OU. Ecological risk from unit-specific COPCs is assessed on the basis of the potenital for adverse effects on the assessment endpoints: (1) survival and reproduction of terrestrial wildlife populations at the unit, including herbivores and predators, and (2) survival and reproduction of populations of aquatic species

and of terrestrial
wildlife species that prey on aquatic species in the wetland near the unit. Effects on assessment endpoints are
predicted from measurement endpoints (e.g., levels of COPCs that have been shown to produce toxic effects in
animal studies). Decision rules by which the potential for effects on assessment endpoints are decided are stated in
terms of the measurement endpoints and are based on the calculation of HQs.

In order to evaluate potential effects on the assessment endpoints, multiple ecological receptor species are chosen to
represent the multiple trophic levels of the ecological communities present within the study area. The receptors
evaluated include: (1) aquatic organisms directly exposed to surface water and sediment; (2) a herbivorous rodent

(meadow vole) directly exposed to soil, sediment, and surface water, as well as biotic uptake of COPCs: and (3)
predators (mink and green-backed heron) that are directly exposed to environmental media as well as to
bioaccumulative COPCs in the food chain.

Risks to each of these receptors from the exposure groups at the OU are estimated on the basis of calculated HQs.
COPCs with an HQ greater than one are designated as PCOCs. Risk is estimated for both current conditions and
hypothetical future conditions (i.e., assuming wildlife exposures to subsurface soil that may be excavated, and
assuming exposure of aquatic organisms to current groundwater concentrations of COPCs). PCOCs are individually
evaluated based on their chemical and toxicological characteristics and the uncertainty associated with their HQ
value. Those PCOCs that are estimated to have a significant potential to cause adverse ecological effects are
summarized for each combination of exposure area, receptor, and medium. This subset of COPCs is further
evaluated based on uncertainty in the risk assessment, confidence in the risk estimates, and the ecological
significance of the risk estimated to be posed by these PCOCs. This evaluation of ecological significance ultimately
determines whether each PCOC actually poses significant ecological risk and warrants designation as a final COC.

The ecological receptors identified as having a significant potential for toxicological effects at the D-Area OSB are
aquatic, semi-aquatic, and benthic organisms living in the Carolina bay and the wetland. The

community of
aquatic/semi-aquatic organisms that can be supported by the Carolina bay is inherently restricted in diversity and
abundance of organisms due to the intermittent character of the inundation of the bay and its hydrological isolation.
The ERA found that there may be significant potential for adverse effects from DRO on the more sensitive members
of the aquatic community during chronic, long-term exposures. However, such exposures are unlikely due to the
frequent dry periods during which the aquatic animal community is essentially absent. DRO at the concentrations
detected in sediment is unlikely to significantly affect populations of aquatic species at the Carolina bay, therefore,
the ecological risk posed by DRO is considered insignificant, and it is not a final COC.

The aquatic community in the arm of the wetland that extends to the south of the OU also is subject to intermittent
desiccation, though it appears to be a more diverse and productive community than that of the Carolina bay. A
potential for adverse ecological effects on this community is indiciced by the measured concentrations of aluminum
and barium in surface water and of DRO and TPH in sediment. Chronic exposure of aquatic organisms (e.g.,
invertebrates, fish, and amphibians) to these contaminants at RME levels could reduce reproduction and/or increase
mortality among sensitive individuals sufficiently to cause a reduction in population size. However, if such effects
are limited to the small area evaluated, the larger ecological community of the wetland system is unlikely to
experience significant effects, such as a loss of species. Therefore, aluminum and barium in surface water and DRO
and TPH in sediment of the wetland are unlikely to pose significant ecological risk to the wetland assessment
endpoint (the biodiversity of the aquatic community), and they are not considered to be ecological final COCs.

In summary, the assessment of ecological risk at the D-Area OSB indicates that the COPCs and environmental media
in the exposure areas evaluated do not pose significant risk to ecological assessment endpoints, and policy goals for
the OU are achieved under baseline conditions. There is essentially no likelihood of unit-specific chemicals causing
significant impacts to the community of species in the vicinity of the unit. Based on their toxicity at their current
concentration, none of the COPCs identified in soil, sediment, or surface water at the D-Area OSB are estimated to
pose significant ecological risk.

COCS

PCOCs, which include primary and secondary COCs, were selected for the D-Area OSB because they exceed ARARs, because they exceed risk-based criteria in the BRA, or because they are projected to have the potential to leach to the groundwater at levels exceeding an MCL or RBC. Primary COCs are defined in the human health risk assessment as constituents that contribute a chemical-specific risk of more than 1E-06 or an HQ of greater than 0.1 to any media risk estimate that exceeds a 1E-04 risk or an HI of 3. Secondary COCs are defined as those constituents in each medium contributing a chemical-specific risk greater than 1E-06 or an HQ of at least 0.1 to a media with a risk greater than 1E-06, but not more than 1E-04 or an HI of one or greater, but not more than three. Table 3 lists all PCOCs and the basis for their qualification as PCOCs.

The final risk-based COCs are presented by potential receptor scenario, pathway, and exposure route in Figures 12 through 16.

Final COCs were selected from the PCOCs by evaluating the uncertainty associated with each chemical during each phase of the RFI/RI/BRA (Table 4). Eight groundwater PCOCs [1,1-DCE; cis-1,2-DCE; total 1,2-DCE; benzene; dichloromethane (methylene chloride); PCE; TCE, and vinyl chloride] were judged to be USCs and, therefore, final COCs. One soil PCOC [dichloromethane (methylene chloride)] was judged to be a USC and, therefore, a final COC

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Table 4

Uncertainty Matrix for COCs

CATEGORY UNCERTAINTY LEVELS *

Constituent Name	Unit	Background	Analytical	Unit-Related toxicity	Risk	Exceeds	Overall	Retain as

	Level of Assessment	Final ARAR?	Uncertainty	COC?	History	Comparison	Distribution		
Groundwater COCs									
Antimony	high	high	high	no	high	LOW	high	high	high
Benzene	high	LOW	LOW	YES	LOW	LOW	LOW	LOW	LOW
Beryllium	LOW	high	high	no	high	high	LOW	high	LOW
Bis(2-ethylhexyl)phthalate	LOW	LOW	high	no	high	LOW	LOW	high	LOW
Dichloroethene, (cis-) 1,2-	LOW	LOW	LOW	YES	LOW	LOW	LOW	LOW	LOW
Dichloroethene, (mixed-)1,2-	LOW	LOW	LOW	YES	LOW	LOW	LOW	LOW	LOW
Dichloroethene, 1,1-	LOW	LOW	LOW	YES	LOW	LOW	LOW	LOW	high
Dichloromethane (methylene chloride)	high	LOW	LOW	YES	high	LOW	high	LOW	LOW
Iron	high	high	high	no	high	LOW	LOW	LOW	high
Manganese	high	high	high	no	high	LOW	LOW	LOW	high
Tetrachloroethene	LOW	LOW	LOW	YES	LOW	LOW	LOW	LOW	LOW
Thallium	LOW	LOW	high	no	high	LOW	high	high	high
Trichloroethene	high	LOW	LOW	YES	LOW	LOW	LOW	LOW	high
Vinyl chloride	LOW	LOW	LOW	YES	LOW	LOW	LOW	LOW	LOW
Soil COCS									
Antimony	NA	high	high	no	high	high	high	LOW	NA
Arsenic	high	high	high	no	high	high	high	high	LOW
Dichloromethane (methylene chloride)	NA	high	LOW	YES	LOW	LOW	LOW	LOW	NA
Dieldrin	NA	high	high	no	high	high	high	high	NA
Iron	high	high	high	no	high	LOW	LOW	LOW	high
PCB-1260	high	high	high	no	unknown	LOW	LOW	high	high
Thallium	high	high	high	no	high	high	LOW	high	high

• Uncertainty = "LOW" indicates that this analyte could be a final COC based solely on the indicated category.
• Uncertainty = "high" indicates that this analyte could not be a final COC based solely on the indicated category.
NA = Category does not apply because this compound was added to this list based on its potential to leach to groundwater.

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Record of Decision for the
WSRC-RC-97-403
D-Area Oil Seepage Basin (631-G) (U)
Revision 1, Final
Savannah River Site
August 1998

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Record of Decision for the
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VII. RAOS AND DESCRIPTION OF CONSIDERED ALTERNATIVES FOR THE D-AREA OSB OU

RAOs

RAOs address unit-specific contaminants, media of concern, potential exposure pathways, and

remediation goals.
The RAOs are based on the nature and extent of contamination, threatened resources, and the potential for human
and environmental exposure. Initially, preliminary remediation goals are developed based upon ARARs or other
information from the RFI/RI Report and BRA. These goals should be modified, as necessary, as more information
concerning the unit and potential remedial technologies becomes available. Final remediation goals will be
determined when the remedy is selected and shall establish acceptable exposure levels protective of human health
and the environment.

ARARs are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations
promulgated under federal, state, or local environmental law that specifically address a hazardous substance,
pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. The following three
types of ARARs have been developed to simplify identification and compliance with environmental requirements:

- Action-specific requirements - set controls on the design, performance, and other aspects of implementation of
  specific remedial activities.

- Chemical-specific requirements - are media-specific and health-based concentration limits developed for site-
  specific levels of constituents in specific media. There are two general sources of chemical-specific RGOs: (1)
  concentrations based on ARARs, and (2) concentrations based on risk.

- Location-specific requirements must consider federal, state, and local requirements that reflect the
  physiographical and environmental characteristics of the unit or the immediate area.

Action-specific and location-specific ARARs are addressed as part of the remedial alternatives developed for the
D-Area OSB groundwater. Only MCLs (as identified in South Carolina R.61-58.5 State Primary Drinking Water
Regulations and Federal 40 Code of Federal Regulations (CFR) 141 National Primary Drinking Water Regulations)
have been identified as chemical-specific ARARs. The groundwater is not a current source of drinking water:
however, all groundwater in South Carolina is classified as GB under South Carolina R.61-68 Water Classification
and Standards and, as such, is required to be addressed in some manner (State of South Carolina groundwaters must
undergo active remediation to achieve MCLs unless a groundwater mixing zone (GWMZ) is granted). MCLs will be
the clean-up standard for groundwater contaminants.

The RFI/RI and BRA identified the following COCs for groundwater at the D-Area OSB: PCE; TCE; 1,1-DCE;
1,2-DCE; cis-1,2-DCE; vinyl chloride; benzene; and methylene chloride.

Two of these contaminants (1,1-DCE and 1,2-DCE) became COCs based on risk calculations. However, neither 1,1-
DCE nor 1,2-DCE were detected in the D-Area OSB groundwater at concentrations exceeding their respective
MCLs. MCLs are drinking water standards developed to be protective of human health and obtainable by current
treatment methods. Because these contaminants do not exceed the levels determined to be protective of human
health and safe for drinking water purposes, l,l-DCE and 1,2-DCE will not be addressed in D-Area OSB
groundwater remediation. However, the remedial alternatives developed for the D-Area OSB groundwater include
roundwater monitoring of VOCs (with the exception of no action) that will be inclusive of 1,1-DCE and 1,2-DCE.
These VOCs are degradation products of TCE and require evaluation during remediation.

The primary chemical-specific ARAR for soil is an EPA SSL for methylene chloride (EPA, 1994). The screening
level limits the concentration of methylene chloride in soil to 1.0 µg/kg based on its potential to leach to
groundwater. A second screening level, the MLSSL (EPA, 1996), has been calculated to be 41 µg/kg based on unit
specific conditions. Following biovent testing, methylene chloride concentrations were below the MLSSL of 41
µg/kg. Therefore, because methylene chloride concentrations in the soil have been reduced to levels that cannot
leach to the groundwater above the MCL (WSRC, 1998a) remediation of deep soils is not warranted and it is not
addressed further in this document.

Based on ARARs and BRA results, the RAOs developed for the groundwater at the D-Area OSB OU are to:

- reduce risks to human health associated with dermal contact and ingestion of groundwater, and inhalation of groundwater vapor

- restore groundwater to achieve ARARs and RGOs

RGOs for groundwater COCs will be equivalent to their respective MCL values. The groundwater contaminants that
will be addressed at the D-Area OSB and their corresponding MCLs are provided in Table 5.

At the close of the IRA, the contractor installed two horizontally oriented, perforated pipes along the length of the
former waste unit for treatability (biovent) study purposes. These pipes were used to force fresh air, nutrients and
tracers into the soils at a depth of about 8 ft in order to volatilize the constituents in the soil, enhance the aerobic
degradation of the constituents in both the soil and groundwater, and monitor the effectiveness of a potential soil
treatment program (WSRC, 1997b, c, d, e).

Table 5

Final COCs, with Selected RGOs

FINAL COCs	Basis for Becoming Final COC: Excess Risk	Excess Hazard	Leach to GW	Exceeds MCL	Maximum Concentration Detected (µg/l)	Average Concentration in Groundwater (µg/l)	Selected RGO	Basis for RGO
Tetrachloroethene	X			X	85	2.1	5.0	MCL
Trichloroethene				X	1151	8.0	5.0	MCL
cis-1,2-Dichloroethene				X	457	4.88	70.0	MCL
total-1,2-Dichloroethene	X	X			68.6	21.24	70.0	MCL
1,1-Dichloroethene	X				0.84	0.399	7.0	MCL
Vinyl Chloride	X			X	52	1.1	2.0	MCL
Benzene				X	6.2	0.22	5.0	MCL
Dichloromethane (Methylene Chloride)			X	X	9.5	0.16	5.0	MCL

Secondary Source Alternatives

As part of the investigation/assessment process for the D-Area OSB waste unit, a CMS/FS was performed using data generated during the assessment phase. Detailed information regarding the development and evaluation of remedial alternatives can be found in the Corrective Measures Study/Feasibility Study for the D-Area Oil Seepage Basin (631-G) (U) (WSRC, 1998a). The RFI/RI and BRA indicate that D-Area OSB groundwater poses a risk to human

health. Risk associated with ingestion, dermal contact, and inhalation of groundwater for the future on-unit worker
and resident result in risk greater than the EPA's target risk range for future use scenarios. Therefore, a CMS/FS was
conducted, which includes detailed analyses and groundwater alternatives. Concerning other environmental media,
the no further action alternative was selected for soil, and no action is required for surface water and sediment.

Remedial alternatives were not developed for soil, surface water, or sediment at the unit. Remediation of these
media is not warranted based on the evaluation of federal and state standards and the risk assessment. As discussed
above, the interim action and the biovent test cycle performed on unit soil adequately eliminated the source of
groundwater contamination. Six alternatives were evaluated for remedial action of the D-Area OSB OU
groundwater. Each alternative is described below.

Alternative GW-1 - No Action

Under this alternative, no remedial efforts would be conducted to remove, treat, or otherwise reduce the toxicity,
mobility, or affected volume of contaminated media. An IRA and biovent test have been conducted for unit soils.
These reduced contaminant concentrations to acceptable levels. Biovent testing appears to have also reduced
groundwater contaminant concentrations in the vicinity of the testing. However, under the no-action alternative, no
further remedial efforts would be made to monitor or treat unit groundwater.

The semi-confining unit ("tan clay") lying within the uppermost, water table aquifer is not continuous and has not
prevented contaminant migration. However, the next confining layer ("green clay") provides an adequate barrier,
which prevents the migration of COCs to lower aquifers (Figure 10). Additionally, modeling results indicate that
under most scenarios, contaminant plumes have already largely reached their maximum extent downgradient and will
not migrate significantly further. Therefore, both the horizontal and vertical migration of contaminants appears to
have largely stopped. However, the no-action alternative would not provide a mechanism to monitor the migration
of contaminants in the future and confirm that further migration is not occurring. Additionally, the no-action
alternative would not guarantee that access to contaminated groundwater would be restricted.

If no action were implemented, no action would be taken to reduce or monitor contaminant concentrations.
Transport modeling of the D-Area OSB DCE, PCE, TCE, and vinyl chloride contaminant plumes indicates that

without degradation concentrations would be reduced to below MCLs within 35 years. (Model runs that included degradation indicated that the maximum time required for contaminants to reach their MCLs was only approximately 10 years.) For the purpose of cost estimating, the maximum length of time to be evaluated is 30 years, as determined by EPA guidance. Therefore, the cost of this alternative would include a review of remedy every five years for 30 years and would total S278,000.

Alternative GW-2 - Natural Attenuation/GWMZ with Institutional Controls

Under this alternative, natural subsurface processes, such as flushing, volatilization, biodegradation, adsorption, and chemical reaction with subsurface materials, would be allowed to continue to reduce contaminant concentrations in the groundwater to acceptable levels. A GWMZ application has been approved by the SCDHEC under South Carolina Regulations R.61-68 as part of this alternative. This GWMZ creates a specific area at the unit that would be required to meet mixing zone concentration limits (MZCLs) at plume monitoring wells. Downgradient compliance boundary wells would be installed. Groundwater at this compliance boundary would be required to meet RGOs (equivalent to MCLs). Between the compliance boundary wells and the plume wells, intermediate wells will be monitored and compared to concentrations predicted by the fate and transport models. The well locations for the approved GWMZ are illustrated in Figure 17. In addition to groundwater monitoring, institutional controls will be maintained to restrict access to groundwater until RGOs are met in all areas of the plume. Institutional controls would include:

- controlled access to SRS through existing security gates and perimeter fences
- signs posted in the area to indicate that groundwater in the vicinity of the unit has been contaminated by hazardous materials

- deed notification to any future landowner of groundwater contamination, as required under CERCLA Section 120(h)

Although institutional controls are inclusive of the alternatives (except the no-action alternative), the DOE has recommended that residential use of SRS land in the vicinity of D Area be prohibited (DOE, 1996); therefore, future residential use and potential residential water usage in this area is unlikely. Modeling of groundwater alternatives, indicates that MCLs for the contaminants of concern will be met in the D-Area OSB groundwater in approximately 10 years. Upon confirmation that RGOs have been achieved, neither the institutional controls at the unit nor the 5-year ROD reviews will be required any longer.

Natural attenuation could effectively treat D-Area OSB groundwater. Results from bioventing testing indicate that the source of groundwater contamination (the D-Area OSB soil) is abated and no longer contributes to groundwater

contamination. Evidence presented in the RFI/RI and BRA indicated that natural degradation is occurring in D-Area OSB groundwater. Herbert et al., 1984, report that natural attenuation can be selected as a preferred remedial option when the following site-specific conditions exist:

- Groundwater is unsuitable for consumptive use.
- Contaminants degrade quickly or are not at highly toxic concentrations.
- There is low potential for exposure.
- Active restoration is not feasible due to complex hydrogeologic conditions.
- There is low projected demand for future groundwater use.
- The unit is in close proximity to a surface water discharge area, with dilution to levels that are protective of human health and the environment.

The RFI/RI conducted at the D-Area OSB revealed the following:

- The source of contamination at the D-Area OSB was removed during IRA in conjunction with the biovent testing and no longer contributes to groundwater contamination.
- Naturally occurring mechanisms will continue to reduce contaminant concentrations.
- There are no receptors of groundwater at the D-Area OSB; therefore, there is low potential for exposure.
- The aquifer is limited in thickness and yield and is not targeted for residential or commercial use; therefore, projected demand for future groundwater use is low.
- Modeling indicates that contaminant concentrations in the D-Area OSB groundwater would be reduced to below MCLs prior to discharging to Fourmile Branch; therefore dilution in the surface water body is not necessary to achieve MCLs.

Based on this information the contaminants in the D-Area OSB would be conducive to natural attenuation.

Howard (1990) reports that the half-lives for PCE range from one to two years, for TCE range from 1.5 months to 4.5 years, for cis-1,2-DCE range from eight weeks to eight years, for vinyl chloride range from eight weeks to eight years, and for methylene chloride range from 14 days to eight weeks. The groundwater modeling effort utilized contaminant degradation rates from the higher limit (slower degradation) of the range of half-lives for each contaminant. Therefore, degradation times in the model output were conservatively estimated to be longer than expected in the field. These model results indicate that all contaminants should be below their respective MCLs within approximately 10 years. The primary conclusions of the groundwater modeling effort include the following:

1. Degradation is more effective at removing contaminant mass than the simulated extraction wells.

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2. None of the contaminants simulated (DCE, TCE, PCE, and vinyl chloride) ever reached Fourmile Branch.
regardless of the modeled scenario.

3. Model runs that included degradation indicated that the maximum time required for contaminants to reach
MCLs was approximately 10 years.

4. Under most scenarios modeled (pumping, non-pumping, degradation, and no degradation), plumes do not
migrate beyond their current extent.

According to the Ground-Water Mixing Zone Guidance Document (SCDHEC, 1997), a GWMZ application must
demonstrate that the unit will meet the following four criteria:

1. "reasonable measures have been taken or binding commitments are made to minimize the addition of
contaminants to groundwater and/or control the migration of contaminants in groundwater";

2. "the groundwater in question is confined to a shallow geologic unit that has little or no potential of being an
Underground Source of Drinking Water, and discharges or will discharge to surface waters without contravening
the surface water standards set forth in this regulation";

3. "the contaminant(s) in question occurs on the property of the applicant, and there is minimum possibility for
groundwater withdrawals (present or future) to create drawdown such that contaminants would flow off-site";

4. "the contaminants or combination of contaminants in question are not dangerously toxic, mobile, or persistent."

A GWMZ application has been approved by the SCDHEC that demonstrates how D-Area OSB meets these

four
criteria. Based on area characteristics and evidence presented in the GWMZ Application, a GWMZ for the D-Area
OSB is an appropriate part of natural attenuation remedies.

Based on data from monitoring wells around the D-Area OSB and groundwater transport modeling (WSRC, 1997b,
Appendix B), remedial goal objectives will be met and MCLs will not be exceeded beyond the GWMZ. This
alternative will reduce the risks associated with groundwater ingestion, dermal contact, and inhalation by ensuring
that through natural GWMZ processes, the nearest groundwater receptor is not exposed to groundwater contaminated
above MCLs.

Capital costs associated with natural attenuation would include the installation of nine new monitoring wells. Wells
would be sampled quarterly the first year and semiannually thereafter. Operation and maintenance costs would
include groundwater monitoring, maintenance of institutional controls, and a review of remedy every five years until
contaminant concentrations are reduced to below their MCLs within the mixing zone. Transport modeling of DCE,
PCE, TCE, and vinyl chloride indicates that this will be achieved in approximately 10 years. The total estimated
cost associated with natural attenuation is $391,000.

Alternative GW-3 - Bioremediation with Institutional Controls

Under this alternative, groundwater would be extracted from the leading edge of the plume, oxygen and other
nutrients would be added, and then the supplemented water would be injected back into the plume area via injection
wells. Institutional controls would be maintained as part of this alternative to prohibit access to unit groundwater
(i.e., SRS security, sign posting, and deed notifications). Groundwater monitoring would also be conducted to
monitor contaminant concentrations and any migration.

This alternative would utilize the same natural processes as natural attenuation, discussed in the previous subsection.
Bioremediation would involve the injection of oxygen and nutrients into the subsurface, which should expedite
natural biodegradation processes. Based on unit conditions and modeling results, bioremediation could effectively
reduce contaminant concentrations in less than ten years.

Following addition of nutrients and oxygen, groundwater would be injected into the aquifer. Injection would require
a variance to inject water exceeding MCLs.

Components of Alternative GW-3 include installation of new monitoring wells, a groundwater

extraction system, an
oxygen/nutrient addition system, and wells through which the treated groundwater would be reinjected. Operation
and maintenance costs associated with this alternative would include nutrients, operation, and groundwater
monitoring (quarterly the first year and semiannually thereafter). It is estimated that this remedy will take less than
ten years to reach MCLs. A review of remedy would be required at five and ten years. Estimated costs associated
with Alternative GW-3 total $1,102,000.

Alternative GW-4a - Air Sparging Hot Spot Areas/GWMZ with Institutional Controls

Alternative GW-4a includes air sparging at the hot spot areas within the contaminant plume. COC concentrations in
the hot spot areas would reduce rapidly, allowing natural subsurface processes, such as flushing, volatilization,
biodegradation, adsorption, and chemical reaction with subsurface materials to reduce contaminant concentrations in
the remaining contaminant plume. Based on physical properties of unit contaminants, air sparging would provide

effective treatment. A GWMZ would be applied for under South Carolina Regulations R.61-68 as part of this
alternative. This would create a specific area at the unit that would be required to meet MZCLs at plume monitoring
wells. Downgradient compliance wells would be installed. Groundwater at this compliance boundary would be
required to meet RGOs (equivalent to MCLs). Between the compliance boundary wells and the plume wells,
intermediate wells will be monitored and compared to concentrations predicted by the fate and transport models.
Vadose zone soils and groundwater would be monitored to determine contaminant removal rates. Institutional
controls to restrict access to unit groundwater would be maintained as a component of Alternative GW-4a (i.e., SRS
security, sign posting, and deed notifications). Groundwater contaminant concentrations would also be monitored to
ensure that concentrations decrease as a result of treatment and contaminants do not migrate.

Costs associated with Alternative GW-4a include the labor and materials needed to construct the sparging system.
Also included in the costs is operation and maintenance of the system and a remedy review every five years until
clean-up levels are met. It is estimated that contaminant concentrations would be sufficiently reduced through air
sparging in less than 10 years. Operation and maintenance would include air, soil, and groundwater monitoring, and
operation. Groundwater would be sampled quarterly the first year and semiannually thereafter. Estimated costs
associated with Alternative GW-4a total $1,080,000.

Alternative GW-4b - Air Sparging with Institutional Controls

Air sparging would involve the injection of air into a series of wells in the area of the groundwater plume. The air would migrate upward through the aquifer in the form of bubbles. The air would volatilize VOCs and carry them up through and out of the aquifer, through the vadose zone, and into the atmosphere where they could be degraded (e.g., by photolysis). Vadose zone soils, as well as groundwater, would be monitored to determine contaminant removal rates. Nine additional monitoring wells would be installed as part of this alternative to monitor contaminant concentrations in groundwater. Institutional controls would be maintained to prevent access to unit groundwater. Based on physical properties of unit contaminants, air sparging would provide effective treatment.

Costs associated with Alternative GW-4b include the labor and materials needed to construct the sparging system. Also included in the costs is operation and maintenance of the system and a remedy review every five years until clean-up levels are met. It is estimated that contaminant concentrations would be sufficiently reduced through air sparging in less than 10 years. Operation and maintenance would include air, soil, and groundwater monitoring, and operation. Groundwater would be sampled quarterly the first year and semiannually thereafter. Estimated costs associated with Alternative GW-4b total $1,144,000.

Alternative GW-5 - Extraction/Stripping/Discharge with Institutional Controls

This alternative would generally require three components: an extraction system, a treatment system, and a discharge system. Institutional controls and groundwater monitoring would also be implemented and maintained as a component of this alternative.

Extraction System

Contaminated groundwater would be extracted using either extraction wells or interceptor trenches. For purposes of this document, extraction wells will be considered the preferred extraction technique. Selection of the appropriate extraction system would be determined during Corrective Measures/Remedial Design. The objective of extraction would be to capture groundwater contaminants. Based on groundwater quality data from the RI, contaminants are limited to the upper two aquifers, which are both located above the "green clay" confining unit (Figure 10). An extraction system would, therefore, have wells that are screened in the upper two aquifers.

Modeling of groundwater extraction indicated that two extraction wells would be necessary downgradient of the

plume. The extraction well located in the upper aquifer would be pumped at approximately 3 gallons per minute and the lower well would be pumped at approximately 2 gallons per minute. As part of this alternative, new monitoring wells would be installed to confirm reduction in concentrations of contaminants.

Groundwater extraction has been proven effective in containing groundwater plumes. Based on the high hydraulic conductivity in the impacted area of the aquifer, extraction wells would be effective at this unit. Modeling indicates that clean-up levels could be reached in 9 years (with degradation) to 25 years (without degradation).

Air Stripping

Air stripping is a physical process in which volatile compounds in groundwater are transferred to an air stream, typically using a packed tower. Compounds with a Henry's Law Coefficient (H c) greater than 0.01 are readily stripped. 1,2-DCE (cis and trans), methylene chloride, PCE, TCE, and vinyl chloride have H cs of 0.29, 0.13, 1.08. 0.38, and 3.4, respectively. Therefore, DCE, methylene chloride, PCE, TCE, and vinyl chloride would be effectively removed through air stripping. Air stripping would effectively treat contaminated groundwater at the D-Area OSB.

Discharge

Under this alternative, treated groundwater would be discharged to an existing National Pollutant Discharge Elimination System (NPDES) permitted outfall or to infiltration galleries. For purposes of this document, it is assumed that treated groundwater would be discharged at the nearest existing NPDES outfall. Selection of the preferred discharge option would be conducted during Corrective Measures/Remedial Design.

An NPDES permit places a restriction or effluent limitation on the quantities, discharge rates, and/or concentrations of pollutants that may be discharged into surface waters. Therefore, the effluent limitations specified in the existing NPDES permit would determine the type and extent of treatment required prior to a discharge.

Costs associated with this alternative would include the labor and materials needed to construct new monitoring wells, an extraction system (assumed extraction wells), an air stripping system, a discharge line to the NPDES outfall, and modification of an existing NPDES permit. Operation and maintenance costs for the system include operation of the system, groundwater monitoring, maintenance of institutional controls, and a remedy review at five years, which is the estimated time required to meet RAOs. The estimated costs associated with this alternative total

$1,309,000.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF THE ALTERNATIVES

Each of the remedial alternatives was evaluated using the nine criteria established by the NCP [40 CFR § 300.430 (e)
(9)]. The criteria were derived from the statutory requirements of CERCLA Section 121, to provide the basis for
evaluating alternatives and selecting a remedy. The nine criteria are listed below:

- overall protection of human health and the environment
- compliance with ARARs
- long-term effectiveness and permanence
- reduction of toxicity, mobility, or volume through treatment
- short-term effectiveness
- implementability
- cost
- state acceptance
- community acceptance

In selecting the preferred alternative, the above mentioned criteria were used to evaluate the alternatives developed
in the Corrective Measures Study/Feasibility Study for the D-Area Oil Seepage Basin (631-G) (U) (WSRC, 1998a).
Seven of the criteria are used to evaluate all the alternatives based on human health and environmental protection,
cost, and feasibility issues. The preferred alternative is further evaluated based on the final two criteria: state
acceptance and community acceptance. The comparative analysis for the five groundwater alternatives, using the
first seven criteria, is presented in Table 6. Brief descriptions of the nine criteria are provided below, followed by a
brief comparison of soil and groundwater alternatives based on the criteria.

Table 6
Comparative Analysis of Groundwater Alternatives

Alternative	Alternative GW-1	Alternative GW-2	Alternative GW-3	Alternative GW-4a	Alternative GW-4b	Alternative GW-5
Criterion	No Action	Natural Attenuation/GW Mixing Zone with Institutional Controls	Extraction/Air Stripping/ Discharge with Institutional Controls	Air Sparging Hot Spots/GW Mixing Zone with Institutional Controls	Air Sparging with Institutional Controls	Bioremediation with Institutional Controls

Overall Protection of Human and the Environment

Human Health Protective

Not protective without existing institutional controls and groundwater monitoring

Protective

Protective

Protective

Protective

Environment Protective

Protective

Protective

Protective

Protective

Compliance with ARARs

Chemical-Specific Will meet MCLs following treatment

Does not meet MCLs

Will meet MCLs following treatment

Will meet MCLs following treatment

Will meet MCLs following treatment

Will meet MCLs following treatment

Location-Specific Wetland Protection

Not applicable

Wetland Protection

Wetland Protection

Wetland Protection

Wetland Protection

Action-Specific State air requirements; MZCLs will be met at intermediate wells and MCLs at compliance boundary wells

Not applicable

State air requirements

Will meet MCLs at intermediate wells and MCLs at compliance boundary wells

State air requirements

NPDES modification

Variance required to inject waters exceeding MCLs

Long-Term Effectiveness and Permanence

Magnitude of Residual Risks Contaminants would be removed; minimal residual risk

Residual risk Contaminants would remain uncontrolled minimal residual risk

Contaminants would be removed; minimal residual risk

Contaminants would be removed; minimal residual risk

Contaminants would be removed; minimal residual risk

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Table 6
Comparative Analysis of Groundwater Alternatives

Alternative GW-4a	Alternative GW-1	Alternative GW-2	Alternative GW-3	Alternative GW-4b
Criterion	No Action	Natural Attenuation/GW Mixing Zone with Institutional Controls	Extraction/Air Stripping/ Discharge with Institutional Controls	Bioremediation with Institutional Controls
Adequacy of Institutional Controls	No controls would be provided	Institutional Controls and groundwater monitoring	Institutional Controls, groundwater monitoring, process controls, and conventional equipment requiring maintenance	Institutional Controls, groundwater monitoring, process controls, and conventional equipment requiring maintenance
Reduction of Toxicity, Mobility, or Volume through Treatment				
Toxicity	No active treatment	Reduced by natural attenuation; no active treatment	Reduced by Reduced by extraction and	Reduced by biodegradation
Mobility	No active treatment	Reduced by natural attenuation; no active treatment	Reduced by Reduced by extraction and	Reduced by biodegradation
Short-Term Effectiveness				
Risk to Remedial Workers	None	Minimal; workers protected under health and safety plan	Minimal; workers protected under health and safety plan	Minimal; workers protected under health and safety plan

Table 6
Comparative Analysis of Groundwater Alternatives

Alternative	Alternative GW-1 No Action	Alternative GW-2 Natural Attenuation/GW Mixing Zone with Institutional Controls	Alternative GW-3 Bioremediation with Institutional Controls	Alternative GW-4a Air Sparging Hot Spots/GW Mixing Zone with Institutional Controls	Alternative GW-4b Air Sparging with Institutional Controls	Alternative GW-5 Extraction/Air Stripping/ Discharge with Institutional Controls
Risk to Community	None	None	None	Minimal risk from air emissions	Minimal risk from air emissions	Minimal risk from air emissions
Risk to Environment	None	Minimal; precautions would be taken	Minimal; precautions would be taken	Minimal; precautions would be taken	Minimal; precautions would be taken	Minimal; precautions would be taken
Time to Achieve	35 years	10 years	Less than 10 years	Less than 10 years	Less than 10 years	9 years
Implementability						
Ability to Construct and Operate	No implementation required	Readily Implemented	Readily constructed, but effectiveness during operation limited	Readily implemented	Readily implemented	Readily implemented
Ability to Obtain Approval	May cause regulatory or public concern	No concerns	May be difficult to obtain approval for reinjection	No concerns	No concerns	No concerns
Cost						
Capital Costs	$451,000	$142,000	$594,000	$491,000	$671,000	

O&M Costs	$278,000	$299,000	$508,000	$629,000	$653,000	$638,000
Estimated Years of	35	10	<10	<10	<10	9
Total Present Worth Costs	$278,000	$391,000	$1,102,000	$1,080,000	$1,144,000	$1,309,000

Overall Protection of Human Health and the Environment

The remedial alternatives are assessed to determine the degree to which each alternative eliminates, reduces, or controls threats to human health and the environment through treatment, engineering methods, or institutional controls.

All groundwater alternatives, except no action, would be protective of human health and the environment because they result in a decrease of contaminant concentrations and include institutional controls to restrict access to unit groundwater. The alternatives also include monitoring to verify that contaminants do not exceed target levels at compliance boundaries (if applicable) and that contaminant concentrations are decreasing. As contaminant concentrations decrease, risks to human health associated with ingestion, dermal contact, and inhalation of groundwater would be prevented. The BRA determined that groundwater contaminants do not pose a significant risk to ecological receptors. Additionally, modeling results indicate that the nearest surface water body downgradient of D-Area OSB will not receive groundwater contaminants at concentrations exceeding MCLs. Therefore, all alternatives are protective of the environment.

Compliance with ARARs

ARARs are federal and state environmental regulations that establish standards that remedial actions must meet. There are three types of ARARs: (1) chemical-specific, (2) location-specific, and (3) action-specific.

Chemical-specific ARARs are usually health- or risk-based levels or methodologies that, when applied to unit-specific conditions, result in the establishment of numerical values. Often these numerical values are promulgated in federal or state regulations.

Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in specific locations. Some examples of specific locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats.

Action-specific ARARs are usually technology- or remedial activity-based requirements or limitations on actions taken with respect to hazardous substances or unit-specific conditions. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy.

In addition to complying with ARARs, other criteria. guidance, or proposed standards are "to be considered" even though they are not legally binding, because they may provide useful information or recommended procedures, when setting remedial objectives.

Under all groundwater alternatives, contaminant concentrations in groundwater would remain above current MCLs (chemical-specific ARARs) for the near future, but would meet MCLs following remediation. However, the no-action alternative would not provide monitoring to confirm when MCLS are reached.

No action-specific ARARs are associated with Alternative GW-1. Alternatives GW-2 and GW-4a would require compliance with the GWMZ. Alternative GW-3 would require a variance to inject groundwater exceeding MCLs. Such a variance may be difficult to obtain. State air quality regulations would apply to emissions from Alternatives GW-4a, GW-4b, and Alternative GW-5, but should not be difficult to meet. Alternative GW-5 may also require an NPDES permit modification, which should not be difficult to obtain. Alternatives GW-3, GW-4a, GW-4b, and GW-5 would also require construction permits, which should not be difficult to obtain.

No location-specific ARARs are associated with Alternative GW-1. The potential location-specific ARAR associated with Alternatives GW-2, GW-3, GW-4a, GW-4b, and GW-5 would require protection of the nearby wetlands.

Long Term Effectiveness and Permanence

The remedial alternatives are assessed based on their ability to maintain reliable protection of human health and the environment after implementation.

All alternatives except the no-action alternative would result in a permanent reduction of contaminants to below remediation goals (MCLs) by an effective means of treatment. The no-action alternative would not provide treatment to reduce contaminant concentrations and would result in contaminants remaining at the unit above regulatory limits.

Process controls are available for Alternatives GW-3, GW4a, GW-4b, and GW-5 that could adequately and reliably control each system. Alternative GW-2 would not require any process controls. All alternatives

except no action
would also utilize institutional controls and groundwater monitoring to restrict access to unit groundwater and
monitor treatment effectiveness, respectively. The no-action alternative would provide no control over existing
groundwater contamination.

Reduction of Toxicity, Mobility, or Volume Through Treatment

The remedial alternatives are assessed based on the degree to which they employ treatment that reduces toxicity (the
harmful nature of the contaminants), mobility (ability of the contaminants to move through the environment), or
volume of contaminants associated with the unit.

Alternative GW-l would provide no treatment of groundwater contaminants. Alternative GW-2 would involve
passive treatment through natural attenuation processes and would result in decreases in contaminant toxicity,
mobility, and volume. alternative GW-4a includes natural attenuation as part of the active treatment alternative.
Alternatives GW-3, GW-4a, GW-4b, and GW-5 would provide active treatment of unit contaminants to reduce the
toxicity, mobility, and volume of groundwater contaminants. Each alternative would result in reaching MCLs; the
time frames required to reach MCLs are provided in the following section.

Short-Term Effectiveness

The remedial alternatives are assessed considering factors relevant to implementation of the remedial action,
including risks to the community during implementation, impacts on workers, potential environmental impacts (e.g.,
air emissions), and the time required to achieve protection.

Remedial goals (MCLs) would be met by each alternative in the following time periods based on groundwater
modeling (WSRC, 1998a, Appendix B), and professional experience:

- Alternative GW-1 35 years
- Alternative GW-2 10 years
- Alternative GW-3 <10 years
- Alternative GW-4a <10 years
- Alternative GW-4b <10 years
- Alternative GW-5 9 years

Alternative GW-1 would not require any remedial actions and would, therefore, not result in any risk to remedial
workers. Of the remaining alternatives, Alternative GW-2 would result in the least risk to remedial workers and
Alternative GW-5 would result in the most. However, no significant risks are associated with any of the alternatives
and compliance with the health and safety plan should protect remedial workers during implementation.

Construction and implementation activities would not endanger the community for any of the alternatives. However, a minimal risk would be associated with Alternatives GW-4a, GW-4b, and GW-5 due to air emissions from the treatment systems. However, compliance with air regulations would provide protection to the community.

All alternatives except no action would involve some disturbance to the environment. This disturbance would be least for Alternative GW-2 and greatest for alternative GW-5. However, precautions would be taken to minimize disturbance.

Implementability

The remedial alternatives are assessed by considering the difficulty of implementing the alternative including technical feasibility, constructability, reliability of technology, ease of undertaking additional remedial actions (if required), monitoring considerations, administrative feasibility (regulatory requirements), and availability of services and materials.

All alternatives could be readily implemented with no difficulty obtaining materials or equipment. All alternatives except the no action alternative would provide an effective means of treatment and groundwater monitoring to evaluate treatment effectiveness. The added effectiveness provided by injecting nutrients under Alternative GW-3 would likely be limited due to subsurface heterogeneities and preferential pathways that would develop. It would also be difficult to evaluate overall performance because the areas of preferential pathways will have increased bioactivity. None of the alternatives would preclude any further remedial action, should it be deemed necessary in the future. All alternatives except no action would require approval of permits or variances. Obtaining approval is not anticipated to be difficult for any of these alternatives except Alternative GW-3, which would require a variance to inject groundwater exceeding MCLs. However, obtaining such a variance would not likely prevent implementation of the alternative.

Cost

The evaluation of remedial alternatives must include capital, operational, and maintenance costs. Present value costs are estimated within +50/-30 percent, per EPA guidance. The cost estimates given with each alternative are prepared from information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope, final project schedule, and other variable factors. As a result, the final project costs may vary from the

estimates presented
herein.

For ease of comparison, the total estimated present worth costs for each alternative are listed below:

Alternative GW-1	$278,000
Alternative GW-2	$391,000
Alternative GW-3	$1,102,000
Alternative GW-4a	$1,080,000
Alternative GW-4b	$1,144,000
Alternative GW-5	$1,309,000

State Acceptance

In accordance with the FFA, the state is required to comment on and approve the RFI/RI Report and BRA, the
CMS/FS, and the SB/PP. State acceptance of previous documentation as listed above has been obtained. Also, state
acceptance of the GWMZ application has been obtained, as well.

Community Acceptance

Community acceptance of the preferred alternative is assessed by giving the public an opportunity to comment on the
remedy selection process. A public comment period was held from May 1, 1998 to June 14, 1998 during which
comment was invited from the general public. No comments were received during this time. The ER&WM Program
subcommittee of the SRS CAB was given a briefing on the preferred alternatives on May 6, 1998. The ER&WM
subcommittee was supportive of the preferred alternative and made a motion to the full CAB at the May 18, 1998
meeting to accept the preferred alternative. This motion was accepted with no opposition. The subcommittee also
commended the site's successful use of the bioventilation system in the remediation of the unit's subsurface soil.

IX. THE SELECTED REMEDY

The selected remedy for the D-Area OSB deep soils is No Further Action, since RAOs have been achieved by the
IRA and biovent testing.

The selected remedy for shallow soil, surface water, and sediment is No Action, because no COCs in those media
were identified in the RFI/RI/BRA.

The selected remedy for D-Area OSB groundwater is alternative GW-2: Natural Attenuation/GWMZ with Institutional Controls. Under this alternative, natural attenuation mechanisms such as biodegradation, flushing, volatilization, adsorption, and hydrolysis would continue to reduce contaminant concentrations in the groundwater to acceptable levels. Results from the bioventing study, conducted as part of the interim action, indicate that the source of groundwater contamination (i.e., the D-Area OSB soil) was abated as a result of the combined interim action and biovent test, and no longer contributes to groundwater contamination. Evidence indicating that natural attenuation processes are occurring in the D-Area OSB groundwater was presented in the RFI/RI Report and BRA and included. (1) decreased dissolved oxygen levels in groundwater, which indicates that microorganisms are utilizing a combination of the contaminants as a carbon source and oxygen within the groundwater as an oxygen source to produce energy, (2) elevated chemical oxygen demand, chloride, and sulfate levels downgradient, (3) depressed pH levels in contaminated areas, and (4) presence of breakdown products.

Researchers report that natural attenuation is appropriate for sites with certain characteristics and emphasis on the removal of the contaminant source and the ability of the specific contaminants to naturally degrade. Herbert et al., 1984, report that natural attenuation can be selected as a preferred remedial option when the following site-specific conditions exist:

- Groundwater is unsuitable for consumptive use.
- Contaminants degrade quickly or are not at highly toxic concentrations.
- There is low potential for exposure.
- Active restoration is not feasible due to complex hydrogeologic conditions.
- There is low projected demand for future groundwater use.
- The unit is in close proximity to a surface water discharge area, with dilution to levels that are protective of human health and the environment.

The RFI/RI conducted at the D-Area OSB revealed the following:

- The source of contamination at the D-Area OSB was removed during IRA in conjunction with the biovent testing and no longer contributes to groundwater contamination.
- Naturally occurring mechanisms will continue to reduce contaminant concentrations.
- There are no receptors of groundwater at the D-Area OSB; therefore, there is low potential for exposure.
- The aquifer is limited in thickness and yield and is not targeted for residential or commercial use; therefore, projected demand for future groundwater use is low.

· Modeling indicates that contaminant concentrations in the D-Area OSB groundwater would be reduced to below MCLs prior to discharging to Fourmile Branch: therefore dilution in the surface water body is not necessary to achieve MCLs.

Based on this information the contaminants in the D-Area OSB would be conducive to natural attenuation.

The time required to degrade the unit-specific contaminants was conservatively estimated through groundwater modeling. The modeling indicates that all contaminants in groundwater would be reduced below their respective MCLs within approximately 10, years, which is well within the time-frame that DOE plans to maintain control of the SRS.

A GWMZ application, defined under the South Carolina Regulations R.61-68, has been approved by the SCDHEC as part of this alternative (Figure 17). Mixing zones are considered in situations where the source of groundwater contamination has been removed and contaminant concentrations are decreasing by natural processes. This alternative will demonstrate through monitoring that RAOs will be met, MZCLs (Table 7) will be achieved throughout the aquifer, MCLs wi1l be achieved at the compliance boundary, and predicted concentrations will be achieved at intermediate wells, as described in the approved GWMZ application. Implementation of this alternative involves installation of nine new wells and monitoring of a total of 12 groundwater wells. Based on area characteristics and evidence presented in the GWMZ Application, a GWMZ for the D-Area OSB is an appropriate part of a natural attenuation remedy and has been approved by the SCDHEC.

The D-Area OSB is in an industrial use zone, as identified in Figure 3.3 of the SRS FFA Implementation Plan (WSRC, 1996e), for both current and anticipated future land use. Although the remediation decisions for this unit were based on the industrial use scenario, the groundwater remedy will achieve the more protective residential use scenario. The D-Area OSB currently meets unrestricted land use criteria for soils, sediment and surface water. Groundwater beneath the unit exceeds the MCLs. Although institutional controls are included in all of the alternatives (except the no-action alternative), the DOE has recommended that residential use of SRS land in the vicinity of D Area be prohibited (DOE, 1996); therefore, future residential use and potential residential water usage in this area is unlikely. Modeling of groundwater transport processes as part of the evaluation of the remedial alternatives indicates that MCLs for the contaminants of concern will be achieved in all areas of the D-Area OSB groundwater after approximately 10 years. Upon confirmation that MCLs have been achieved, institutional controls

at the unit will no longer be required.

Per the EPA Region-IV LUCs Policy a LUCAP for SRS and a LUCIP for the D-Area OSB will be developed and
submitted to the regulators for approval. The LUCAP will be submitted under separate cover, whereas the LUCIP

will be submitted with the RDWP/RDR/RAWP in accordance with the post-ROD document schedule provided in
Figure 18. The LUCIP details how SRS will implement, maintain, and monitor the land use control elements of the
D-Area OSB ROD to insure that the remedy remains protective of human health.

The LUC objective necessary to ensure the protectiveness of the preferred alternative is:

· Prevent unauthorized access to the D-Area OSB contaminated groundwater plume.

The institutional controls required to prevent unauthorized exposure to the contaminated media at the D-Area OSB
include the following:

· controlled access to the D-Area OSB through existing SRS security gates and perimeter fences and the site
use/site clearance programs

· signs posted in the area to indicate that groundwater in the vicinity of the unit has been contaminated by
hazardous materials

· notification of groundwater contamination to any future landowner through deed notification, as required under
CERCLA Section 120(h)

A certified survey plat of the site will be prepared by a registered land surveyor and will be included with the post-
ROD documents. If D-Area OSB is transferred to non-Federal ownership prior to remediation of the groundwater to
the MCLs for the COCs, reevaluation of the need for deed restrictions would be performed through an amended
ROD with EPA and SCDHEC approval. The survey plat will be reviewed and updated, as necessary, at the time the
site is transferred and will be recorded with the appropriate county recording agency. The D-Area OSB is located in
Aiken County.

Along with the institutional controls identified above, implementation of the selected remedy will involve the
placement of compliance boundary monitoring wells between the basin and the downgradient stream and periodic
monitoring of these compliance wells against the MCLs. This alternative will meet RAOs. MZCLs will be achieved
throughout the aquifer and MCLs will be achieved at the compliance point as described in the approved GWMZ
application. All monitoring, compliance, and reporting requirements to satisfy the GWMZ demonstration should be

met in accordance with Section 5 of the approved GWMZ application.

Table 7

MZCLs and MCLs for COCs

Constituent of Concern	MZCL (µg/l)	MCL (µg/l)
Tetrachloroethene	85	5.0
Trichloroethene	1150	5.0
Cis- 1,2-Dichloroethene	457	70.0
1,1 -Dichloroethene	7.0	7.0
Total- 1,2-Dichloroethene	70.0	70.0
Vinyl Chloride	32	2.0
Benzene	6.2	5.0
Methylene Chloride	9.5	5.0

X. STATUTORY DETERMINATIONS

The selected remedy for the D-Area OSB deep soils is No Further Action, since RAOs have been achieved by the IRA and biovent testing.

The selected remedy for shallow soil, surface water, and sediment is No Action, because no COCs in those media were identified in the RFI/RI/BRA.

Based on the findings of the D-Area OSB RI and BRA, groundwater contaminants present a risk to human health through ingestion, dermal contact, and inhalation. Modeling of unit groundwater indicates that naturally occurring processes, such as flushing, volatilization, biodegradation, adsorption. and chemical reaction with subsurface materials, would effectively reduce contaminant concentrations in groundwater to target levels within approximately 10 years. Monitoring wells would be used to verify that MCLs are not exceeded at compliance boundaries and that MZCLs would not be exceeded in the area of the contaminant plumes. Institutional controls would be maintained to limit access to unit groundwater until MCLs are satisfied. Natural attenuation is the most cost effective remedy for D-Area OSB unit groundwater.

The selected remedies for all media are protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. These remedies can be easily implemented with minimal risk to remedial workers, the community,

and the
environment. These remedies would also provide a permanent solution to unit contamination that would not require
any future remedial actions and satisfy the statutory preference for remedies that employ treatment that reduces
toxicity, mobility, or volume as a principal element.

XI. EXPLANATION OF SIGNIFICANT CHANGES

The SB/PP provides for involvement with the community through a document review process and a public comment
period. No comments were received during the 45-day public comment period. Therefore, there have been no
significant changes to the selected remedy as a result of public comments.

XII. RESPONSIVENESS SUMMARY

No comments were received during the public comment period (May 1 to June 14, 1998), This is indicated in the
Responsiveness Summary (Appendix A).

XIII. POST-ROD DOCUMENT SCHEDULE

The post-ROD document schedule, based on calendar days, is listed below and is illustrated in Figure 18.

1. The combined Revision 0 RDWP/RDR/RAWP Report for the D-Area OSB will be scoped 45 days after the
   ROD is approved, if determined by all three parties to be necessary.

2. RDWP/RDR/RAWP Report will be submitted to EPA and SCDHEC within 180 days of approval of the ROD.
   This report will contain the LUCIP, as part of the submittal.

3. EPA and SCDHEC review of the D-Area OSB RDWP/RDR/RAWP Revision 0 Report will be completed 90
   days from submittal of the document.

4. SRS revision of the D-Area OSB RDWP/RDR/RAWP Report will be completed 60 days after receipt of all
   regulatory comments.

5. EPA and SCDHEC final review and approval of the D-Area OSB RDWP/RDR/RAWP Revision 1 Report will
   extend to 30 days after receipt of the Rev. 1.0 document.

6. D-Area OSB Remedial Acition Field Start will begin on September 3, 1999, following EPA and SCDHEC
   approval of the Rev 1.0 RDWP/RDR/RAWP Report.

7. D-Area OSB PCR/FRR Revision 0 will be submitted to EPA and SCDHEC 90 calendar days after completion
   of the remedial action.

8. EPA and SCDHEC review of the D-Area OSB PCR/FRR will last 90 calendar days.

9. SRS revision of the D-Area OSB PCR/FRR will be completed 60 calendar days after receipt of all regulatory comments.

10. EPA and SCDHEC final review and approval of the Revision 1 PCR/FRR will last 30 calendar days.

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APPENDIX A

RESPONSIVENESS SUMMARY

Record of Decision for the
D-Area Oil Seepage Basin (631-G) (U)
Savannah River Site
August 1998

WSRC-RP-97-402
Revision 1, Final

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RESPONSIVENESS SUMMARY

The public was notified of the public comment period through mailings of the SRS Environmental Bulletin, a newsletter sent to approximately 3500 citizens in South Carolina and Georgia, through notices in the Aiken Standard, the Allendale Citizen Leader, the Augusta Chronicle, the Barnwell People-Sentinel, and The State newspapers. The public comment period was also announced on local radio stations.

The 45-day public comment period began on May 1, 1998 and ended on June 14, 1998. However, no public comments were received during this period.

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 09/04/1998
Operable Unit: 23
ROD ID: EPA/541/R-98/190

Text: Full-text ROD document follows on next page.

PB98-964029
EPA541-R98-190
May 1999

EPA Superfund
Record of Decision:

Savannah River Site (USDOE)
F-Area Retention Basin (281-3F)
Aiken, SC
9/4/1998

Department of Energy
Savannah River Operations Office
P.O.Box A
Aiken, South Carolina 29802

APR 28 1999

Mr. K. A. Collinsworth, Manager
Federal Facility Agreement Section
Division of Site Assessment and Remediation
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

Mr. J. L. Crane, Manager
SRS Remedial Project
Waste Management Division
United States Environmental Protection Agency, Region IV
61 Forsyth Street, SW
Atlanta, GA 30303

Dear Mr. Collinsworth and Mr. Crane:

SUBJECT: Submittal of the Record Copy of the Signed Record of Decision for the F-Area Retention Basin (281-3F)

Enclosed, please find a signed copy of the F-Area Retention Basin Record of Decision for your records. Savannah River Site (SRS) will make the distribution of the Administrative Record file(s) and publish the notice of availability.

Please contact me at (803) 725-7032 if you have any questions.

Sincerely,

Brian T. Hennessey
Environmental Restoration Division
SRS Remedial Project Manager

BTH/LHW:ed
OD-99-254
Enclosure
1. Record of Decision for the F-Area Retention Basin (281-3F), WSRC-RP-97-145, Revision.1.1

c: A.B. Gould, DOE-ECD, 703-A
C.V. Anderson, DOE-ERD, 703-A
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J.T. Litton, SCDHEC-Columbia
M.D. Sherritt, SCDHEC-Columbia
G.K. Taylor, SCDHEC-Columbia
SRS Administrative Record Files (Palmer, 730-2B, 1000)*
*w/enclosure

United States Department of Energy

Savannah River Site

Record of Decision
Remedial Alternative Selection for the F-Area Retention Basin (281-3F) (U)

WSRC-RP-97-145

Revision 1.1

August 1998

Prepared by:
Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808
Prepared for U.S. Department of Energy under Contract No. DE-AC09-9

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DISCLAIMER

This report was prepared by Westinghouse Savannah River Company (WSRC) for the United States Department of Energy under Contract No. DE-AC09-96SR18500 and is an account of work performed under that contract. Reference herein to any specific commercial product, process or service does not necessarily constitute or imply endorsement, recommendation, or favoring of same by WSRC or by the United States Government or any agency thereof.

Printed in the United States of America

Prepared for
U. S. Department of Energy
by
Westinghouse Savannah River Company
Aiken, South Carolina

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RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

F-Area Retention Basin (281-3F)

WSRC-RP-97-145
Revision 1.1
August 1998

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U.S. Department of Energy under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

F-Area Retention Basin (SRS Building 281-3F)
Savannah River Site
Aiken, South Carolina

The F-Area Retention Basin (FRB) Operable Unit (OU) is listed as a Resource Conservation and Recovery Act (RCRA) 3004 (U) Solid Waste Management Unit/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS). This OU includes the retention basin (basin soils), the former process sewer line (pipeline, pipeline sediment, and pipeline associated soils), and the groundwater associated with the unit.

Statement of Basis and Purpose

This decision document presents the selected remedial alternatives for the FRB OU located at the SRS south of Aiken, South Carolina. The selected alternatives were developed in accordance with CERCLA, as amended by SARA, RCRA, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this specific RCRA/CERCLA unit.

Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

The preferred alternatives for the FRB OU are: (1) for the basin soil; Alternative S5: Institutional Controls, Grouting, a Low Permeability Cover, and Groundwater Monitoring; (2) for the former process sewer line: Alternative P4: Institutional Controls, Pipeline Grouting, and Soil Excavation and Disposition with Basin Soils; and (3) for the groundwater; Alternative G1: No Action. The waste unit will be physically maintained and institutional controls will remain in place in perpetuity. The field conditions will be evaluated to determine the need to modify the program or to identify if further remedial action is appropriate during the five-year ROD review.

Under Alternative S5, deep basin soil will be grouted from approximately 0.6 m (2 ft) above the basin bottom to approximately 4.3 m (14 ft) below grade. The purpose of grout is to prevent leaching of Sr-90, which is the only contaminant migration COC (CMCOC) to the groundwater above maximum concentration level 8.0 pCi/L. Furthermore, grouting the soil provides an additional layer of protection by offsetting the inherent uncertainty associated with the mathematical model used to predict contaminant migration. Grouting will also immobilize other deep contaminants which represent principal threat source material such as Cs-137, Ra-226, thallium, arsenic, etc., and further reduce infiltration of water through the deeper contaminated soils. Grouting of soils is preferred over only capping because it meets the CERCLA preference for treatment. A cover will be provided over the stabilized soil to minimize stormwater percolation and erosion. The cover is also very effective in reducing direct radiation exposure received from radionuclides in the shallow soil. This alternative includes institutional controls to prevent exposure of current and future workers to hazardous constituents in the waste unit and direct radiation from the waste unit. Since waste is left in place, the future use of land will be restricted to industrial use to prevent unrestricted residential use of the land.

In situ grouting reduces air emissions and is relatively simple to implement. However, *in situ* grouting results in a slight increase in waste volume. The volume of the basin, when clean soil is excavated prior to grouting, will be adequate to accommodate any increase in grouted soil volume. The estimated volume of grout/soil mixture is 6,600 m^3 (8,100 yd^3).

Implementation of institutional controls will involve both short- and long-term actions. For the short-term action, signs will be posted at the FRB OU indicating that this area was used for the disposal of waste material and contains buried waste. Additionally, existing SRS access controls will be used to maintain use of this site for industrial use only. In the long-term, if the property is ever transferred to non-Federal ownership, the U.S. Government will take those actions

necessary pursuant to Section 120(h) of CERCLA. These actions will include a deed notification disclosing former waste management and disposal activities as well as any remedial actions taken on the site and any continuing groundwater monitoring commitments. These requirements are also consistent with the intent of the RCCA deed notification required at final closure of the RCRA facility if contamination would remain at the unit. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of radioactive materials and hazardous substances. The deed shall also include deed restrictions precluding residential use of the property. However, the need for these deed restrictions may be reevaluated at the time of transfer in the event that contamination no longer poses and unacceptable risk under residential use. Any reevaluation of the need for deed restrictions would be done through an amended ROD with the Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC) approval. In addition, a certified survey of the area will be prepared by a registered land surveyor and will be included in the Post-Construction Report. The survey will be reviewed and updated, as necessary, at the time the site is transferred and will be recorded into the appropriate county recording agency. The FRB OU is located in Aiken County.

Per the EPA-Region IV Land Use Controls (LUCs) Policy, a Land Use Control Assurance Plan (LUCAP) and a Land Use Control Implementation Plan (LUCIP) will be developed and submitted to the regulators for their approval. The LUCAP will be submitted under separate cover whereas the LUCIP will be submitted with the Remedial Work Plan/Remedial Design Report/Remedial Action Work plan (RFWP/RDR/RAWP) for the FRB OU in accordance with the Post-ROD document schedule provided in this ROD. The LUCAP will include the information requested in the EPA policy. The LUCIP details how SRS will implement, maintain, and monitor the land use control elements of the FRB OU ROD to insure that the remedy remains protective of human health.

The LUC objective necessary to ensure the protectiveness of the preferred alternative is:

- Prevent unauthorized access/exposure to contaminated grout and basin soil

The institutional controls required to prevent unauthorized exposure to the contaminated grout and soil include the following:

- Controlled access to the FRB waste unit through existing SRS security gates and perimeter fences and the site use/site clearance programs

- Signs posted in the area to indicate that contaminated grout and soil are present in the waste unit

- Notification of contaminated grout and soil to any future land owner through deed notification as required under CERCLA Section 120(h)

Along with the institutional controls identified above for the FRB soils, the preferred alternative for the process sewer line and associated soils will include pipeline and manholes grouting, and excavation and disposition of pipeline soils (approximate volume 240m^3 or 300 yd^3) with basin soil. In this alternative, the localized areas of the contaminated soil around the pipeline hot spots will be excavated. If necessary, the sections of pipeline associated with the hot spots will also be excavated. The excavated soil and pipeline will be disposed of at the basin by *in situ* grouting along with soil from the basin. Clean soil from SRS borrow areas will be used to fill excavated areas around the pipeline. This alternative will also include access controls such as installing warning signs around the pipeline area.

The preferred alternative for the FRB OU groundwater is "No Action". The history of the FRB, the results of the groundwater modeling, and the current groundwater data reveal that the FRB-associated groundwater poses no risk to human health or the environment. No contaminant exceeds the maximum contaminant levels (MCLs) stipulated by EPA under the Safe Drinking Water Act. However, to ensure that the grout monolith, formed by *in situ* grouting of soils under Alternatives S5 and P4, has accomplished the required immobility of contamination, a groundwater monitoring program will be established under Alternative S5. The groundwater will be monitored semi-annually until it is confirmed that the remedial response action for the FRB OU has achieved the required stabilization of the contaminants. Groundwater monitoring, in conjunction with institutional controls, will help prevent ingestion of groundwater; verify that no upgradient source of contamination exists; and reduce the uncertainty in the environmental data collected during the characterization of the FRB OU.

The post-ROD document, the Corrective Measures Implementation/Remedial Design Work Plan (CMI/RDWP), will be submitted to the U.S. Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC) following the issuance of the ROD. The CMI/RDWP will contain a summary description of the scope of work for the remedial action design, detailed implementation/submittal schedule for subsequent post ROD documents, and an anticipated field activities start date. The CMI/RDWP will also include regulatory review period, SRS revision period, and final regulatory approval period. The regulatory review period, SRS revision period, and final regulatory review and approval period normally are 45 days, 30 days, and 30 days, respectively.

The SCDHEC has modified the SRS RCRA permit to incorporate the selected remedy.

Statutory Determinations

Based on the Remedial Investigation Report and the Baseline Risk Assessment (RI/BRA prepared under SRS RFI/RI Program Plan), the FRB OU poses no significant risk to the environment but poses a significant risk to human health. Therefore, institutional controls, *in situ* grouting of the contaminated basin soil and covering the grouted soil with a low permeability cover, and confirmatory groundwater monitoring are necessary for the basin soil; institutional controls, pipeline and manhole grouting, and excavation and disposition of soil with the basin soil are necessary for the pipeline and pipeline associated soil. No additional remedial action is required for the FRB OU groundwater. However, as a part of remedial action, the groundwater will be monitored: (1) to confirm that the source remediation has achieved the required stabilization of the contaminants; (2) to relieve any uncertainty in the analytical data; and (3) to verify that there exists no upgradient source contributing any contamination to the FRB OU groundwater. If monitoring detects contamination above MCLs (or Risk-Based Concentrations (RBCs) without MCLs) for those constituents attributable to the FRB OU groundwater (or an upgradient source) for two consecutive monitoring periods, the regulators will be informed within 30 days. A plan for evaluating the data and developing further action needed will be submitted within 90 days for regulatory approval.

In situ grouting of soils and cover will: (1) result in the protection of unit groundwater through the stabilization of unit constituents of concern (COCs); and (2) serve to stabilize the principal threat source material. The grout testing under actual field conditions will be performed to confirm the successful soil stabilization. The remedial action, therefore, will be protective of on unit human and ecological receptors by shielding exposure and preventing the assimilation of unit COCs. The selected remedy is protective of human health and the environment, and complies with Federal and state Applicable or Relevant and Appropriate Requirements (ARARs). The selected remedy is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatments that reduce toxicity, mobility, or volume as a principal element.

Section 300.430 (f)(4)(ii) of the NCP requires that a Five-Year Review of the ROD be performed if hazardous substances, pollutants, or contaminants remain in the waste unit. Since hazardous substances will remain on-unit above health-based standards, the United States Department of Energy, the United States Environmental Protection Agency, and the South Carolina Department of Health and Environmental Control have determined that a Five-Year Review of the ROD for the FRB OU will be performed to ensure continued protection of human health and the environment.

8/26/98

Date

T. F. Heenan
Assistant Manager for Environmental Quality
U. S. Department of Energy
Savannah River Operations Office

SEP 0 4 1998

Date

Richard D. Green
Division Director
Waste Management Division
U.S. Environmental Protection Agency

10/19/98

Date

R. Lewis Shaw
Deputy Commissioner
Environmental Quality Control
South Carolina Department of Health and Environmental Control

DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

F-Area Retention Basin (281-3F)

WSRC-RP-97-145
Revision 1.1
August 1998

Savannah River Site
Aiken, South Carolina

Prepared by:

_____

Westinghouse Savannah River Company
for the
U.S. Department of Energy under Contract DE-AC09-96SRI 8500
Savannah River Operations Office
Aiken, South Carolina

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RESPONSIVENESS SUMMARY 1

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ACRONYMS AND ABBREVIATIONS

ANS	American Nuclear Society
ARAR	Applicable or Relevant and Appropriate Requirement
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Ci	Curies
COC	Constituent of Concern
COPC	Constituent of Potential Concern
CSM	Conceptual Site Model
DOE	United States Department of Energy
DQO	Data Quality Objectives
EPA	United States Environmental Protection Agency
ERD	Environmental Restoration Department
FFA	Federal Facility Agreement
FRB	F-Area Retention Basin
CMS/FS	Corrective Measures Study/Feasibility Study
ft	foot (feet)
GPR	Ground Penetrating Radar
HI	Hazard Index
HQ	Hazard Quotient
m	meter
MCL	Maximum Contaminant Level
pCi/g	picoCurie per gram
NCP	National Oil and Hazardous Substances Contingency Plan
NEPA	National Environmental Policy Act
NPL	CERCLA National Priorities List
OU	Operable Unit
O&M	Operation and Maintenance
PCR	Post-Construction Report
mCi/g	milliCurie per gram
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RBA	Risk-Based Activity
RBC	Risk-Based Concentration

RCRA	**Resource Conservation and Recover Act**
RDR	**Remedial Design Report**
RDWP	**Remedial Design Work Plan**
RGO	**Remedial Goal Option**
RI	**CERCLA Remedial Investigation**
RME	**Reasonable Maximum Exposure**
ROD	**Record of Decision**
SB/PP	**Statement of Basis/Proposed Plan**
SCDHEC	**South Carolina Department of Health and Environmental Control**
SCHWMR	**South Carolina Hazardous Waste Management Regulations**
SRS	**Savannah River Site**
TBC	**To-Be-Considered (requirement)**
TCLP	**Toxicity Characteristic Leaching Procedure**
USC	**Unit-Specific Constituent**
WSRC	**Westinghouse Savannah River Company**

I. SAVANNAH RIVER SITE AND OPERABLE UNIT NAME, LOCATION, DESCRIPTION AND PROCESS HISTORY

Savannah River Site Location, Description, and Process History

The Savannah River Site (SRS) occupies approximately 803 square kilometers (310 square miles) of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of western South Carolina. SRS is a secured U.S. Government facility with no permanent residents and is located approximately 40 kilometers (25 miles) southeast of Augusta, Georgia, and 32 kilometers (20 miles) south of Aiken, South Carolina (Figure 1).

SRS is owned by the United States Department of Energy (DOE). Management and operating services are currently provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense and the space program. Chemical and radioactive wastes are by-products of nuclear material production processes.

Operable Unit Name, Location, Description, and Process History

The Federal Facility Agreement (WSRC, 1993) lists the F-Area Retention Basin (FRB) as a Resource Conservation and Recovery Act/Comprehensive Environmental Response, Compensation, and Liability Act (RCRA/CERCLA) unit requiring further evaluation using an investigation/assessment process that integrates and combines the RCRA Facility Investigation (RFI) process with CERCLA Remedial Investigation (RI) to determine the actual or potential impact to human health and the environment.

The FRB, designated as Building 281-3F, is located outside and south of the F-Area perimeter fence, approximately 1035 m (3397 ft) from Fourmile Branch (Figure 2). The FRB, with an area of approximately 0.6 acres (2,400 square meters) and approximate dimensions of 61 m (200 ft) long, 36.6 m (120 ft) wide, and 2.1 m (6.9 ft) deep (Figure 3), was designed and operated as an unlined, temporary container [capacity approximately 4.68 million liters (1.2 million gallons)]

Figure 1. Location of F Area at the Savannah River Site

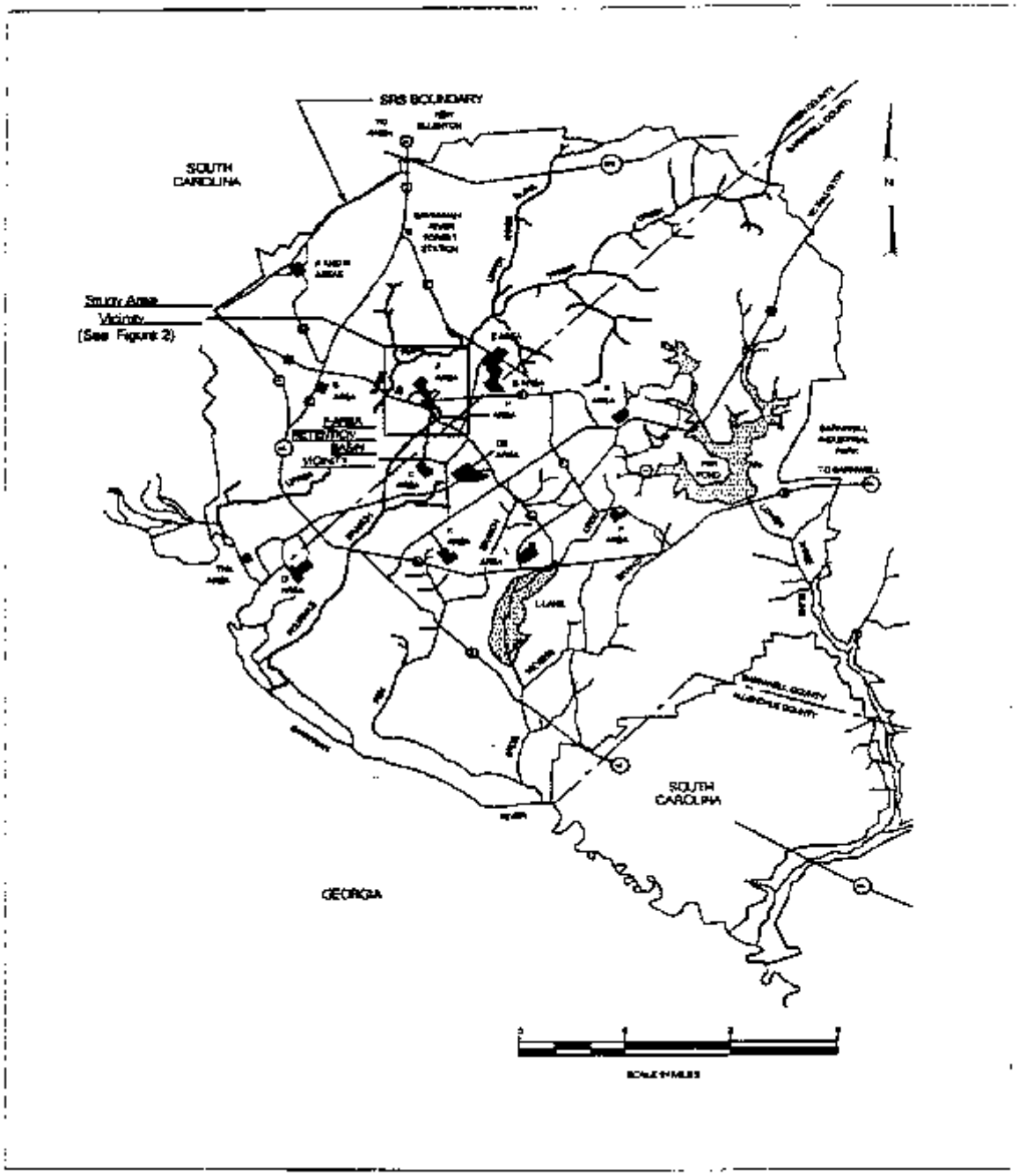


Figure 2. Topographic Map of the F-Area Retention Basin and Surrounding Area

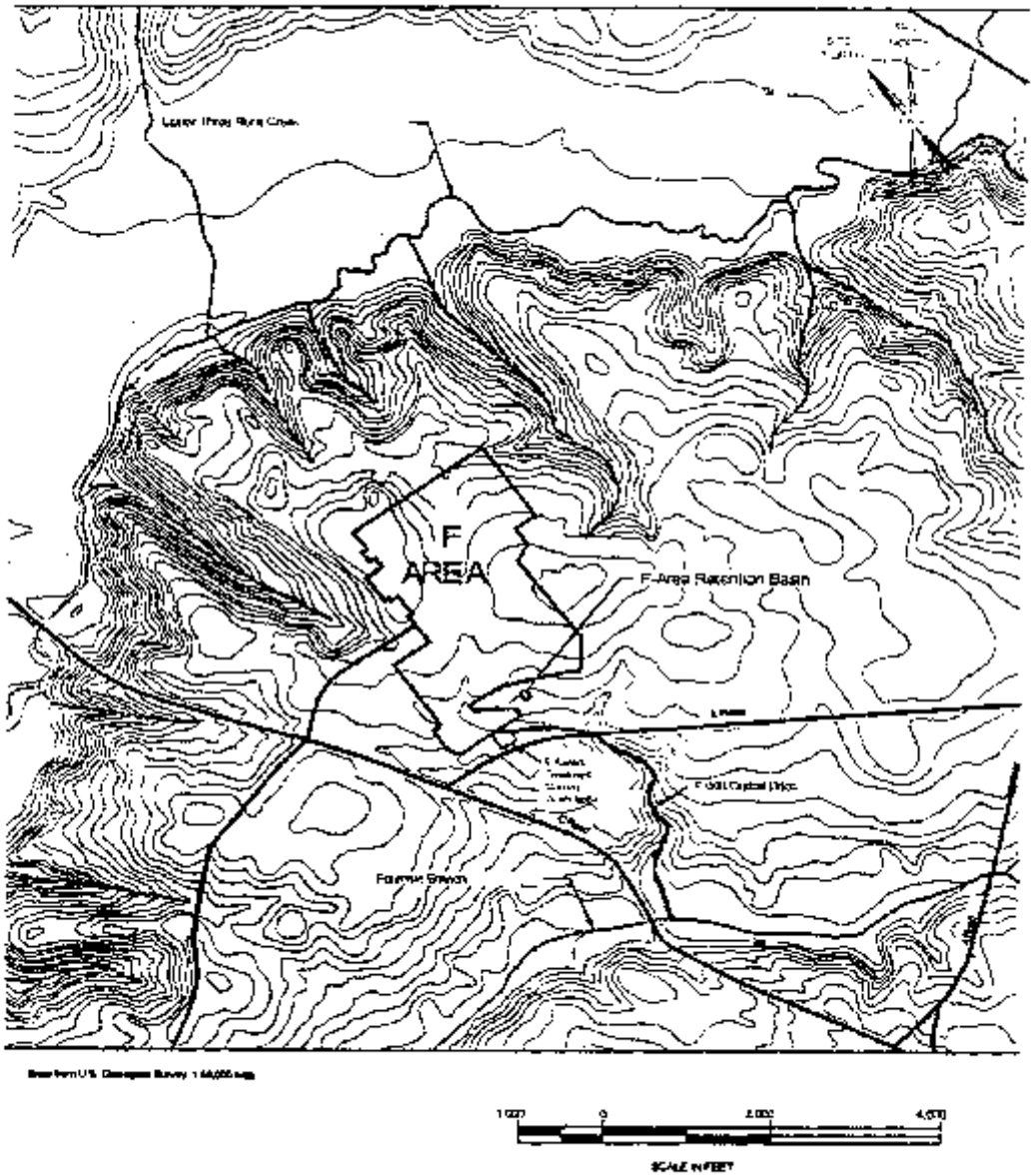
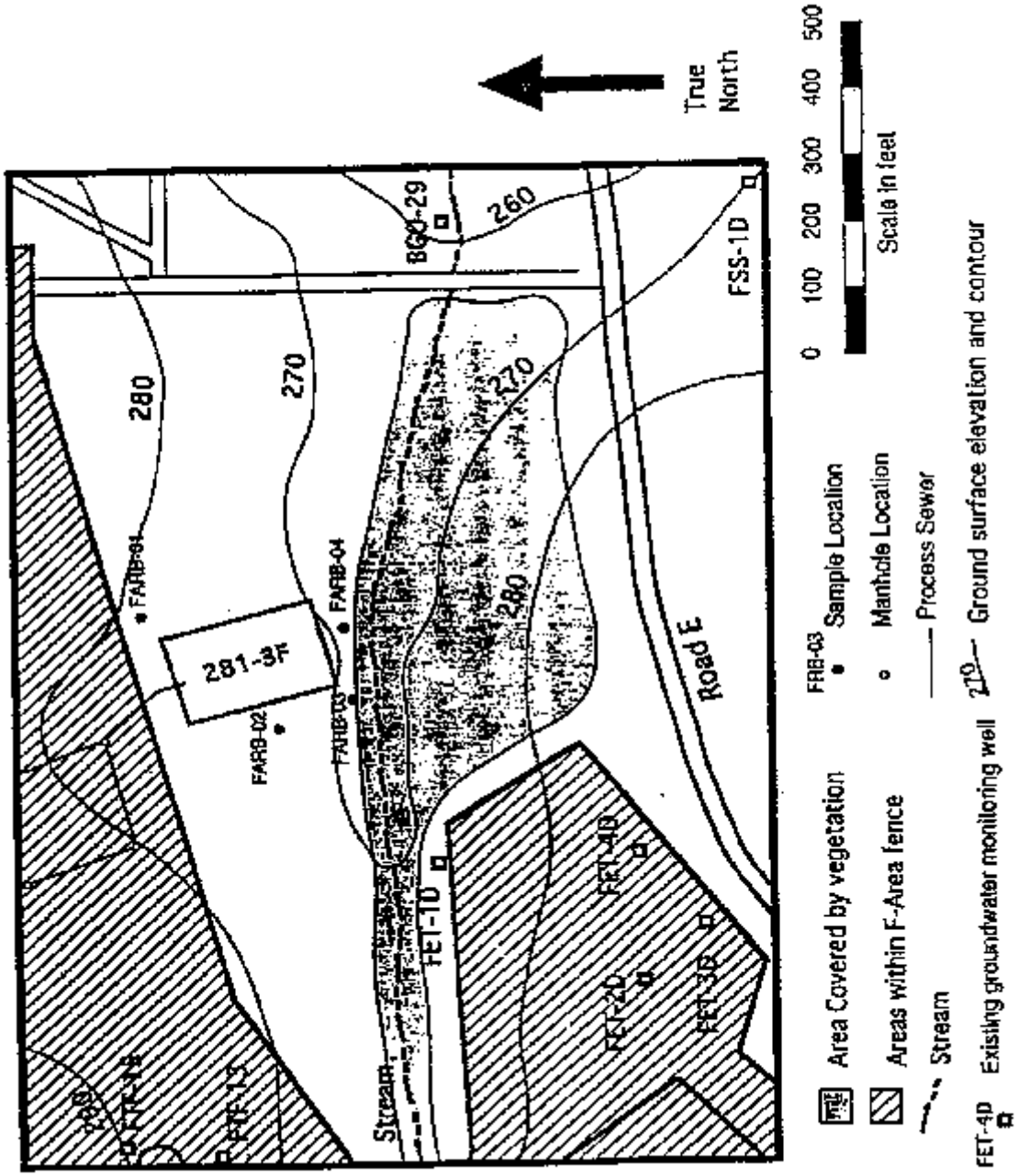


Figure 3. Plan View of the F-Area Retention Basin



for potentially contaminated cooling water from the F-Area Canyon Facility and stormwater drainage from the F-Area Tank Farm. Water was conveyed to the basin by a process sewer line (approximately 168 m (550 ft) of 61-cm (24-inch) diameter and approximately 212 m (700 ft) of 91 cm (36-inch) diameter that discharged into the north side of the basin. One branch of the line conveyed water from the Canyon Facility and the other branch conveyed water from the Tank Farm. Cooling water from the Canyon Facility generally had low levels of radioactivity, while water from the Tank Farm is believed to have had only trace quantities of nonradionuclide chemicals. The quantities of water released to the retention basin and the level of various constituents contained within the water are unknown.

The FRB is currently an inactive basin filled with clean soil and covered with grass. The FRB and its surrounding area lies at an elevation of approximately 275 ft above mean sea level. Surface water runoff drains southeast to Fourmile Branch via an unnamed drainage ditch (tributary) and overland flow.

II. SITE AND OPERABLE UNIT COMPLIANCE HISTORY

SRS Operational History

The primary mission of SRS was to produce tritium ($^{-3}$H), plutonium-239 (^{239}Pu), and other special nuclear materials for our nation's defense programs. Production of nuclear materials for the defense programs was discontinued in 1988. SRS has provided nuclear materials for the space program, as well as for medical, industrial, and research efforts up to the present. Chemical and radioactive wastes are by-products of nuclear material production processes. These wastes have been treated, stored, and in some cases, disposed at SRS. Past disposal practices have resulted in soil and groundwater contamination.

SRS Compliance History

Waste materials handled at SRS are regulated and managed under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities have required federal operating or post-closure permits under RCRA. SRS received a hazardous waste permit from the South Carolina. Department of Health and Environmental Control (SCDHEQ). The permit was most recently renewed on September 5, 1995. Part IV of the permit mandates that SRS establish and implement an RFI Program to fulfill the requirements specified in Section 3004(u) of the federal permit.

On December 21, 1989, SRS was included on the National Priorities List (NPL). This inclusion created a need to integrate the RFI Program established under RCRA with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA, DOE has negotiated an FFA (1993) with the United States Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEQ) to coordinate remedial activities at SRS with one comprehensive strategy that fulfills these dual regulatory requirements.

Operable Unit History

The F-Area Retention Basin (FRB) includes the retention basin and the abandoned process sewer line associated with the basin. The history of the FRB prior to characterization activities is briefly described.

F-Area Retention Basin

The basin operated from 1955 until 1972 and was closed in December 1978. This closure included the following activities:

- Sampling soil at four locations in the bottom of the retention basin
- Excavating approximately 0.6 m (2 ft) of soil from within the basin
- Sampling soil, from 53 locations from the bottom excavation and basin berm
- Removing and transporting a total of 970 m^3 (1267 yd^3) of contaminated soil to Burial Grounds (Building 643-G) for disposal
- Backfilling the basin with clean soil and seeding the area with grass

Excavation of soil from the bottom of the basin greatly reduced the level of radiological contamination at the basin. The maximum levels of cesium-137 (Cs-137) and strontium-89/90 (Sr-89/90) detected in basin soils prior to excavation were 80,600 picoCuries per gram (pCi/g) and 1540 pCi/g, respectively. The transferred radionuclide inventory was calculated as 11.5 Ci of Cs-137 and 0.5 Ci of Sr-89/90. Following excavation, the maximum levels of Cs-137 detected in FRB soils were 430 pCi/g in the basin and 1410 pCi/g in the berm while the maximum concentrations of Sr-89/90 were 1700 pCi/g in the basin and 1000 pCi/g in the berm.

Process Sewer Line

A portion of the process sewer line extending north from the basin was abandoned at the same time the basin was closed. The branch of the line from the Tank Farm approximately 168 m (550 ft) of 61-cm (24-inch diameter) was sealed off at a point close to manhole P37 (see Figure 6). The wastewater coming from the Tank Farm was diverted by installing a sluice box to Building 281-9F. The branch of the line from the Canyon Facility approximately 212 m (700 ft) of 91-cm (36-inch diameter) was sealed off at manhole P40 (see Figure 6). The abandoned portion of the process sewer line north of the basin and outlet pipe located south of the basin (total length approximately 380 m (1250 ft) is a part of this unit. The process sewer line north of manholes P37 and P40 is still active and is not included in this unit.

The depth to the top of the abandoned process sewer line varies from less than 1 in (3ft) near the original location of the basin to 4.6m (15 ft) for the segment from P40 to P39. There are several access points to the abandoned process sewer line (see Figure 6). Two of the four access points (P39 and one unnumbered manhole) are standard manholes constructed of brick. Access point P38 is a nonstandard manhole constructed of poured concrete walls and floor. The final access point is a valve/junction box located just downstream from manhole P39. The purpose of this junction box was to regulate the amount of liquid released to the retention basin during normal operation.

Drainage Ditch

The FRB was designed to discharge its contents through an outlet into a ditch naturally connected with an unnamed tributary discharging into Fourmile Branch. However, the remedial investigations conducted in response to SRS' established cleanup program revealed that the outfall ditch and the unnamed tributary to Fourmile Branch were not impacted by FRB operations; therefore, they are not considered for cleanup operations under this remedial action.

Operable Unit Compliance History

As previously stated, the FRB OU is listed in the FFA as a RCRA/CERCLA unit requiring further evaluation to determine the actual or potential impact to human health and the environment. A Remedial Investigation (RI) and Baseline Risk Assessment (BRA) were conducted for the unit between 1995 and 1997. The results of the RI and BRA were presented in the RI/BRA report (WSRC, 1997b). The RI/BRA report was submitted in accordance with the FFA-approved implementation schedule and was approved by the EPA and SCDHEC in

October 1997. The Corrective Measures Study/Feasibility Study (CMS/FS) (WSRC, 1997c) and Statement of Basis/Proposed Plan (SB/PP) (WSRC, 1997d) were submitted in accordance with the FFA-approved implementation schedule and were approved by EPA and SCDHEC in December 1997.

The post-ROD documents include Corrective Measures Implementation/Remedial Design Work Plan (CMI/RDWP) and Corrective Measures Implementation/Remedial Design Report/Remedial Action Work Plan (CMI/RDR/RAWP). In accordance with the FFA-approved implementation schedule, the Rev. 0 CMI/RDWP and Rev. 0 CMI/RDWP will be submitted to EPA and SCDHEC for approval. The Field Start Date for the implementation of the remedial action is scheduled for April 4, 1999.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Both RCRA and CERCLA require that the public be given an opportunity to review and comment on the proposed remedial alternative. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternatives for addressing the FRB OU soils and groundwater. The Administrative Record File must be established at or near the facility at issue. The SRS Public Involvement Plan (DOE, 1994a) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS Public Involvement Plan addresses the requirements of RCRA, CERCLA and the National Environmental Policy Act, 1969 (NEPA).

The South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79.124 and Section 117(a) of CERCLA, as amended, requires the advertisement of the notice of any proposed remedial action and mandates that the public be given an opportunity to participate in the selection of the remedial action. The Statement of Basis/Proposed Plan for the F-Area Retention Basin (281-3F) (WSRC, 1997d), which is a part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for remediating the FRB OU.

The FFA Administrative Record File, which contains the information pertaining to the selection of the response action, is available at the EPA office and at the following locations:

U. S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

Reese Library
Augusta State University
2500 Walton Way
Augusta, Georgia 30910
(706) 737-1744

Asa H. Gordon Library
Savannah State College
Tompkins Road
Savannah, Georgia 31404
(912) 356-2183

The public was notified of the public comment period through mailings of the *SRS Environmental Bulletin*— a newsletter sent to approximately 3500 citizens in South Carolina and Georgia—and through notices in the *Aiken Standard*, the *Allendale Citizen Leader*, the *Augusta Chronicle*, the *Barnwell People-Sentinel*, and *the State newspapers*. The public comment period was also announced on local radio stations.

The 45-day public comment period began January 20, 1998, and ended on March 5, 1998. A public briefing was provided in the CAB subcommittee meeting on February 23, 1998. In the meeting, SRS briefed the public regarding the path forward for the remediation of FRB. At the meeting, a concern was raised over the need to grout the contaminated soil in addition to capping the basin soil. Consequently, an extension for the public comment period was granted, extending the period to April 4, 1998. A formal public comment was also received which questioned the risk reduction and necessity of soil grouting. CAB recommendation No. 56 (Appendix A) was also received on March 28, 1998. The SRS response to this concern is provided with this ROD in the Responsiveness Summary (Appendix A). It will also be available with the final RCRA permit. The response to public comment and CAB recommendation has been accepted by EPA and SCDHEC.

IV. SCOPE AND ROLE OF THE OPERABLE UNIT WITHIN THE SITE STRATEGY

RCRA/CERCLA Programs at SRS

RCRA/CERCLA units (including the FRB) at SRS are subject to a multi-stage remedial investigation process that integrates the requirements of RCRA and CERCLA as outlined in the RFI/RI Program Plan (WSRC, 1993b). The RCRA/CERCLA process summarized in Figure 4 consists of investigation and characterization of potentially impacted environmental media (such as soil, groundwater, and surface water) comprising the waste unit and surrounding areas, the evaluation of risk to human health and the local ecological community; the screening of possible remedial actions to identify the selected technology which will protect human health and the environment; implementation of the selected alternative; documentation that the remediation has been performed competently; and evaluation of the effectiveness of the technology. The steps of this process are iterative in nature and include decision points which involve concurrence between the DOE (as owner/manager), the EPA and SCDHEC (as regulatory oversight), and the public. The RCRA/CERCLA process was used for the characterization of the FRB OU, and for developing the remedial alternatives and finally selecting the remedial action.

F-Area Retention Basin (281-3F) Remedial Strategy

The FRB OU includes the retention basin (basin soils), the former process server line (pipeline, pipeline sediment, and pipeline associated soils), and groundwater associated with the unit. The F-Area Retention Basin is located within the Fourmile Branch Watershed (see Figure 1). Several source control and groundwater operable units within this watershed will be evaluated to determine future impacts, if any, to the associated streams and wetlands. It is the intent of SRS, EPA, and SCDHEC to manage these sources contamination to minimize impact to the watershed.

Presently, based on the characterization and risk assessment information, the FRB OU does not significantly impact the watershed. The investigation and sampling for the FRB OU considered all unit specific groundwater. Based on the results of the investigation of the groundwater, the contamination in the water table aquifer is not attributable to the wastes associated with FRB OU. Upon disposition of all the source control and groundwater operable units within this watershed, a final, comprehensive evaluation of the watershed will be conducted to determine whether any additional actions are necessary.

The preliminary investigation conducted for the FRB OU identified two primary sources of contamination: (1) the former basin; and (2) the process sewer line leading from the F-Area Canyon Facility and the F-Area Tank Farm to the FRB. To characterize the FRB OU and to identify the primary sources of contamination and primary contaminated media, numerous environmental investigations were conducted at the unit between 1993) and 1997. The *Groundwater Sampling Report with Residential* Risk *Assessment for the F-Area Retention Basin* (WSRC, 1997a) and the *Remedial Investigation with the Baseline Risk Assessment Report for the F-Area Retention Basin* (WSRC, 1997b) contain detailed analytical data for all the environmental media samples taken in the characterization of the FRB OU. These reports are part of the Administrative Record File (see Section III). The primary media of contamination determined included soils associated with the former basin area primarily the subsurface soils (deeper than 1.2 m [4 ft]); the surface [0-0.6 m (0-4 ft) and subsurface soils associated with process sewer line area; and sediment within the sewer pipeline. Only human health COCs (i.e., Cs-137, Ra-226, K-40, thallium) were identified in the surface soil and only one CMCOC (Sr90) was identified in the subsurface soil. Radionuclide contaminants in subsurface soil (deep soils, 6-14 feet) represent a principal threat source material (i.e., highly toxic or highly mobile contaminants which would present a significant risk to human health or the environment should exposure occur). No COCs associated.with FRB OU were identified for the groundwater. To address the remediation of FRB OU soils, various potential remedial alternatives were developed and evaluated. After evaluation, the alternatives S5 and P4 were selected as the preferred remedies for FRB OU soils and sewer pipeline, respectively. For the groundwater, no action was selected as the preferred remedy. However, groundwater monitoring is included as an integral part of S5 alternative to monitor the effectiveness of the remedial action against any future leaching of Sr-90; to mitigate any uncertainty in the environmental data collected during the investigations; and to confirm that there are no upgradient sources to the FRB OU groundwater. In the event, monitoring detects contamination above MCLs (or RBCs) for those constituents attributable to the FRB OU or an unknown upgradient source, for two consecutive monitoring periods, the regulators will be informed within 30 days. A plan for evaluating the data and developing further action will be submitted within 90 days for regulatory approval. The plan will also include a schedule for assessing the need for corrective action and a schedule for developing the specifics for that corrective action.

The preferred remedies meet the remedial action objectives of the remedial actions, as described in Section VII of the ROD, for the former basin area soil and groundwater as well as the soils

Figure 4. RCRA/CERCLA Logic and Documentation

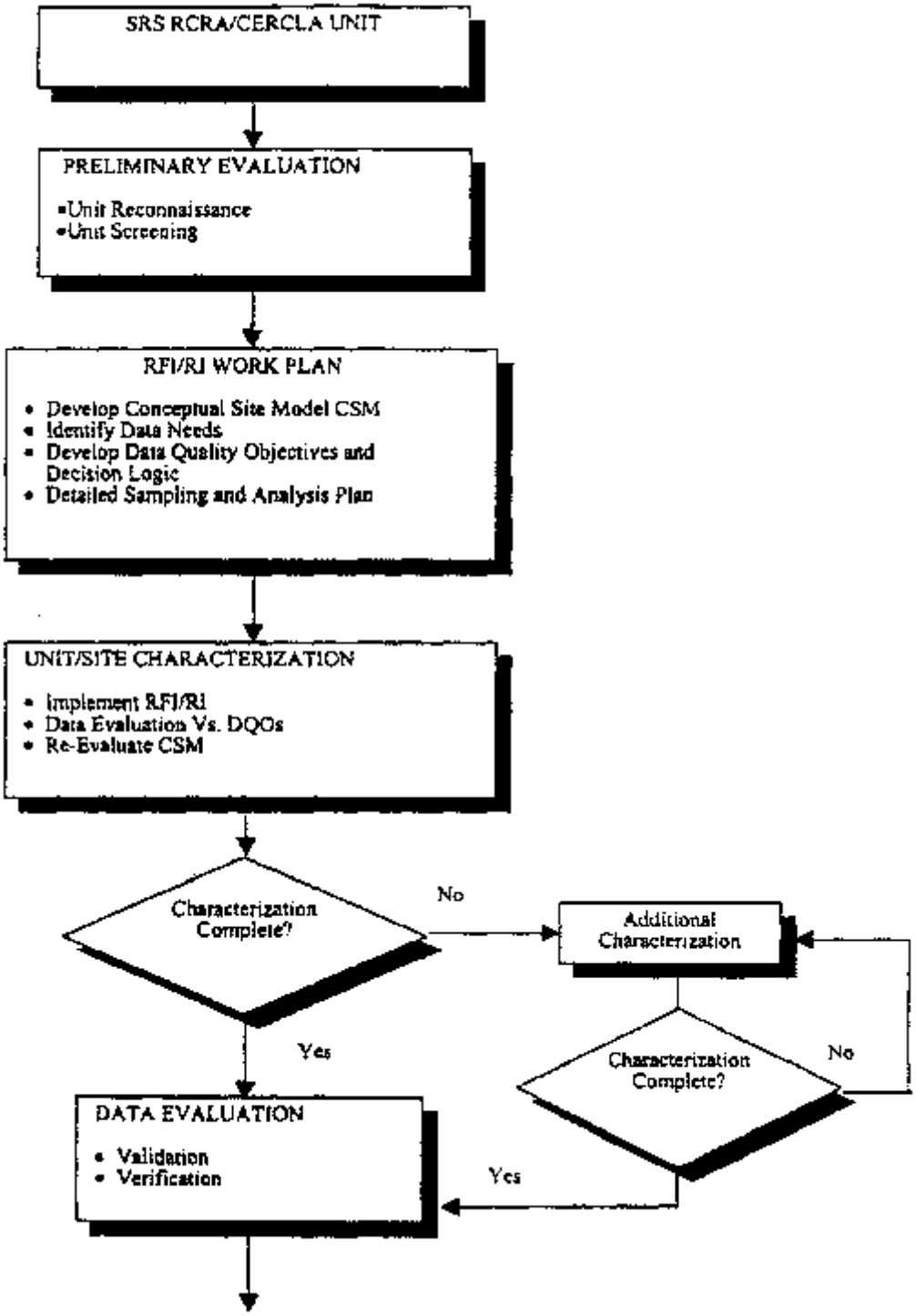
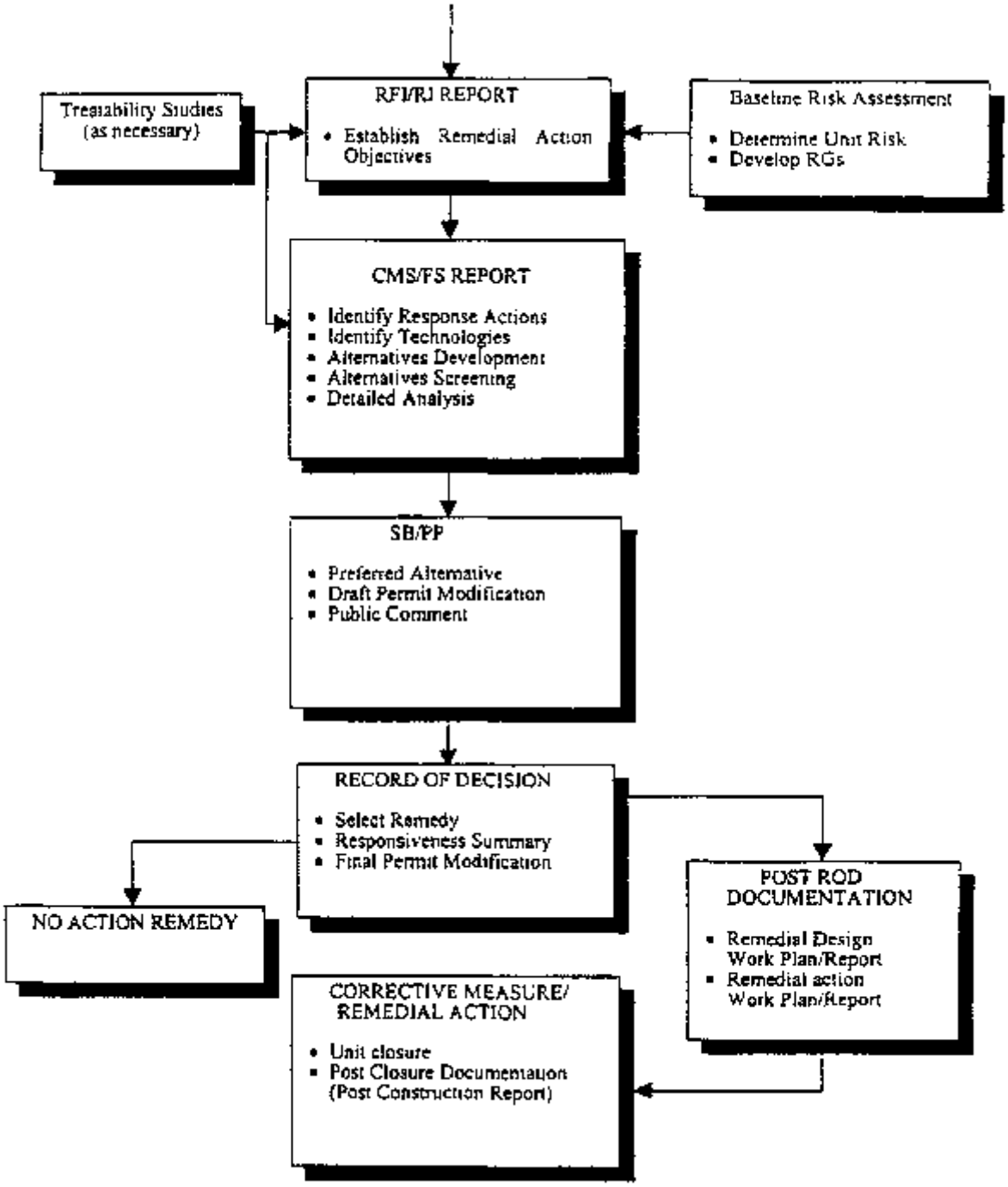


Figure 4. (Cont'd). RCRA/CERCLA Logic and Documentation



associated with the process sewer line area and significantly contribute toward the overall protection of the groundwater as a resource.

V. OPERABLE UNIT CHARACTERISTICS

Media Assessment

The primary sources of contamination associated with the FRB OU are the former basin and abandoned process sewer line. A Conceptual Site Model (CSM) (Figure 5) was developed for both the basin and the process sewer line to identify the primary sources, primary contaminated media, migration pathways, exposure pathways, and potential receptors for FRB OU. The detailed analytical data for all the environmental media samples taken in the characterization of the FRB OU are contained in two reports: *The Remedial Investigation with the Baseline Risk Assessment Report for the F-Area Retention Basin (U)* (WSRC 1997a); and *Groundwater Sampling Report with Residential Risk Assessment for the F-Area Retention Basin* (WSRC 1997a). The documents are available in the Administrative Record File (see Section III).

The primary data used for the RI/BRA report was collected during the environmental investigations conducted at the unit between 1993 and 1995. These investigations included a soil-gas survey, soil sampling, groundwater sampling, and field measurement of radionuclides. Also, two horizontal bore holes were drilled and monitored for radionuclides in real-time using Environmental-Measurement-While-Drilling Gamma Ray Spectrometer System Technology.

Surface and subsurface soil samples were collected in the area of the former basin, in the adjacent basin overflow area, and in the area along the abandoned process sewer line. Samples were also collected from residual water and sediments in the sewer pipeline. Figure 6 shows sampling locations in and around the F-Area Retention Basin. All samples were analyzed in accordance with EPA-approved protocols. Results of the environment investigation and subsequent analysis indicate the following:

- Groundwater quality has not been adversely affected at this site

Figure 5. Revised Conceptual Site Model for the F-Area Retention Basin and Process Sewer Line

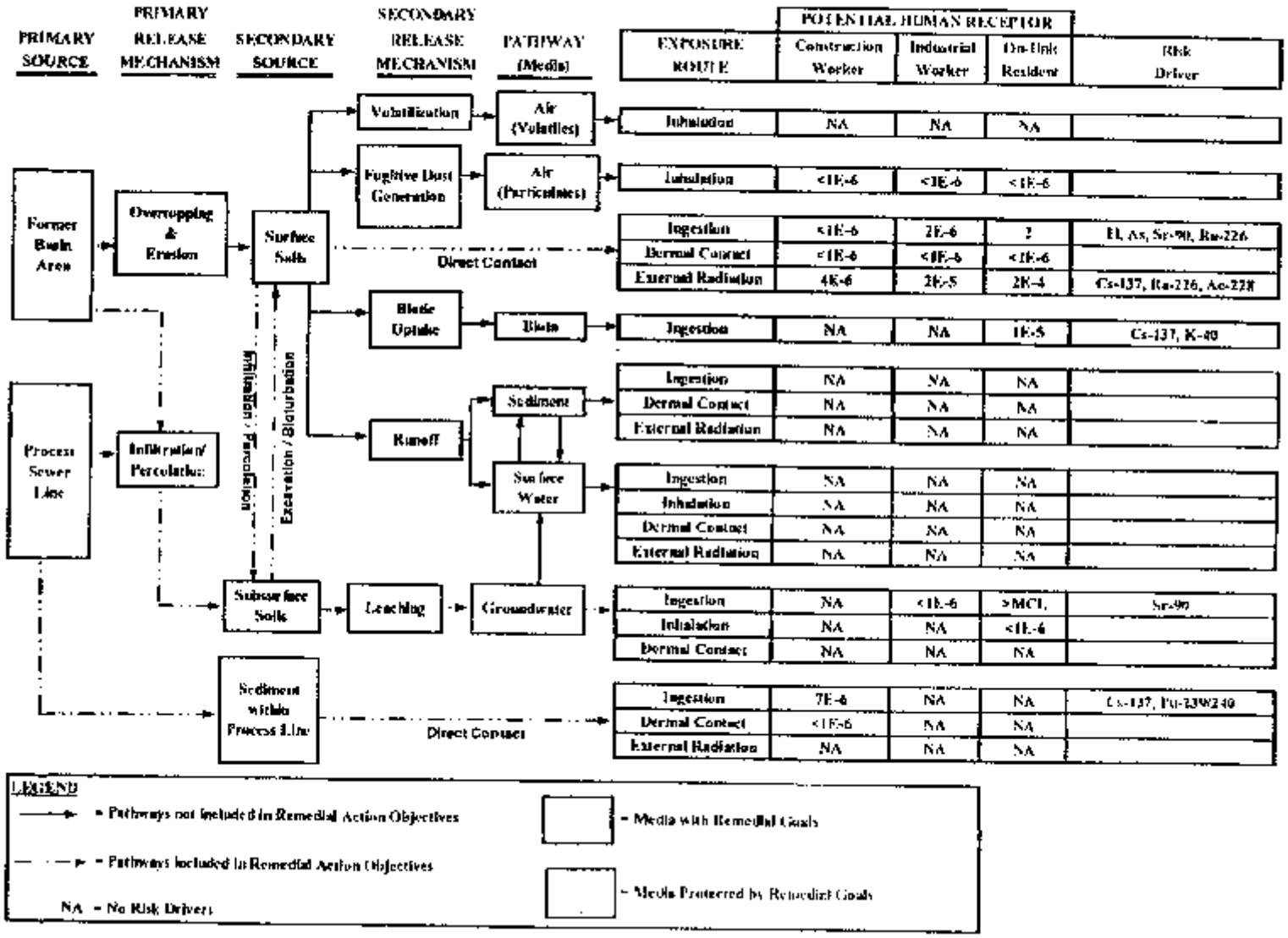
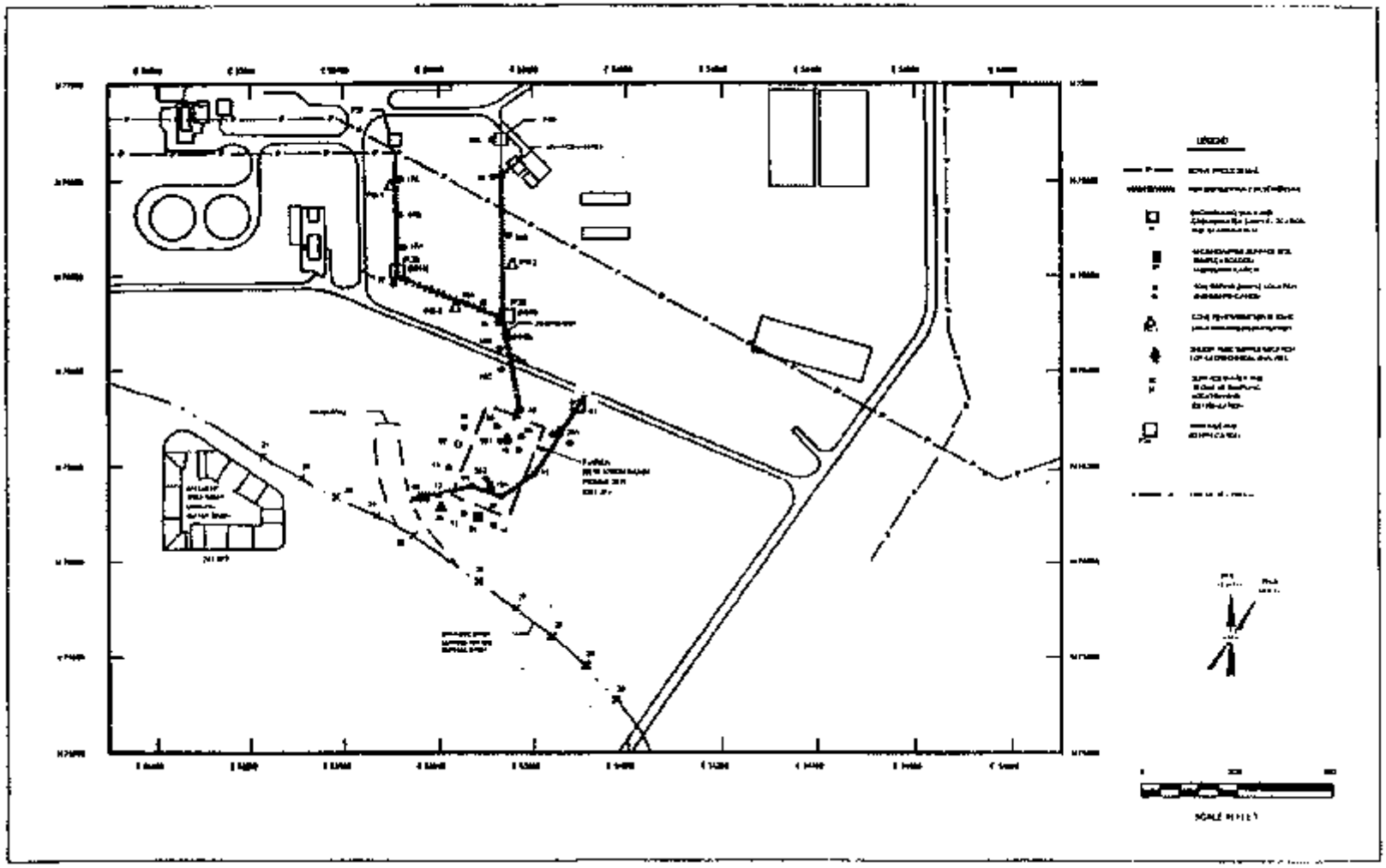


Figure 6. Sampling Locations in and Around the F-Area Retention Basin



- Levels of Sr-90 in soil beneath the basin represent a risk that future contaminant migration could result in contamination of the groundwater

- Levels of contaminants (example Sr-90 and Cs-137) at depth represent principal threat source material (i.e., highly toxic or highly mobile contaminants that would present a significant risk to human health or the environment should exposure occur).

- Levels of the remaining radioactive and non-radioactive contaminants in soil beneath the basin do not represent a risk that future contaminant migration could result in contamination of the groundwater

- Levels of several contaminants (e.g., Cs-137) in surface soil represent a potential risk to human health

- Levels of contamination in the surface soil and beneath the basin do not represent a risk to ecological receptors

Nature and Extent of Contamination

The CSM was developed for two primary sources: (1) the former basin area; and (2) the process sewer line area. The CSM also identified primary as well as secondary release mechanisms for both sources.

During characterization, primary contamination sources and release mechanisms were also identified using CSM. The results of the investigations and CSM are summarized below.

Primary Sources and Release Mechanisms

The primary release mechanisms for contamination from the former basin area are infiltration/percolation of contaminants to groundwater and overflow of the basin. The overflow of the basin could result in the discharge of contaminants to surface soils and to the nearby drainage ditch. The sole primary release mechanism identified by CSM for contaminants associated with the process sewer line area is the escape of contaminants through defects in the line, followed by percolation of contaminated water to the groundwater.

Secondary Sources and Release Mechanisms

The CSM identified surface soil and subsurface soil (deep soil) in the basin and around the perimeter of the basin as secondary sources for the former basin area. The surface soil and subsurface soil (deep soil) along the abandoned process sewer line were also identified as secondary sources for the abandoned process sewer line. The sediment in the process sewer line is an additional secondary source for the process sewer line.

The secondary release mechanisms for the basin surface soil included volatilization, fugitive dust generation, biotic uptake, and runoff. Leaching was identified as the secondary release mechanism for subsurface soils. The secondary release mechanisms for the process sewer line included volatilization, fugitive dust generation and biota uptake for surface soil and leaching for the subsurface soils. No secondary release mechanism was identified for the sediment in the process sewer line.

Unit Specific Constituents

Constituent concentrations found in soil, groundwater, and surface water were compared against twice the background concentrations. The groundwater concentrations were compared with EPA primary Drinking Water Standards (i.e., MCLs) or twice the mean background concentrations, where no MCL exists. Unit constituents that exceeded twice the background concentration were considered Unit-Specific Constituents (USCs). These USCs were used to define the nature and extent of contamination at the unit and were evaluated in detail in the RI/BRA report to reflect risk to human health or the environment. Table 1 contains the list of USCs identified for the FRB source OU. These include 7 inorganics, 16 organics, and 22 radionuclides.

Former Basin Area

USCs were detected in subsurface soils within the former basin area. The metals arsenic and beryllium and several radiological parameters exceeded maximum screening level concentrations. Primarily, Cesium-137 and Strontium-90 were the radiological parameters with the highest detected concentrations. Their concentrations exceeded twice the background concentrations by factors of 38,000 and 2,570, respectively. Europium-154 also exceeded the maximum screening level concentration for deep soils. Beryllium slightly exceeded its maximum screening level in one surface soil sample. Cesium-137 and Radium-226 (a naturally occurring isotope) slightly exceeded their maximum screening levels in several surface and

Table 1. Unit-Specific Constituents Identified for the FRB Source Operable Unit

Inorganic	Organics	Radionulides
Arsenic	Acetone	Actiniun-228
Barium	Carbon disulfide	Americium-241
Beryllium	2-Chlorophenol	Carbon-14
Chromium	Dibenzofuran	Cesium-137
Lead	1,1-Dichloroethane	Cobalt-57
Nickel	Dichloromethane	Cobalt-60
Thallium	Di-n-butyl phthalate	Europium-154
	Ethylbenzene	Europium-155
	Methyl ethyl ketone	Lead-212
	N-Nitrosodiphenylamine	Nickle-63
	Styrene	Plutonium-238
	Tetrachloroethene	Plutonium-239/240
	Toluene	Potassium-40
	Trichloroethylene	Promethium-147
	Trichlorofluoromethane	Radium-226
	Xylenes	Sodium-22
		Strontium-90
		Technetium-99
		Thorium-234
		Uranium-233/234
		Uranium-235
		Uranium-238

shallow subsurface soil samples taken in the basin area. USCs were also identified in surface soils and shallow subsurface soils within the former basin area. However, these USCs are not associated with operation of the basin since the former basin was backfilled in 1978 with clean soil. Hence, only USCs identified in subsurface soils could be attributable to past operations.

USCs were also detected in soils adjacent to the former basin (overflow area). Beryllium, Cesium-137, and Thallium, Radium-226, and Plutonium 239/240 were detected and exceeded twice the background levels. These detections, however, closely matched the detected levels in the background borings and did not exhibit any discernible pattern of contamination. Therefore, the soils in the basin overflow area do not appear to have been adversely impacted by basin overflow.

Process Sewer Line Area

USCs were detected in residual water in the abandoned process sewer line and manholes. Primarily, Cesium-137 and Strontium-90 were the radiological parameters with the highest detected concentrations. Cesium-137 exceeded its maximum screening level concentration by a factor of 327 while Strontium-90 exceeded its maximum screening level concentration by a factor of 94.4. These were also the largest margins by which the maximum screening level concentrations were exceeded.

USCs were detected in residual sediments in the abandoned process sewer line. The inorganic constituents Arsenic and Beryllium exceeded their maximum screening level concentrations. Cesium-137, Strontium-90, and Plutonium-239/240 were the radiological parameters with the highest detected concentrations that exceeded their maximum screening level concentrations.

The concentrations exceeded their twice background levels by factors of 24,600, 118, and 86.3, respectively.

USCs were detected in soils adjacent to the abandoned process sewer line. Arsenic and Beryllium were the inorganic constituents that exceeded maximum screening level concentrations. The radiological parameters that exceeded maximum screening level concentrations were Cesium-137 and Strontium-90. Their maximum concentrations occurred in deep samples and exceeded their twice background levels by factors of 368 and 51.9, respectively.

Groundwater

The only contaminant detected (a single detect) in groundwater was trichloroethylene at sampling location FR.B-2 (see Figure 6), but it was also detected in the background well. This could indicate that the trichloroethylene originated from an area hydraulically, upgradient from

the site, particularly since a trichloroethylene source was not found in the soil. Metals other than common cations were not detected consistently. Only one radiological analyte was detected above twice background concentrations, and only in one round of sampling. However, based on the data collected in January 1997 and February 1997, activities associated with the former basin do not appear to have impacted the groundwater.

Groundwater Transport Analysis

In response to a recommendation from the Citizens Advisory Board (CAB), transport modeling was performed for the most prevalent radioactive constituents (e.g., Sr-90 and Cs-137). This analysis was performed using RESRAD modeling for leachability of contaminants. Results of this analysis indicate that only Sr-90 is predicted to reach the groundwater at levels which exceed relevant standards. This analysis supersedes overly conservative calculations reported in the RFI/BRA which indicated that TC-99 and Sr-90 could potentially contaminant groundwater. However, the remedy to stabilize the Sr-90 will also reduce the mobility of Tc-99 and the other radioactive contaminants present in the soil.

VI. SUMMARY OF OPERABLE UNIT RISKS

As part of the F-Area Retention Basin RFI/RI process, a baseline risk assessment (BRA) was prepared to evaluate the potential risk to human health and the environment from chemical and radioactive contaminants identified in investigations at the FRB. The following sections outline the results of the human health and ecological risk characterizations conducted as part of the assessment. A complete discussion of the risk assessment methodology, receptor analysis, risk characterizations, and uncertainty within the characterizations can be found in the *Groundwater Sampling Report with Residential Risk Assessment for the F-Area Retention Basin* (WSRC, 1997a) *and the Remedial Investigation with the Baseline Risk Assessment Report for the F-Area Retention Basin* (WSRC, 1997b).

Unit-specific data from the RFI/RI were used to identify and screen constituents of potential concern (COPCs). Exposure point concentrations were calculated and used to estimate potential

exposures and risks to humans and wildlife. Carcinogenic risks and hazard indices. (HIs), based on a combination of exposure scenarios, locations, and receptors identified in the CSM, were calculated and then compared to EPA risk guidelines [i.e., 1×10^{-4} to 1×10^{-6} carcinogenic risk, HI > 1, and ecological effects quotient (EEQ) > 1]. COPCs were screened and identified as preliminary COCs (PCOCs) and designated as primary or secondary COCs, based on their individual contribution to total media risk or hazard.

Human Health Risk Assessment

To evaluate the risk to human receptors due to the contamination at the FRB, unit-specific analytical data are used to identify COPCs. Exposure point concentrations are determined for each COPC to estimate the potential exposure for various receptors and exposure scenarios. The current land use scenario is inactive industrial use and an infrequent on-unit visitor (researcher or sampler) was postulated but quantitative risks were not determined for this receptor because SRS programs and procedures are implemented to protect workers from harmful exposure to contaminants at waste units. Receptors for the future land use exposure scenario identified for the former basin area included an on-unit industrial worker and an on-unit resident (adult/child). Receptors identified for future land use at the process sewer line area included an on-unit industrial worker, an on-unit resident (adult/child), and an on-unit construction worker (Figure 5).

Following the selection of human receptors for evaluation, the carcinogenic risks and the noncarcinogenic health hazards were estimated for each COPC and for each pathway/receptor combination based on EPA guidance (EPA, 1989b).

Carcinogenic risk is defined as the incremental probability of an individual developing cancer over a lifetime as a result of pathway-specific exposure to cancer-causing contaminants. The risk to an individual resulting from exposure to non-radioactive chemical carcinogens is expressed as the increased probability of cancer occurring over the course of a 70-year lifetime. At Superfund sites incremental risk from carcinogens is compared to the EPA target risk range of one in ten thousand (1×10^{-4}) to one in one million (1×10^{-6}).

Noncarcinogenic hazards are also evaluated to identify a level at which there may be concern for potential noncarcinogenic health effects. The hazard quotient (HQ), which is the ratio of the exposure dose to the reference dose, is calculated for each contaminant. HQs are summed for each exposure pathway to determine the specific HI for each exposure scenario. If the HI exceeds unity (1.0), there is the potential for adverse health hazards.

Former Basin Area

Future Land Use Carcinogenic Risks

The future on-unit industrial worker has three exposure routes with carcinogenic risks within the target range of 1×10^{-4} to 1×10^{-6} (Table 2). External radiation exposure to surface soil has a risk, of 2×10^{-5} primarily due to Cs-137 and Ra-226. Ingestion of subsurface soil has a risk of 2×10^{-6} primarily due to arsenic. External radiation exposure to subsurface soil has a risk of 9×10^{-6} primarily due to Cs-137 and Ra-226. The risks for the future worker from all other pathways are less than the EPA action level (1×10^{-6}).

Several pathways for the future on-unit resident have estimated risks within the target range (Table 2). External exposure to radionuclides in surface soil has a risk of 2×10^{-4} primarily due to Cs-137, K-40, and Ra-226. Ingestion of produce grown on surface soil has a risk of 1×10^{-5} primarily due to plant uptake of Cs-137 and K-40. Exposure to subsurface soil has a risk of 8×10^{-6} from ingestion primarily due to arsenic, Pu-239/240, Ra-226, and Cs-137. External exposure to radionuclides in subsurface soil has a risk of 8×10^{-5} primarily due to Cs-137 and Ra-226. Ingestion of produce grown on subsurface soil has a risk of 5×10^{-6} primarily due to plant uptake of Cs-137 and K40. RESRAD modeling indicates that the MCL for Sr-90 (8 pCi/L) will be exceeded by leaching from deep soils (>4 feet deep) with the peak concentration of 79 pCi/L reached in 76 years (*E7 Calc Note reference*).

Noncarcinogenic Hazards

The BRA shows that potential adverse noncarcinogenic health effects are not likely to occur for the future on-unit worker because the sum of HIs for all pathways evaluated is less than the value of 1.0 (Table 2).

The HIs for hypothetical future resident exposures equal or exceed 1.0 for the ingestion of surface soil (0-1 foot) and subsurface soil (0-4 feet) (Table 2). The HI for ingestion of surface soil equals 1 and is primarily the result of thallium. The HI for ingestion of subsurface soil equals 2 and is primarily the result of thallium and arsenic.

Table 2. Summary of Risk-Based COPCs, Grouped by Exposure Route

Receptor *	Exposure Route/Medium	Preliminary COCs	Carcinogenic Risks	Hazard Index
Former Basin Area Hypothetical Future Worker	External Radiation / Surface Soil	Cs-137, Ra-226	2×10^{-5}	
	External Radiation / Subsurface Soil	Cs-137, Ra-226	2×10^{-6}	
	Ingestion / Subsurface Soil	As	2×10^{-6}	
Hypothetical Future Resident	External Radiation / Surface Soil	Cs-137, K-40, Ra-226	2×10^{-4}	
	Ingestion / Subsurface Soil	Ti		1
	Ingestion / Produce Grown on Surface Soil	Cs-137, K-40	1×10^{-5}	
	External Radiation / Subsurface Soil	Cs-137, Ra-226	8×10^{-5}	
	Ingestion / Subsurface Soil	As, Ti, Pu-239/240, Ra-226, Cs-137	8×10^{-5}	2
	Ingestion / Produce Grown on Surface Soil	Cs-137, Ra-226	5×10^{-6}	
	Ingestion / Deep Soil Leaching to Groundwater	Sr-90	Exceedance of MCL	
Process Sewer Line Area Hypothetical Future Worker	External Radiation / Surface Soil	Cs-137, Ra-226,Ac-228	1×10^{-5}	
	External Radiation / Subsurface Soil	Cs-137, Ra-226, Ac-228	9×10^{-6}	
Hypothetical Future Construction Worker	External Radiation / Surface Soil	Cs-137, Ra-226	4×10^{-6}	
	External Radiation / Subsurface Soil	Cs-137, Ra-226	4×10^{-6}	
	Ingestion / Sediments within Pipeline & Manholes	As, Cs-137, Pu-239/240	8×10^{-6}	
Hypothetical Future Resident	External Radiation / Surface Soil	Cs-137, Ra-226, Ac-228	1×10^{-4}	
	Ingestion / Surface Soil	As	3×10^{-6}	
	Ingestion / Produce Grown on Surface Soil	Cs-137, K-40	5×10^{-6}	
	External Radiation / Surface Soil	Cs-137, Ra-226, Ac-228	1×10^{-4}	
	Ingestion / Subsurface Soil	As, Ra-226, Sr-90	5×10^{-6}	
	Ingestion / Produce Grown on Subsurface Soil	Cs-137, K-40	5×10^{-6}	

* No Ecological Receptors were identified as being impacted by USCs

As = arsenic
Tl = Thallium
Cs-137 = Cesium-137
Ra-226 = Radium-226
K-40 = Potassium-40
Pu-239/240 = Plutonium-239/240
Ac-228 = Actinium-228
Sr-90 = Strontium-90

Total Pathway Risks and Hazard Indices

Carcinogenic risks and noncarcinogenic hazards associated with the individual exposure pathways for surface soil (0-1 ft) and subsurface soil (0-4 ft) have been summed to obtain total pathway risks and HIs for each receptor (worker and resident).

The total pathway risk values for the hypothetical future on-unit worker and hypothetical future on-unit resident are 3×10^{-5} and 3×10^{-4}, respectively. The risk values that exceeded the EPA point of departure (1×10^{-6}) for the future receptors are a result of exposure to constituents in soil. Additionally, leaching of Sr-90 from deep soil to the groundwater will exceed the MCL by almost 10-fold in 76 years.

Total pathway HIs exceeded 1.0 for the future on-unit resident. These HIs were1 [for pathways excluding subsurface soil (0-4 ft)] and 2 [for pathways excluding surface soil (0-1 ft)]. The noncarcinogenic hazards for the future on-unit resident were a result of exposure to metals in surface and subsurface soil.

Process Sewer Line Area

Future Land Use Carcinogenic Risks

The future on-unit industrial worker has two exposure routes with carcinogenic risks within the target range of 1×10^{-4} to 1×10^{-6} (Table 2). External radiation exposure to surface soil has a risk of 1×10^{-5} primarily due to Ra-226, Cs-137, and Ac-228. External radiation exposure to subsurface soil has a risk of 9×10^{-6} primarily due to Ra-226, Cs-137, and Ac-228. The risks for the future worker from all other pathways are less than the EPA action level (1×10^{-6}).

The future on-unit construction worker has two exposure routes with carcinogenic risks within the target range of 1×10^{-4} to 1×10^{-6} (Table 2). External radiation exposure to surface soil has a risk of 4×10^{-6} primarily due to Ra-226 and Cs-137. External radiation exposure to subsurface soil has a risk of 4×10^{-6} primarily due to Ra-226 and Cs-137. Ingestion of sediments contained within the pipeline and manholes has a risk of 8×10^{-6} primarily due to arsenic, Cs- 137, and Pu-239/240. The risks for the future worker from all other pathways are less than the EPA point of departure (1×10^{-6}).

Several pathways for the future on-unit resident have estimated risks within the target range (Table 2). Ingestion of surface soil has a risk of 3×10^{-6} primarily due to arsenic. External exposure to radionuclides in surface soil has a risk of 1×10^{-4} primarily due to Cs-137, Ac-228, and Ra-226. Ingestion of produce grown on surface soil has a risk of 5×10^{-6} primarily due to plant uptake of Cs-137 and K-40. Exposure to subsurface soil has a risk of 5×10^{-6} from ingestion primarily due to arsenic, Ra-226, and Sr-90. External exposure to radionuclides in subsurface soil has a risk of 1×10^{-4} primarily due to Ac-228, Cs-137, and Ra-226. Ingestion of produce grown on subsurface soil has a risk of 5×10^{-6} primarily due to plant uptake of Cs-137 and K-40.

Noncarcinogenic Hazards

The BRA shows that potential adverse noncarcinogenic health effects are not likely to occur for the future on-unit worker, construction worker, and resident because the sum of HIs for all pathways evaluated is less than the value of 1.0 (Table 2).

Total Pathway Risks and Hazard Indices

Carcinogenic risks and noncarcinogenic hazards associated with the individual exposure pathways for surface soil (0-1 ft), subsurface soil (0-4 ft), and sediment in the pipeline and manholes have been summed to obtain total pathway risks and HIs for each receptor (worker and resident).

The total pathway risk values for the hypothetical future on-unit worker, future construction worker, and hypothetical future on-unit resident are 1×10^{-5}, 3×10^{-2} and 5×10^{-4}, respectively. The risk values that exceeded the EPA point of departure (1×10^{-6}) for the future receptors are a result of exposure to constituents in soil.

Total pathway HIs did not exceed the threshold of 1.0 for any of the exposure pathways.

Table 3. Contaminants of Concern for Soil at the FRB Operable Unit with Maximum Detected Concentrations and Remedial Goals

Former Basin Area			
Medium	**Analyte**	**Maximum Detect**	**RG for soil**
Surface Soil (0-1 foot)	Cesium-137 Potassium-40 Radium-226 Thallium*	0.29 pCi/g 2.49 pCi/g 0.931 pCi/g 6.12 mg/kg	0.74 pCi/g 2.53 pCi/g 0.226 pCi/g 25.9 mg/kg
Surface Soil (0-4 foot)	Arsenic Cesium-137* Potassium-40 Radium-226 Thallium*	7.13 mg/kg 10.9 pCi/g 3.04 pCi/g 0.931 pCi/g 6.93 mg/kg	11.1 mg/kg 0.74 pCi/g 2.53 pCi/g 0.226 pCi/g 25.9 mg/kg
Groundwater (current)	None	N/A	N/A
Leachability to Groundwater from FRB Soil	Strontium-90	79 pCi/L @ 76yrs (modeled level)	109 pCi/g**

Process Sewer Line Area			
Medium	**Analyte**	**Maximum Detect**	**RG for soil**
Surface Soil (0-1 foot)	Arsenic* Actinium-228 Cesium-137 Lead-212* Potassium-40 Radium-226	20.8 mg/kg 1.57 pCi/g 2.69 pCi/g 165 pCi/g 2.42 pCi/g 1.21 pCi/g	11.1 mg/kg 0.202 pCi/g 0.74 pCi/g 2.19 pCi/g 2.53 pCi/g 0.226 pCi/g
Surface Soil (0-4 foot)	Arsenic* Actinium-228 Cesium-137 Lead-212* Potassium-40 Radium-226 Strontium-90	17.7 mg/kg 2.51 pCi/g 21.3 pCi/g 2.44 pCi/g 1.49 pCi/g 2.60 pCi/g 21.8 pCi/g	11.1 mg/kg 0.202 pCi/g 0.74 pCi/g 2.19 pCi/g 2.53 pCi/g 0.226 pCi/g 233 pCi/g
Groundwater (current)	None	None	N/A
Sediment within the Pipeline & Manholes	Arsenic* Cesium-137* Plutonium-239/240*	16.3 mg/kg 2040 pCi/g 32.2 pCi/g	63.9 mg/kg 1.1 pCi/g 26.3 pCi/g

*Secondary COCs

**RG is the level of leachable contaminants from FRB soil that will not exceed the MCL in the future. The RG is derived from the RESRAD modeling for leachability (K-CLC-F-00030). The MCL for Strontium-90 is 8.0 pCi/L (CFR 1991).

Ecological Risk Assessment

The BRA also addressed the ecological risk associated with the former basin area and the process sewer line area. Risks from both nonradionuclide and radionuclide constituents were evaluated.

Quantitative risk estimations were based on a comparison of estimated intake to a predetermined toxicity reference value, expressed as a HQ. The assessment concluded that no ecological risk is associated with FRB OU.

Constituents of Concern

COCs were selected for the FRB because they exceed ARARs, because they exceed risk-based criteria in the BRA, or because they are projected to have the potential to leach to the groundwater at levels exceeding a maximum contaminant level (MCL). Primary COCs are defined in the human health risk assessment as constituents that contribute a chemical-specific risk of more than 1×10^{-6} or an HQ of greater than 0.1 to any media risk estimate that exceeds a 1×10^{-4} risk or an HI of 3. COCs projected to exceed an MCL due to soil leachability are also considered primary COCs. Secondary COCs are defined as those constituents in each medium contributing a chemical-specific risk greater than 1×10^{-6} or a HQ of at least 0.1 to a media with a risk greater than $1x\ 10^{-6}$, but not more than 1×10^{-4}, or a HI of one or greater, but not more than three. Final COCs are listed in Table 3. A pictorial representation of the distribution of Sr-90 where the soil concentration exceeds the leachability limit of 109 pCi/g (that would exceed the MCL of 8.0 pCi/L) is included in Figure 7. Figures 8 and 9 show that the Sr-90 concentrations outside of the basin area are below levels of concern.

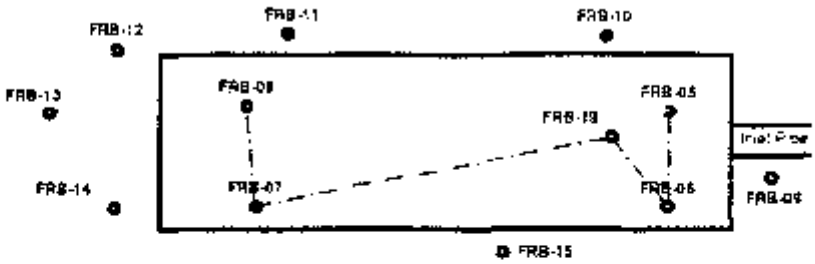
Principal Threat Source Material

Evaluated levels of radioactive contaminants in the FRB OU soils at depth meet the definition of principal threat source material. Principal threat source materials are those contaminants that are highly toxic or highly mobile and would represent a significant risk to human health or the environment should exposure occur, Cs-137, Ra-226, thallium, arsenic, and Sr-90 are present in the FRB OU soils at depth with Cs-137 and Sr-90 representing the highest levels. Distribution of Sr-90 by depth is shown in Figures 7, 8, and 9. Figures 10 through 12 present the distribution of Cs-137 by depth. Principal threat source material at depth are shown in Table 4.

Table 4. Principal Threat Source Material Contamination at Depth for the FRB Operable Unit with Their Maximum Detected Concentrations

Medium	Former Basin Area	
Subsurface Soil at Depth	Cs-137	2200 pCi/g
	Sr-90	1080 pCi/g
	Ra-226	1.37 pCi/g

Figure 7. Distribution of Sr-90 by Depth – FRB Basin Area



Sr-90 Distribution by Depth

Elevation above MSL	Surface Elevation:	FRB-08 269.90	FRB-07 271.90	FRB-19 274.40	FRB-06 276.20	FRB-05 273.40
276						
275					0.346	
274						
273				-0.27		
272		Ground Surface				2.61
271			1.75			
270						0.0713
269	Basin Bottom at 264 ft MSL	2.24	1.43			0.0713
268			1.43			
267		5.25				
266		5.25				
265					0.571	
264					0.571	9.99
263		23.2	91.3	12.3	[redacted]	9.99
262		23.2	91.3	12.3	[redacted]	[redacted]
261		102	[redacted]	93.1	[redacted]	[redacted]
260		102	[redacted]	93.1	[redacted]	[redacted]
259		13.8	13.4	[redacted]	[redacted]	[redacted]
258		13.8	13.4	[redacted]	[redacted]	[redacted]
257		6.35	6.7	[redacted]	[redacted]	[redacted]
256		6.35	6.7	[redacted]	[redacted]	81.5
255			1.62	[redacted]		81.5
254			1.62	[redacted]		13
253				[redacted]		13
252				[redacted]		32.7
251				[redacted]		32.7
250				[redacted]		
249				[redacted]		
248				[redacted]		
247				[redacted]		
246				[redacted]		
245				38.7		
244				38.7		
243				13.3		
242				13.3		
241				24.9		
240				24.9		

[redacted] Exceeds RESRAD Soil Leachability Level of 109 pCi/g that would exceed the MCL of 8.0 pCi/L.

Figure 8. Distribution of Sr-90 by Depth — FRB Basin Area

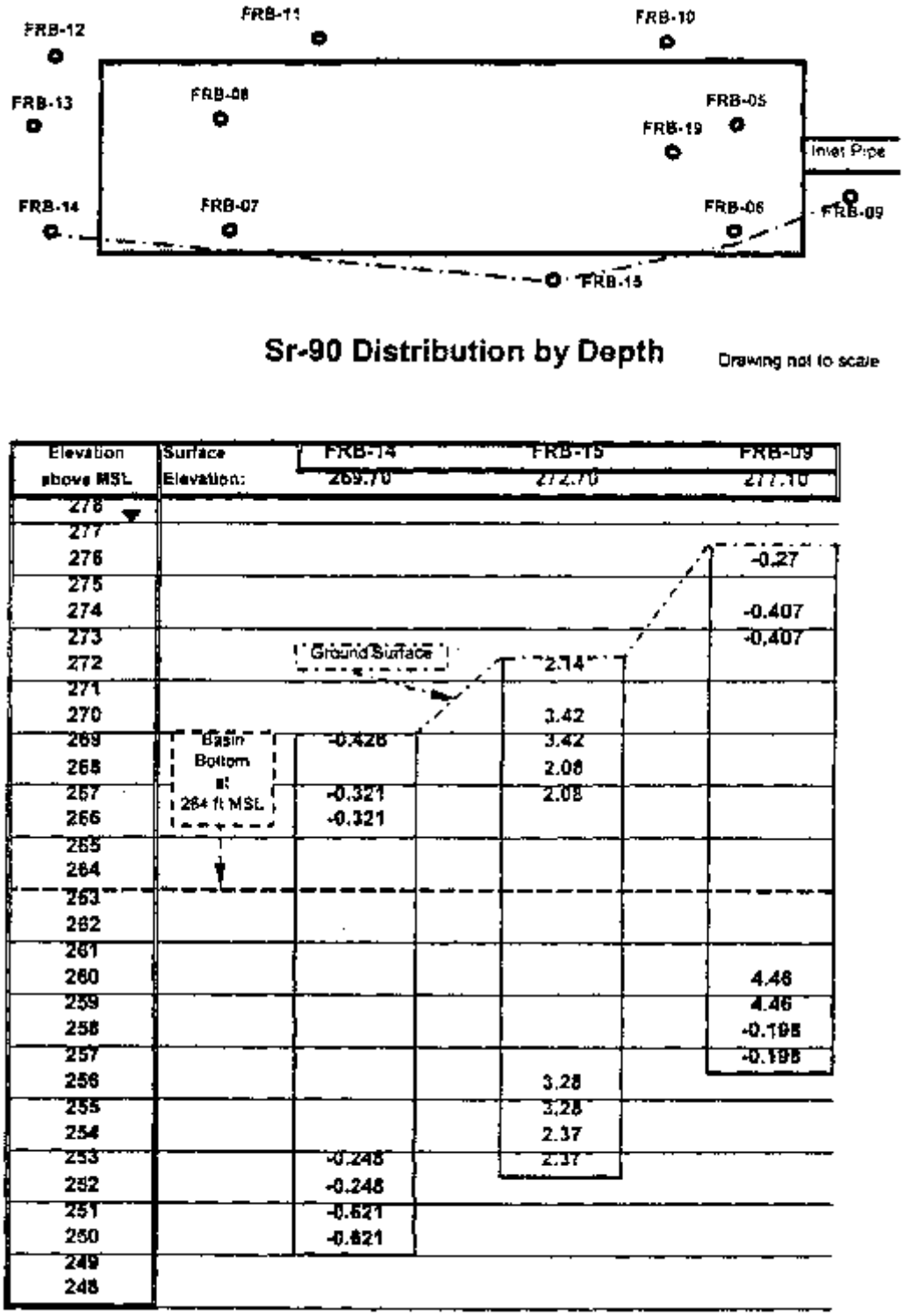


Figure 9. Distribution of Sr-90 by Depth — FRB Basin Area

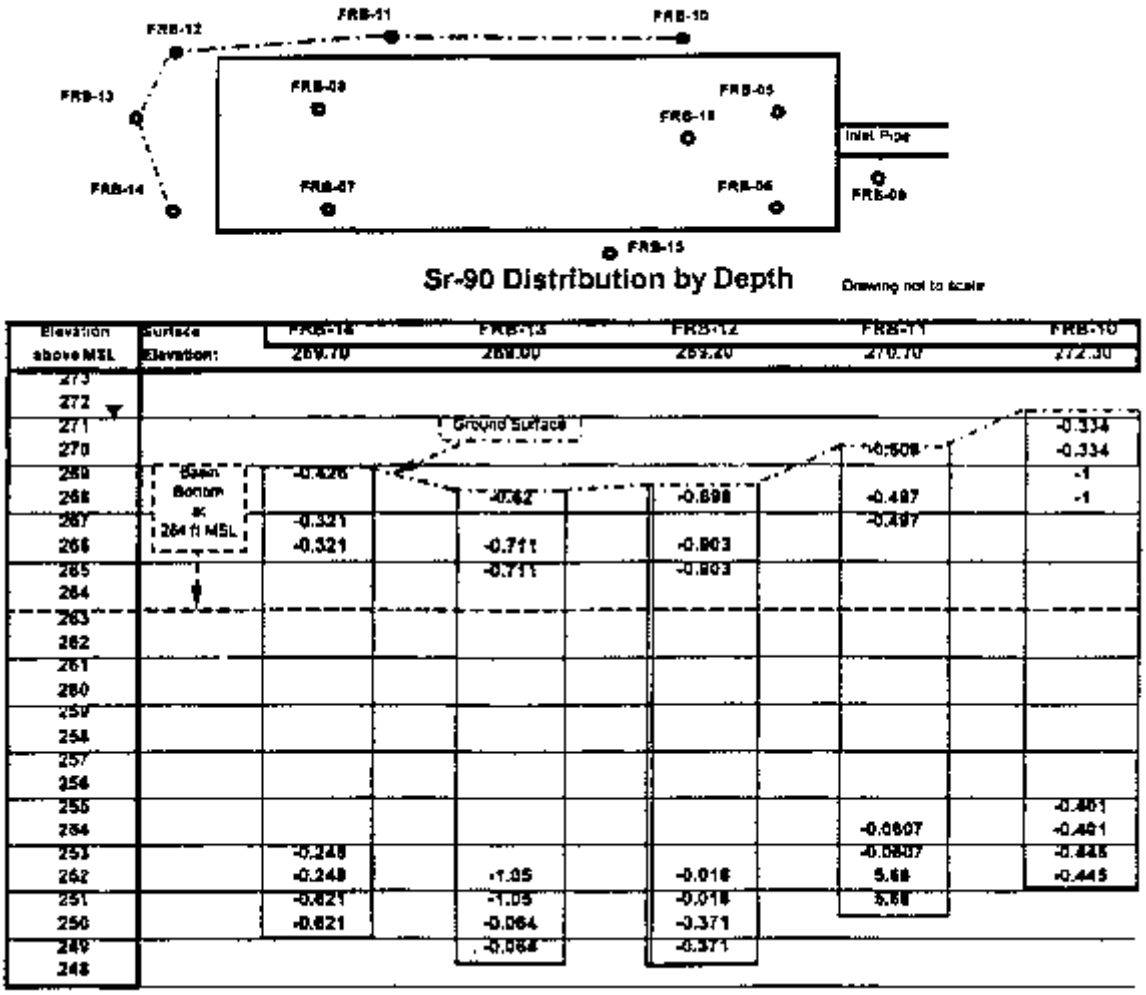
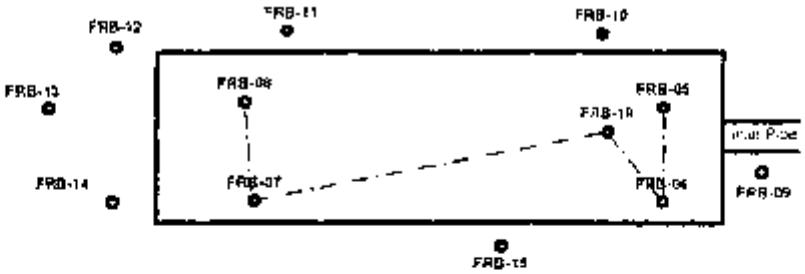


Figure 10. Distribution of Cs-137 by Depth — FRB Basin Area

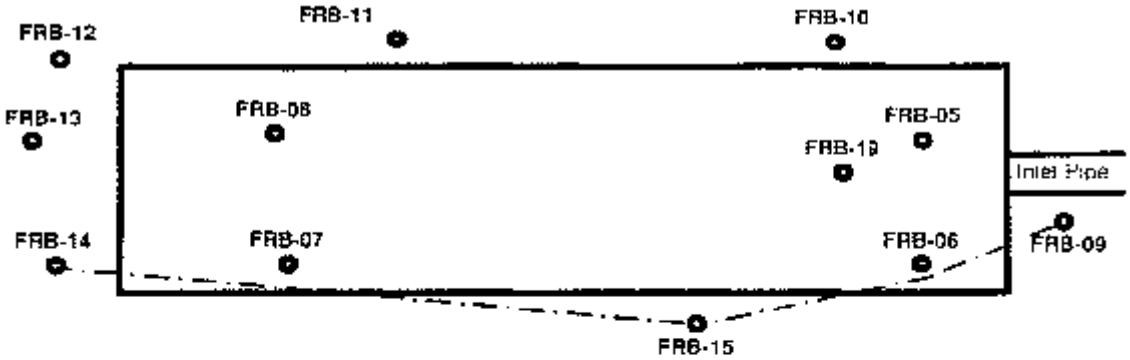


Cs-137 Distribution by Depth

Elevation above MSL	Surface Elevation:	FRB-03 269.90	FRB-07 271.90	FRB-10 274.40	FRB-08 276.20	FRB-05 273.40
276						
275					0.25	
274						
273	Ground Surface			0.12		
272						0.10
271			0.29			
270						0.09
269		0.09	0.09			0.09
268			0.09			
267		0.07				
266		0.07				
265					0.46	
264					0.46	
263						
262						
261			0.33			
260			0.33			
259		0.04	0.07			
258		0.04	0.07			
257		0.12	0.07			
256		0.12	0.07			0.26
255			0.10	0.20		0.26
254			0.10	0.20		0.12
253				0.25		0.12
252				0.25		0.03
251						0.03
250						
249				0.42		
248				0.42		
247				0.01		
246				0.01		
245				0.00		
244				0.00		
243				0.00		
242				0.00		
241				0.01		
240				0.01		

Exceeds Industrial Worker RGO (0.74 pCi/g @ 1E-6 risk level)

Figure 11. Distribution of Ca-137 by Depth —FRB Basin Area



Cs-137 Distribution by Depth

Elevation above MSL	Surface Elevation:	FRB-14 269.70		FRB-15 272.70		FRB-09 277.10
276						
277						
276						
275						
274	Ground Surface					
273						
272				0.07		
271						
270				0.02		
269		0.41		0.02		
268				0.00		
267		0.04		0.00		
266		0.04				
265						
264						
263						
262						
261						0.02
260						0.02
259						-0.01
258						-0.01
257						
256				0.00		
255				0.00		
254				0.01		
253		0.00		0.01		
252		0.00				
251		0.00				
250		0.00				
249						
248						

Figure 12. Distribution of Cs-137 by Depth—FRB Basin Area

Cs-137 Distribution by Depth

Elevation above MSL	Surface Elevation:	FRB-15		FRB-13		FRB-12		FRB-11		FRB-10
		269.70		269.50		269.20		270.70		272.30
273										
272						Ground Surface				0.04
271								0.05		0.04
270		0.41								0.01
269				0.06		0.02		0.00		0.01
268		0.04						0.00		
267		0.04		0.01		0.00				
266				0.01		0.00				
265										
264										
263										
262										
261										
260										
259										
258										
257										
256										0.02
255								0.00		0.02
254		0.00						0.00		0.00
253		0.00		0.00		0.03		0.01		0.00
252		0.00		0.00		0.03		0.01		
251		0.00		0.03		0.00				
250				0.03		0.00				
249										
248										

VII. REMEDIAL ACTION OBJECTIVES AND DESCRIPTION OF THE CONSIDERED ALTERNATIVES FOR THE FRB OPERABLE UNIT

Remedial Action Objectives

Remedial Action Objectives (RAOs) specify COCs, media of concern, potential exposure pathways, and remediation goals. The RAOs are based on the nature and extent of contamination, threatened resources, and the potential for human and environmental exposure. RAOs are developed based upon ARARs or other information from the RI/BRA report. ARARs are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal, state, or local environmental laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site. Initially, remedial technologies are selected based on the RAOs. However, with additional information, the preferred treatment technologies are modified to achieve the goals.

There are three types of ARARs: action-specific, chemical-specific, and location-specific. Action-specific ARARs set controls on the design, performance, and other aspects of implementation of specific remedial activities. Chemical-specific ARARs are media-specific and health-based concentration limits developed for site-specific levels of constituents in specific media. Location-specific ARARs consider federal, state, and local requirements that reflect the physiographical and environmental characteristics of the unit for the immediate area. The action-specific, chemical-specific , or location-specific ARARs (requirements) and to-be-considered requirements relevant to establishing remedial action objectives for the FRB OU identified is shown in Tables 5 through 7.

The RI/BRA report (WSRC, 1997b) has indicated that the secondary sources (i.e., surface soils contaminated with radionuclides) associated with the former basin and process sewer line pose significant carcinogenic risks (approximately 2×10^{-4}) to human health by external exposure to radiation. Since threatened, endangered, or sensitive species are not found at the unit and since it does not offer attractive or unique cover or forage opportunities for wildlife, ecological receptors are not at significant risk from the unit. Although limited risk is associated with the pipeline and manhole sediment (approximately 8×10^{-6}), radioactivity detected inside the pipeline sediment does pose potential future risks associated with this source. The RI/BRA report further indicates that presently there is no contamination in the water table aquifer attributable to the unit. Groundwater modeling indicates there exists a future potential for Sr-90 to leach out and enter the groundwater above MCL. Hence, based on the RI/BRA report conclusions, the feasibility

study (FS) was conducted to consider actions that could reduce the risks associated with the former basin area soils, process sewer line area soils, pipeline sediment, and reduce the potential for the COCs to leach out, and enter the groundwater.

Based on the risks posed by the radionuclides in the soils and pipeline sediment, the general remedial action objectives for the FRB OU are as follows:

- Reduce risks to human health associated with COCs through
  - external exposure to radiological constituents by direct contact with the former basin area soil, surface water, and sewer line area soil,
  - ingestion of former basin area and sewer pipeline area soils and pipeline sediment or produce grown in soils with radiological constituents, and
- Prevent or mitigate exposure to highly toxic or highly mobile contaminants that represent principal threat source material.
- Prevent or mitigate the leaching and migration of Sr-90 to unit groundwater. MCL for Sr-90 is 8.0 pCi/L.

Since groundwater data collected in January 1997 and February 1997 reflected no present risk from groundwater associated with this unit, no RAO was developed for the groundwater.

Summary of the risks associated with FRB OU (see Table 2) indicates that one exposure scenario for the former basin area equals or exceeds an excess carcinogenic risk of one in ten thousand (1×10^{-4}). This scenario, which is addressed by the RAOs, is external radiation from surface soils (on-unit resident). The risk is 2×10^{-4} and COCs contribution to this risk include Cs-137, K-40, and Ra-226. Scenarios for which risk is within the one in ten thousand to one in one a million (1×10^{-4} to 1×10^{-6}) range are soil ingestion (industrial worker and on-unit resident), dermal contact with sediment and surface water (on-unit resident), biota ingestion (on-unit resident), and external radiation from surface soils (industrial worker).

The scenario for the process sewer line area (pipeline sediment and soils) that equals or exceeds a risk of 1×10^{-4} for excess cancer is external radiation from surface soils (on-unit resident). The risk is 1×10^{-4} and COCs contributing to this risk include Cs-137, Ra-226, and Ac-228. Scenarios for which risks are within the 1×10^{-6} to 1×10^{-4} range are surface soil ingestion (on-unit resident), sediment ingestion (construction worker), external radiation from surface soil (industrial worker), and soil and sediment ingestion (on-unit construction worker).

Table 5. Chemical-Specific Requirements

CITATION(S)	STATUS	REQUIREMENT SUMMARY	REASON FOR INCLUSION	ALTERNATIVE(S)
40 CFR 50.6	Applicable	The concentration of particulate matter (PM) in ambient air shall not exceed 50 Fg/m^3 (annual arithmetic mean or 150 Fg/m^3 (24-hour average concentration).	Earth-moving activities will generate airborne dust that will have the potential to exceed the levels specified. Dust suppression will likely be required to minimize dust emissions.	S3, S4, P4
40 CFR 192.12	Relevant and Appropriate	The concentration of radium-226 in land averaged over any area of 100 square meters shall not exceed the background level by more than (1) 5 pCi/g, averaged over the first 15 cm (5.9) of soil below the surface, and (2) 15 pCi/g, averaged over 15-cm (5.9-in) thick layers of soil more than 15 cm (5.9 in) below the surface.	Radium-226 has been identified as a COC for soil.	S1, S3, S4, P1, P4
S C R 6 1 - 58.5(B)(2) and 40 CFR 141.62	Relevant and Appropriate	The proposed MCL for thallium is 1 mg/L	Thallium has been identified as a COC for soil and may leach into the groundwater.	S1, S3, S4, P1, P4, G1, G2
S C R 6 1 - 58.5(B)(2) and 40 CFR 141.62	Relevant and Appropriate	The MCL for arsenic is 0.05 mg/L.	Arsenic has been identified as a COC for soil and may leach into the groundwater.	S1, S3, S4, P1, P4, G1, G2
S C R 6 1 - 58.5(B)(2) and 40 CFR 141.62	Relevant and Appropriate	The MCL for cesium-137 is 200 pCi/L.	Cesium-137 has been identified as COC for soil and may leach into the groundwater.	S1, S3, S4, P1, P2, G1, G2
S C R 6 1 - 58.5(B)(2) and 40 CFR 141.62	Relevant and Appropriate	The proposed MCL for potassium-40 is 300 pCi/L.	Potassium-40 has been identified as a COC for soil and may leach into the groundwater.	S1, S3, S4, P1, P4, G1, G2
S C R 6 1 - 58.5(B)(2) and 40 CFR 141.62	Relevant and Appropriate	The proposed MCL for radium-226 is 14.7 pCi/L.	Radium-226 has been identified as a COC for soil and may leach into the groundwater.	S1, S3, S4, P1, P4, G1, G2
S C R 6 1 - 58.5(B)(2) and 40 CFR 141.62	Relevant and Appropriate	The MCL for strontium-90 is 8.0 pCi/L.	Strontium-90 has been identified as a COC for soil and the RERRAD shows that it can leach out and enter the groundwater	S1, S3, S4, P1, P4, G1, G2
S C R 6 1 - 58.5(B)(2) and 40 CFR 141.62	Relevant and Appropriate	The proposed MCL for plutonium 239/240 is 62.1 pCi/L	Plutonium 239/240 has been identified as a COC for soil and may leach into the groundwater.	S1, S3, S4, P1, P4, G1, G2
S C R 6 1 - 58.5(B)(2) and 40 CFR 141.62	Relevant and Appropriate	The MCL for actinium-228 is 3270 pCi/L.	Actinium-228 has been identified as a COC for soil and may leach out into the groundwater.	S1, S3, S4, P1, P4, G1, G2

Table 6. Action-Specific Requirement

CITATION(S)	STATUS	REQUIREMENT SUMMARY	REASONS FOR INCLUSION	ALTERNATIVE(S)
40 CFR 264.310	Relevant and Appropriate	Cap (or cover) must have permeability less than or equal to the bottom liner systems.	Soil and sediment addressed by this removal action is not RCRA hazardous waste. This requirement is identified as relevant and appropriate for the low permeability cover. The hydraulic conductivity of the cover will be less than or equal to the soils at the bottom of the basin or underneath the former process sewer line.	S3, S5
SC R 61.62.6, Section III	Applicable	Particulate matter must be controlled in such a manner and to the degree that it does not create an undesirable level of air pollution.	Earth-moving activities have the potential to generate airborne particulate matter.	S3, S4, S5, P4, P5A
DOE Order 5820.2A, Chapter III	TBC	Low-level radioactive waste must be managed in a manner that protects public health and safety, assures that external exposure to the waste does not exceed 25 mrem/yr to any member of the public, and protects groundwater resources.	Contaminated soil generated during this remedial action will likely be considered low-level radioactive waste.	S1, S3, S4, S5, P1, P4, P5A

Table 7. Location-Specific Requirements

CITATION(S)	STATUS	REQUIREMENT SUMMARY	REASONS FOR INCLUSION	ALTERNATIVE(S)
16 USC 1531	Applicable	The remedial action must be conducted in a manner to conserve endangered or threatened species.	There are threatened and endangered species at the SRS. however, as stated in the FRB RI/BRA. this action will not affect these species.	S1, S3, S4, S5, G1, G2, P1, P4, P5A
16 USC 661	Applicable	The remedial action must be conducted in a manner to protect fish or wildlife.	This remedial action has the potential to affect wildlife in the vicinity of the FRB and former process sewer line. This action will not affect fish located at the SRS or in nearby bodies of water.	S1, S3, S4, S5, G1, G2, P1, P4, P5A
SC R 51.26.6, Section III	Applicable	The remedial action must be conducted in a manner that minimizes impacts to migratory birds and their habitats.	Migratory bird population may be presented in the vicinity of SRS.	S1, S3, S4, S5, G1, G2, P1, P4, P5A
DOE Order 5820.2A, Chapter III	Applicable	The remedial action must minimize the destruction, loss, or degradation of wetlands.	Wetlands may be located in the vicinity of the FRB and former process sewer line; however, they will be unaffected by this action.	S1, S3, S4, S5, G1, G2, P1, P4, P5A

Description of the Considered Alternatives for FRB Operable Unit

As part of the investigation/assessment process for the FRB OU, a CMS/FS was performed using data generated during the assessment phase. The CMS/FS evaluated various treatment processes and technologies that can be used to remediate the contaminated soil attributed to the FRB OU and groundwater. Detailed information regarding the development and evaluation of remedial alternatives can be found in the *Corrective Measures/Feasibility Study for the F-Area Retention Basin (U)* (WSRC, 1997c).

After screening a number of treatment processes and technologies, various treatment alternatives were developed. Fifteen potential remedial alternatives were identified initially to address the remediation at the former basin area and the process sewer line area. After initial screening, nine alternatives were considered for detailed analysis. Since primary and secondary COCs for the former basin area soil and process sewer line area soil are radionuclides and metals with very similar physical and chemical properties, the remedial alternatives identified in the FS report are applicable to all unit primary and secondary COCs.

Considered Alternatives for Soils

Four alternatives were evaluated for remedial action of the soil. Each alternative is briefly described below. For additional information regarding the description of the alternatives, their cost estimates and their analyses, see the Corrective Measures/Feasibility Study for the F-Area Retention Basin (281-3F) (U) (WSRC, 1997c).

Alternative S1 - No Action

Under this alternative, no action will be taken for the soil, which means leaving the FRB OU soil in its current condition with no additional controls. EPA policy and regulations require the consideration of a No Action alternative to serve as a baseline against which the other alternatives can be compared.

There is no reduction of risk with this alternative. The only reduction in risks resulting from the No Action alternative are due to natural decay of radionuclides, primarily Cs-137 and Ra-226. The half-lives of Cs-137 and Ra-226 are 30 years and 1600 years, respectively. Therefore, natural decay of Cs-137 and Ra-226 will not reduce the external radiation risk significantly from a No Action alternative for the next 30years. Sr-90 could also leach out and enter the

groundwater in 30 years with concentrations above MCL (8.0 pCi/L). The Remedial Action Objective for principal threat source material would not be addressed under this alternative.

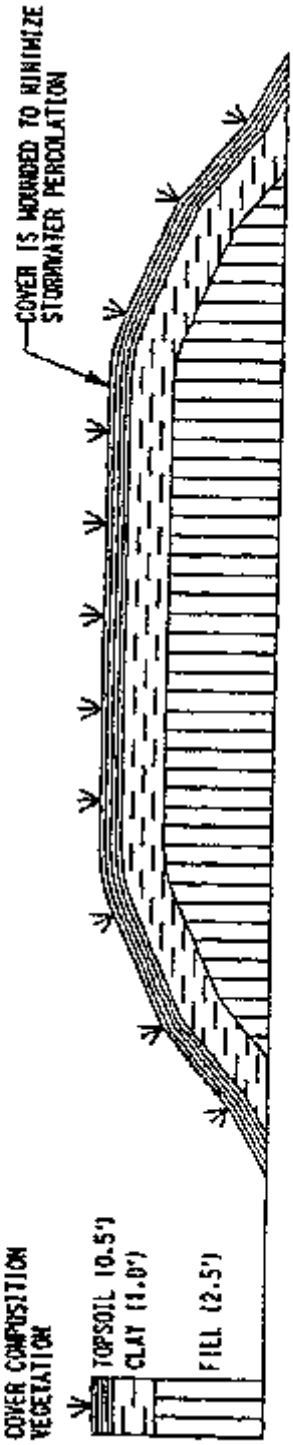
No costs are associated with this alternative. However, the total present worth cost for the five-year ROD reviews for 30 years (for cost estimating purpose only; actual five-year ROD reviews will be required in perpetuity), is approximately $9,600.

Alternative S3 - Institutional Controls and Low Permeability Cover

This alternative will include institutional controls and a low permeability cover placed over the basin. The cover is designed to minimize stormwater percolation. Stormwater percolation is further minimized by mounding the cover and diverting stormwater by constructing a runoff control system around the cover. A vegetative cover is placed over the low permeability cover to minimize erosion (see Figure 13 for illustration). Under institutional controls, deed restrictions and/or notifications will be provided if the government sells the property. Five-year CERCLA ROD reviews will also be performed for this alternative for 30 years. The 30-year period is for cost estimating purposes only; actual five-year ROD reviews will be required in perpetuity.

The institutional controls will involve both short-term and long-term actions. For the short-term action, signs will be posted at the FRB OU indicating that this area was used for the disposal of waste material and contains buried waste. Additionally, existing SRS access controls will be used to maintain use of this site for industrial use only. In the long-term, if property is ever transferred to non-Federal ownership, the U.S. Government will take those actions necessary pursuant to Section 120(h) of CERCLA. These actions will include a deed notification disclosing former waste management and disposal activities as well as any remedial actions taken on the site and any continuing groundwater monitoring commitments. These requirements are also consistent with the intent of the RCRA deed notification required at final closure of the RCRA facility if contamination would remain at the unit. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of radioactive materials and hazardous substances. The deed shall also include deed restrictions precluding residential use of the property. However, the need for these deed restrictions may be reevaluated at the time of transfer in the event that contamination no longer poses an unacceptable risk under residential use. Any reevaluation of the need for deed restrictions would be done through an amended ROD with the Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC) approval. In addition, if the site is ever transferred to non-Federal ownership, a survey plat of the

Figure 13. Low Permeability Cover Cross Section



area will be prepared. The plat will be certified by a professional land surveyor, and recorded with the appropriate county recording agency.

Per the EPA-Region IV Land Use Controls (LUCs) Policy, a Land Use Control Assurance Plan (LUCAP) and a Land Use Control Implementation Plan (LUCIP) will be developed and submitted to the regulators for approval. The LUCAP will be submitted under separate cover whereas the LUCIP will be submitted with the post-ROD documents for the FRB OU

The LUCIP will clearly identify the objectives of the land use controls for the FRB OU. The land use control objectives for the FRB OU are to: reduce risks to human health from direct exposure to radiological COCs by direct contact with basin soil, surface water, sewer line soil, and ingestion of soils and/or produce grown in FRB OU soils; and prevent leaching and migration of Sr-90 to groundwater. The specific manner of achieving the land use control objectives will be included in the LUCIP as part of the post-ROD documents. The LUCIP will also specify the assumptions made concerning current and expected future land use and exposure scenarios. The land use scenarios used in the risk assessment as well as the DOE policy on current and future land use projections are discussed in Section VI.

Under the current land use scenarios, the most reasonable receptor for the FRB OU considered is a visitor who is exposed to the FRB OU area on an infrequent or occasional basis. Under future land use scenarios, the receptor and exposure pathways considered included: an industrial worker exposed to surface soils, redistributed deep soils, and groundwater; a future resident exposed to surface and excavated deep soils, air, groundwater, homegrown produce and external radiation; and a construction worker exposed to surface and subsurface soils, groundwater and sediment within the sewer pipeline. For a construction worker and future resident, both carcinogenic risks and non-carcinogenic hazards also considered exposure to modeled concentrations in groundwater due to leachability of soil contaminants. All the assumptions made concerning current and expected future land use scenarios used in the risk assessment will also be included in the LUCIP as part of the post-ROD documents. The LUCIP will also specify those exposure scenarios, which may not be protective of the human health and the environment under less restrictive land uses.

A low permeability engineered cover will be sufficient to minimize infiltration, intrusion, and surface erosion. The cover design will be approved by the EPA and SCDHEC prior to construction. The low permeability cover will encompass an area of approximately 4,000 square

meters (1.0 acre) and will be maintained for 30 years. The 30-year period is for cost estimating only; actually the cover will be maintained in perpetuity. Based on the known half-lives of the predominant radiological risk drivers (i.e., Cs-137 and Ra-226), only Cs-137 will have gone through approximately one half-life. In addition, institutional controls will remain in place as long as the waste remains a threat to human health or the environment.

A properly engineered cover will function as a physical barrier to prevent direct human exposure to soil-borne contamination and thus will be protective of human health and the environment, A low permeability cover is a performance-based engineering approach since it does not reduce the total mass of COCs. The soil cover will be adequate to reduce the annual effective dose associated with continuous exposure to Cs-137 and Ra-226 to within regulatory limits. In addition, a properly maintained cover will minimize infiltration and subsequent leaching of contamination from unsaturated soil to the groundwater.

Under this remedial alternative, two remedial action objectives are satisfied by: (1) limiting infiltration into the area, thereby reducing the leaching of primary and secondary COCs to unit groundwater; and (2) preventing human or ecological access, thereby reducing risks to human health and the environment. The third remedial action objective to prevent or mitigate the potential exposure to highly toxic or highly mobile contaminants (the principal threat source material) would not be met.

The total present value estimate for this alternative is approximately $286,000. These costs include estimated capital costs approximately $267,000 and operation and maintenance costs, approximately $19,000, for the cover for 30 years and review of the remedy every five years for 30 years, as required by the NCP. The 30-year period is for cost estimating purposes only; actual five-year reviews will be required in perpetuity.

Alternative S4 - Institutional Controls and Grouting

This alternative consists of institutional controls and grouting the soils *in situ* to reduce contaminant mobility and stabilize principal threat source material. A vegetative cover will be installed over the stabilized soil to minimize erosion. The estimated depth range of *in situ* grouting is approximately 1.8 to 4.3 m (6 to 14 ft). The depth range, 6 to 14 ft has been selected for two reasons: (1) Cs-137 and Sr-90 is mostly distributed in the deep soil beneath the former basin in the depth range of 6 to 14 ft as is apparent from Figures 14 and 15; and (2) the permeability of the grouted mass will be no greater than 1×10^{-6} cm/s, thereby preventing

infiltration to the soils beyond the 14 ft depth. Therefore, Sr-90 and any other contaminants present in the soil beyond 14 ft depth will have less potential for migrating to the groundwater.

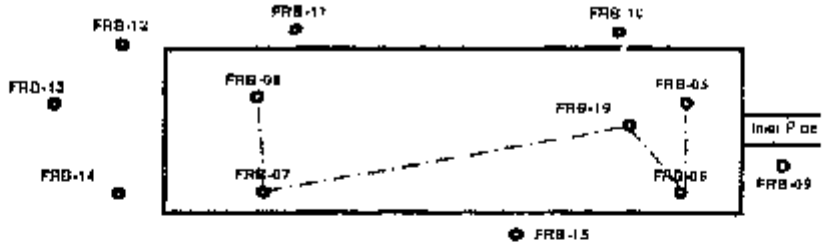
Deed restrictions and/or notifications will be provided if the government chooses to sell the property. Five-year CERCLA ROD reviews will be performed for 30 years. The 30-year period is for cost estimating only; the actual reviews will be required in perpetuity.

This alternative will involve excavating the basin to remove the nominal eight feet of clean soil that was placed in the basin when the basin was closed, cleaned and backfilled in 1978; grouting, or solidification/stabilization (S/S) of the soil in the bottom of the basin down to a 1.8 m (6 feet) depth (4.3 m or 14 feet depth from the present surface of the basin, with an approximate volume of 6,600 m^3 or 8,100 yd^3); backfilling the basin with clean soil; and grading the top surface of the basin. Institutional controls will be same as identified in Alternative S3. In situ S/S involves mixing the S/S reagents into the waste by a mechanical means such as a jet-grouting system or a long-reach backhoe fitted with a grouting device (see Figures 16 and 17 for illustration). A treatability study has been conducted on L-Area Oil and Chemical Basin (LAOCB) soils, which has characteristics almost identical to F-Area Retention Basin soil *(Laboratory-Scale Immobilization Study Report for L-Area Oil and Chemical Basin)* (WSRC, 1996). This study has determined that S/S agents can immobilize unit-specific contaminants; specifically, a mixture of Portland cement, bentonite, and sodium silicate was found to effectively immobilize contaminants, primarily radionuclides such as Cs-137 and Co-60.

In situ S/S does not reduce the total mass or toxicity of the COCS. However, it is a proven performance-based engineering approach that reduces the mobility of the primary and secondary COCs. Based on the results of a literature search and a treatability study performed on LAOCB soils, the in situ S/S reagents are considered effective at reducing the leachability of contaminants. Specifically, the various S/S reagent samples (with LAOCB soil) were subjected to the toxicity characteristic leaching procedure (TCLP) and the extended American Nuclear Society (ANS) 16.1 procedure to simulate leaching of contaminants over time. Analysis of the two leaching tests performed on LAOCB, soil samples mixed with S/S reagents demonstrated that all of the samples released 0.41% and 1.61% or less of gross alpha and gross beta, respectively.

Alternative S4 meets remedial action objectives by: (1) preventing infiltration into the basin area through immobilizing contaminants present in the basin, thereby preventing migration of primary and secondary COCs to groundwater; (2) preventing human or ecological access, thereby reducing risks to human health and the environment; and (3) preventing or mitigating the

Figure 14. Distribution of Sr-90 by Depth —Depicting the Zone of High Concentration —FRB Basin Area Alternative S5—Institutional Controls, Grouting, Low Permeability Cover, and Groundwater Monitoring



Sr-90 Grout Zone

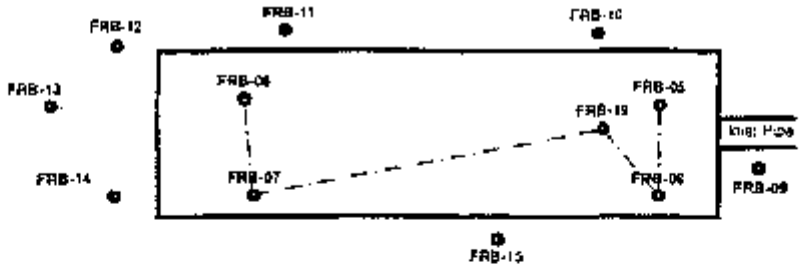
Drawing not to scale

Elevation above MSL	Surface Elevation:	FRB-08 269.90	FRB-07 271.90	FRB-19 274.40	FRB-06 276.20	FRB-05 273.40
276						
275					0.346	
274						
273				-0.27		
272	Ground Surface					2.61
271			1.75			
270						0.0713
269	Basin Bottom at 264 ft MSL	2.24	1.43			0.0713
268			1.43			
267		5.25				
266		5.25				
265					0.571	
264					0.571	9.99
263		23.2	91.3	12.3		9.99
262	Grout Zone	23.2	91.3	12.3		
261		102		93.1		
260		102		93.1		
259		13.8	13.4			
258		13.8	13.4			
257		8.35	8.7			
256		8.35	8.7			81.5
255			1.62			81.5
254			1.62			13
253						13
252						32.7
251						32.7
250						
249						
248						
247						
246						
245				38.7		
244				38.7		
243				13.3		
242				13.3		
241				24.9		
240				24.9		

Exceeds RESRAD Soil Leachability Level of 109 pCi/g that would exceed the MCL of 8.0 pCi/L.

Grout Zone beginning 2 feet above the basin bottom and extending to 6 feet below the basin bottom.
Basin bottom is at 264 feet above mean sea level (MSL).

Figure 15. Distribution of CS-137 by Depth —Depicting the Zone of High Concentration —FRB Basin Area Alternative S5—Institutional Controls, Grouting, Low Permeability Cover, and Groundwater Monitoring



Cs-137 Distribution by Depth

Elevation above MSL	Surface Elevation:	FRB-08 289.90	FRB-07 271.90	FRB-19 274.40	FRB-06 276.23	FRB-05 273.40
276 ▼						
275					0.25	
274						
273	Ground Surface			0.12		
272						0.10
271			0.29			
270						0.09
269		0.09	0.09			0.09
268			0.09			
267		0.07				
266		0.07				
265					0.46	
264					0.46	
263						
262	Grout Zone					
261			0.33			
260			0.33			
259		0.04	0.07			
258		0.04	0.07			
257		0.12	0.07			
256		0.12	0.07			0.26
255			0.10	0.20		0.26
254			0.10	0.20		0.12
253				0.25		0.12
252				0.25		0.03
251						0.03
250						
249				0.42		
248				0.42		
247				0.01		
246				0.01		
245				0.00		
244				0.00		
243				0.00		
242				0.00		
241				0.01		
240				0.01		

Exceeds Industrial Worker RGO (0.74 pCi/g @ 1E-6 risk level)

Grout Zone

potential exposure to high toxic or highly mobile contaminants, i.e., the principal threat source material.

The short- and long-term institutional controls and LUC information described under Alternative S3 would also be applicable under Alternative S4.

The total present value estimate for this alternative is approximately $1,228,000. These costs include estimated capital costs approximately $1,209,000 and operation and maintenance costs approximately $19,000 for the grouted monolith for 30 years and review of the remedy every five years for 30 years, as required by the NCP. The 30-year period is for cost estimating purposes only; the actual five-year ROD reviews will be required in perpetuity.

Alternative S5 - Institutional Controls, Grouting, Low Permeability Cover, and Groundwater Monitoring

Alternative S5 is a combination of alternatives S3 and S4 and consists of grouting the soils *in situ* to reduce contaminant mobility and providing a low permeability cover over the grouted soils. A vegetative cover is placed over the low permeability cover to minimize erosion.

This alternative like S3 will be effective in preventing contact with and ingestion of contaminated soil. Like Alternative S4, it will also be very effective in reducing potential leaching of contaminants from soil to groundwater. Additionally, deed restrictions and/or notification will be provided if the government sells the property. Five-year ROD reviews will also be performed for this alternative.

Under this alternative, contamination in the basin soil will be immobilized and covered with clean soil and a low permeability cover as discussed under Alternative S3. These actions would meet all the three remedial action objectives by:

- preventing infiltration into the soil through cover and immobilizing contaminants present in the basin via in situ S/S, thereby preventing migration of primary and secondary COCs to groundwater;

- preventing human or ecological access, thereby reducing risks to human health and the environment;

Figure 16. Backhoe Soil Mixing

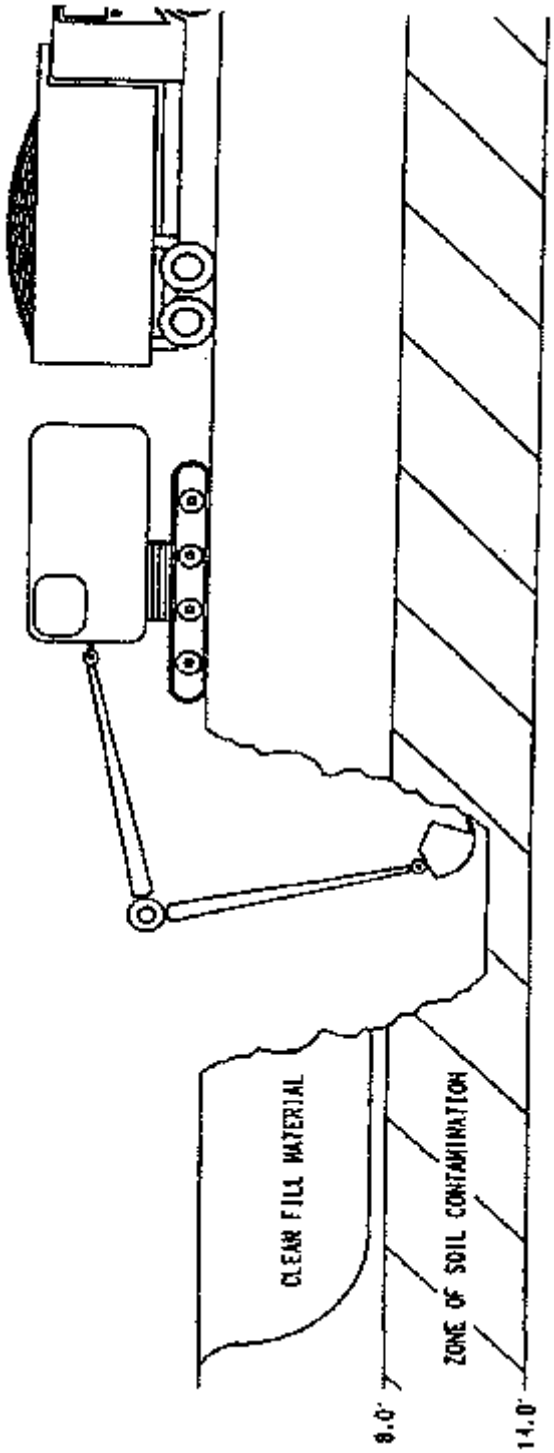
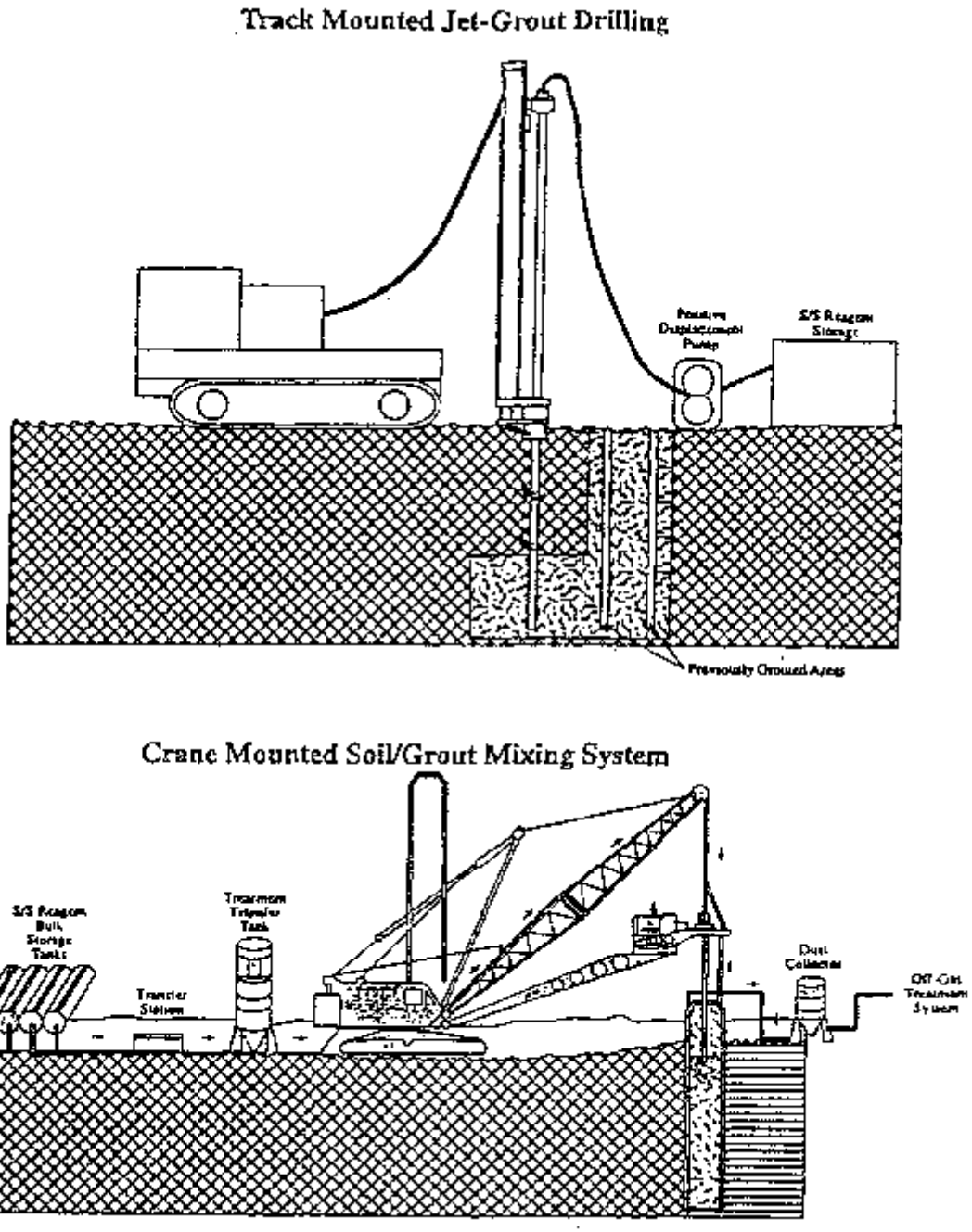


Figure 17. Jet and Soil Mixing Grouting Techniques



- preventing or mitigating potential exposure to highly mobile or toxic contaminants which represent the principal threat source material; and

- reducing the radioactive dose (direct radiation exposure) received from Cs-137 and Ra-226 by nearly 100%, assuming an approximate cover thickness of four feet.

This alternative also includes groundwater monitoring to confirm that the source remediation has achieved the required stabilization of the contaminants; to relieve any uncertainty in the analytical data; and to verify that there exists no upgradient source contributing any contamination to the FRB OU groundwater. The existing monitoring wells (FRB-01, -02, -03, and -04) will be used to collect groundwater samples semi-annually (see Figure 18 for monitoring well locations, groundwater flow direction, and location for the upgradient well).

The analytes monitored will include Cs-137, Sr-90, TCE, and other COCs and normal field measurements specified in the post-ROD document work plans. If monitoring detects contamination above MCLs (or RBCs without MCLs) for those constituents attributable to the FRB OU or an unknown upgradient source, for two consecutive monitoring periods, the regulators will be informed within 30 days. A plan for evaluating the data and developing further action will be submitted within 90 days for regulatory approval. The results of the monitoring will be reported annually; however, no raw data will be provided.

The short-term and long-term institutional controls and LUC information described under Alternative S3 would also be applicable under Alternative S5.

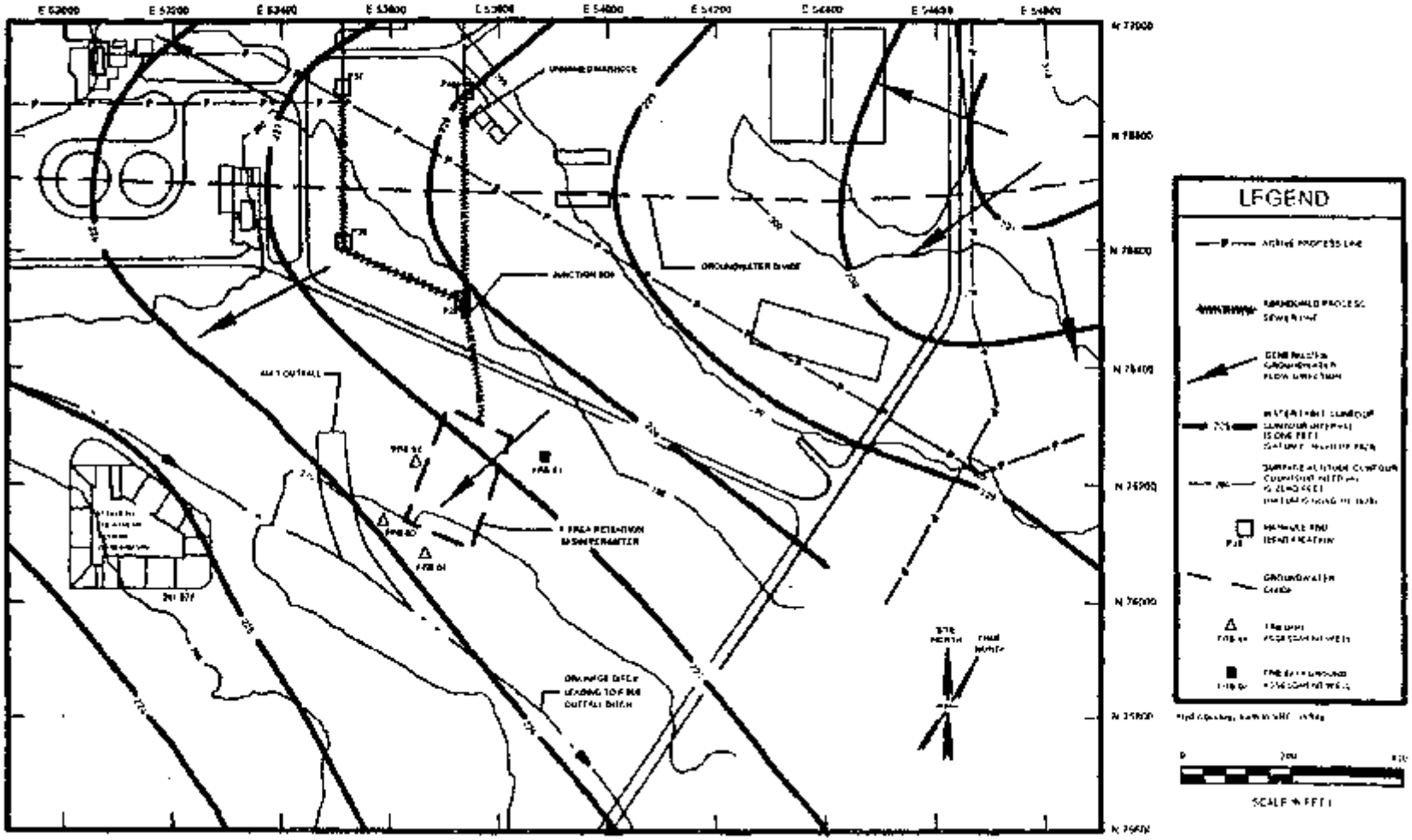
The total present value estimate for this alternative is approximately $1,461,000 with total estimated capital costs approximately $1,442,000 and O&M costs approximately $19,000.

This estimate includes costs for groundwater monitoring, operation and maintenance of the cover for 30 years, and review of the remedy every five years for 30 years as required by the NCP. The 30-year period is for cost estimating purposes only; actual five-year reviews will be required in perpetuity.

Considered Alternatives for Groundwater

Since no impact to the groundwater from the operation of the basin was discovered, only two alternatives were evaluated for groundwater. The alternatives are described below.

Figure 18. Locations of FRB Monitoring Wells and Upgradient Well



Alternative G1 - No Action

This alternative involves leaving the groundwater associated with FRB OU in its current condition with no additional controls. EPA policy and regulations require the consideration of a No Action alternative to serve as a baseline against which the other alternatives can be compared.

Because no further action is taken at the unit, the groundwater remains in its present condition. No costs are associated with this alternative.

Alternative G2 - Groundwater Monitoring

This alternative involves maintaining control of the basin area and monitoring the groundwater annually until it is confirmed that the remedial response action for the FRB OU has achieved the required stabilization of the contaminants. This alternative alone will not be effective in preventing future ingestion of shallow aquifer groundwater. No monitoring is required based on no basin impact. However, groundwater monitoring was considered as an element of the soil remedy.

However, groundwater monitoring when performed in conjunction with institutional controls will be effective in preventing the ingestion of groundwater and thereby reducing the fisks to human health. If contamination is detected above the maximum contamination level, then further groundwater response actions will be necessary. If monitoring conditions change, SRS will request alteration or termination of the monitoring program.

The short-term and long-term institutional controls and LUC information described under Alternative S3 would also be applicable under Alternative G2.

There are no capital costs associated with this alternative; however, total estimated O&M costs are approximately $114,000. Therefore, the total present worth cost for this alternative is approximately $114,000. These costs include a five-year ROD review for 30 years. The 30-year period is for cost estimating purposes only; actual five-year reviews will be required in perpetuity.

Considered Alternatives for Process Sewer Line

Three alternatives were evaluated for remediation of the process sewer line and pipeline-associated soils. The alternatives are described below.

Alternative P1 - No Action

This alternative involves leaving the process sewer line, like the basin, in its current condition with no additional controls. EPA policy and regulations require the consideration of a No Action alternative to serve as a baseline against which the other alternatives can be compared. Because no further action is taken at the unit, the process sewer line along with the basin soil remains in its present condition. There is no reduction in the risk posed by the radionuclides present in the soil, which include Ac-228, Cs-137, K-40, Ra-226, and Sr-90.

No costs are associated with this alternative. However, the total present worth cost for five-year ROD reviews for 30 years is approximately $9,600. The 30-year period is for cost estimating purposes only; actual five-year reviews will be required in perpetuity.

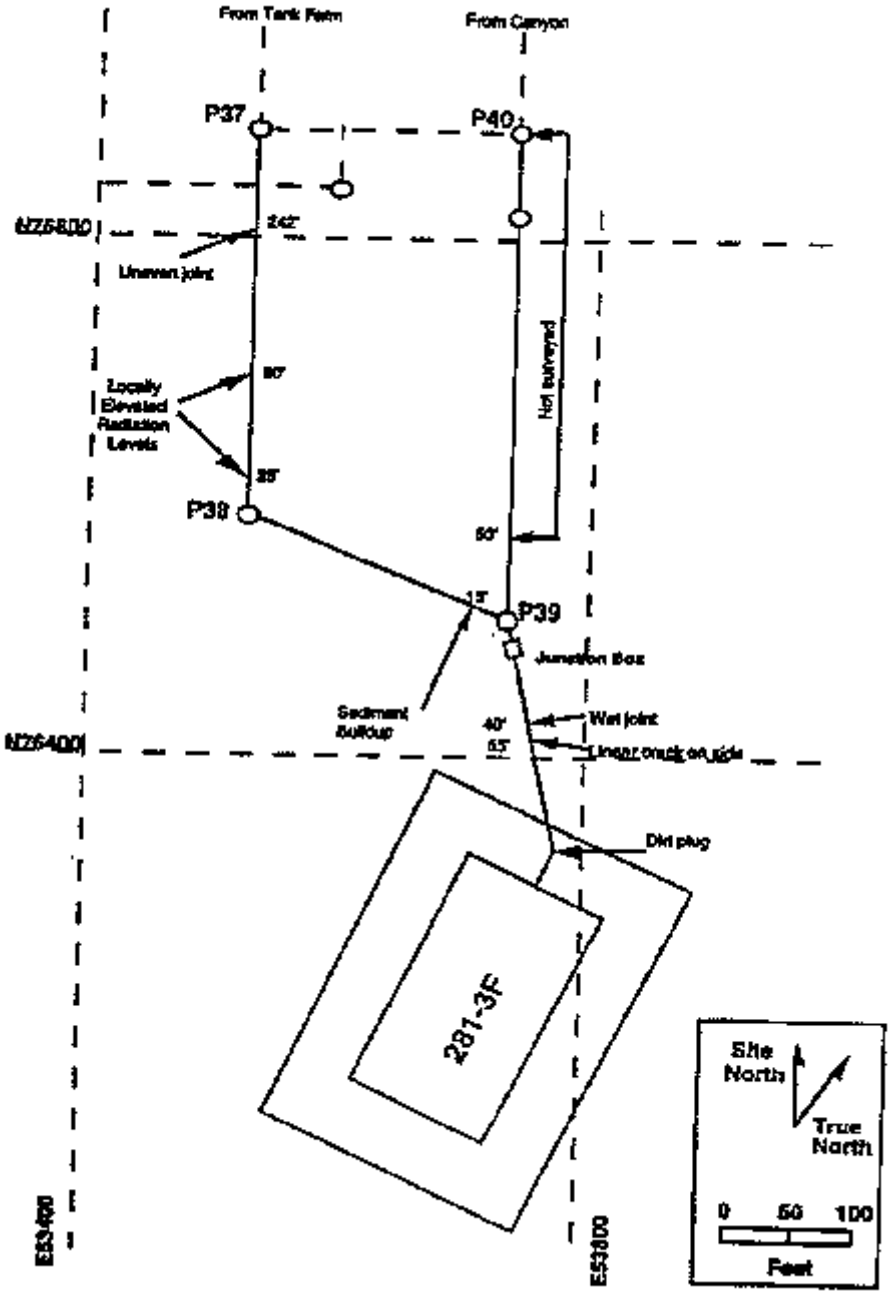
Alternative P4 - Institutional Controls, Pipeline Grouting, Soil Excavation, and Disposal of Soil with Basin Soil

This alternative includes pumping grout into the pipeline and manholes to stabilize contaminants, thereby restricting access to the contaminants inside the pipeline. This alternative also involves excavating localized areas of contaminated soil (areas around the trouble spots determined by robotics investigation and soil sampling) (Figure 19) around the pipeline area using standard earth-moving equipment. The volume of contaminated soil will be determined by comparing the existing sampling data against the acceptance criteria (concentration levels not to exceed 20 pCi/g for alpha and 50 pCi/g for beta and gamma emitters). The material (unacceptable contaminated soil with an estimated volume of approximately 240 m^3 or 300 yd^3) is then transported to the basin for disposal along with the basin soils. Deed restrictions and/or notifications would be provided if the government were to sell the property. Five-year ROD reviews are also included in this alternative.

The short-term and long-term institutional controls and LUC information described under Alternative S3 would also be applicable to P4.

Because the source of contamination is removed under this alternative, the remedial action objectives are met. The sewer line soil hot spots and, if necessary, associated sections of pipeline are excavated and combined with the basin grout mass, thereby reducing the risk from the most contaminated areas of the sewer line soils.

Figure 19. Location of Potential Trouble Spots



The total present worth cost for this alternative is approximately $320,000 with total estimated capital costs approximately $310,000 and estimated O&M costs S96,000. These costs include five-year ROD reviews for 30 years. The 30-year period is for cost estimating purposes only; actual five-year reviews will be required in perpetuity.

Alternative P5A - Excavation and Off-Unit Disposal (SRS Disposal)

This alternative involves excavating and removing the pipeline and associated contaminated soil and using clean backfill from an SRS source to return the area to natural grade. Topsoil will also be used to support a vegetative layer.

Concrete debris (estimated volume of 45 m^3 [58 yd^3]) generated during removal of the pipeline will be transported to E-Area Low Level Radioactive Disposal Facility for disposal. Assuming a 150% bulking factor for the concrete pipe, the volume of pipeline that will be broken and sized into small pieces will be approximately 68m^3 (87 yd^3). Contaminated soil (estimated volume of approximately 240 m^3 [300 yd^3]) will be dispositioned with basin soils.

This alternative meets ARARs. Residual concentrations of Ra-226 in soil will meet the relevant ARAR. Excavation of contaminated material (pipeline and soil) can be performed in a manner that meets air emission ARARs; that is, using conventional earth-moving equipment and standard dust suppression techniques. Current access restrictions prevent inadvertent intrusion into the area. Risks to remediation workers from operating heavy earth-moving equipment and handling contaminated soil and sediment can be managed by following the project-specific health and safety plan. Equipment and materials required for this remedial action are readily obtained by SRS.

Implementation of this alternative will be difficult as a large amount of soil (2728 m^3 [3567 yd^3]) must be excavated and managed while removing the pipeline. There will also be difficulties associated with removing the 0.6 m (2 ft) and 0.9 m (3 ft) diameter pipeline from the ground due to its size and weight. Another process line (unrelated to this unit and not addressed by this alternative) runs close to the former process sewer line. Therefore, excavation activities must be carefully planned and conducted to avoid disturbing this other process line. Disposal capacity at SRS for the disposal of low-level radioactive waste is also limited. Because the source of contamination will be removed under this alternative, remedial action objectives will be met by eliminating any risk to groundwater, human health, and the environment.

The cost of this alternative is approximately $410,000 (total present value cost). There are no O&M costs for this alternative and these costs also do not include costs for five-year ROD reviews since no ROD review will be required for this alternative.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF THE ALTERNATIVES

Evaluation Criteria

Each remedial alternative was evaluated using the nine criteria established by the National Oil and Hazardous Substances Contingency Plan. The criteria were derived from the statutory requirements of CERCLA Section 121 and are listed below:

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements (ARARs)
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

In selecting the preferred alternative, these nine criteria were used to evaluate the alternatives developed in the Corrective Measure Study/Feasibility Study for the FRB (*U*) (WSRC, 1997c). First seven of the criteria are used to evaluate all the alternatives. The preferred alternative is further evaluated based on the final two criteria, state acceptance and the community acceptance. The first two criteria (overall protection of human health and the environment, and compliance with ARARs) are also categorized as threshold criteria. The next five criteria are categorized as primary balancing criteria. The last two criteria (state acceptance and community acceptance) are categorized as modifying criteria.

Detailed Evaluation

The remedial action alternatives discussed in Section VII were evaluated using the nine criteria. A detailed evaluation of the alternatives is provided in the Feasibility Study (WSRC, 1997c).

Comparative Analyses

This section discusses how well each alternative addresses the CERCLA evaluation criteria. The alternatives are discussed in relative order of performance with respect to the particular critenion. Table 8 provides a summary of the comparative analyses.

Overall Protection of Human Health and the Environment

For soil remedial alternatives, Alternative S5 is the most protective because it involves stabilizing the waste and providing a cover to minimize stormwater percolation. Alternative S4 is the second most protective because it involves stabilizing the waste source only. Alternative S3 offers the next best level of protection. Alternative S1, the No Action alternative, offers the least protection.

For goundwater, both alternatives, Alternative G1 and Alternative G2 are equally protective of human health and the environment.

For the process sewer line area, Alternative P5A is the most protective of human health and the environment followed by Alternatives P4 and P1.

Compliance with ARARs

Alternatives S1, S3, S4, S5, P1, P4, and P5A comply with ARARs for soil. Alternative G2 complies with groundwater ARARs.

Long-Term Effectiveness

Of the soil alternatives, Alternative S5 offers the most long-term effectiveness. The second most effective is Alternative S4, followed by S2, and then Alternative S1 (No Action).

Both groundwater alternatives, Alternative G1 and Alternative G2, are equally effective over the long term for groundwater.

Alternative P5A offers the most protection over the long term for the process sewer line area, followed by Alternatives P4 and then P1 (No Action).

Table 8. Comparative Analysis Summary

Alternative	CERCLA Criterion			
	Overall Protection of Human Health of the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment
S1: No Action	Least protective soil alternative	Complies with ARARs	Least effective soil alternative in the long term	Does not reduce toxicity, mobility or volume
S3: Institutional Controls and Low Permeability Cover	Protective, but not to the extent of S4 or S5	Complies with ARARs	Effective in the long term, but not as effective as S4	Reduces contaminant mobility, but not to the extent of S4
S4: Institutional Controls, and Grouting,	Second most protective soil alternative	Complies with ARARs	Second most effective soil alterative in the long term	Second most effective in reducing contaminant mobility for soil alternatives
S5: Institutional Controls, Grouting, and Low Permeability Cover	Most protective soil alternative	Complies With ARARs	Most effective soil alternative in the long term	Most effective in reducing contaminant mobility for soil alternatives
G1: No Action	Equally protective groundwater alternative	Compliance with groundwater ARARs can not be demonstrated	Equally effective groundwater alternative in the long term	Does not reduce toxicity, mobility, or volume
G2: Groundwater Monitoring	Equally protective groundwater alternative	Complies with soil ARARs	Equally effective groundwater alternative in the long term	Does not reduce toxicity, mobility, or volume
P1: No Action	Least protective pipeline alternative	Complies with soil ARARs	Least effective pipeline alternative in the long term	Does not reduce toxicity, mobility, or volume
P4: Institutional Controls, Pipeline Grouting, and Soil Excavation and Disposition with FRB Soils	Second most protective pipeline alternative	Complies with soil ARARs	Second most effective pipeline alternative in the long term	Second most effective in reducing contaminant toxicity, mobility, or volume for pipeline alternatives
P5A: Excavation and Off-Unit Disposal (SRS Disposal)	Most protective pipeline alternative	Complies with Soil ARARs	Most effective pipeline alternative in the long term	Most effective in reducing contaminant toxicity, mobility, or volume for pipeline alternatives

Table 8. (Cont'd). Comparative Analysis Summary

Alternative	CERCLA Criterion		
	Short-term Effectiveness	Implementability	Cost
S1: No Action	Most effective soil alternative in the short term	Easiest soil alternative to implement	$9,578
S3: Institutional Controls and Low Permeability Cover	Equally effective as S4 and S5 in the short term	Readily implemented; less difficult than S4	$285,132
S4: Institutional Controls, and Grouting	Equally effective as S3 and S5 in the short term	Second most difficult soil alternative to implement	$1,227,694
S5: Institutional Controls, Grouting, and Low Permeability Cover, Groundwater Monitoring	Equally effective as S3 and S4 in the short term	Most difficult soil alternative to implement	$1,460,929
G1: No Action	Equally effective groundwater alternative in the short term	Easiest groundwater alternative to implement	No Cost
G2: Groundwater Monitoring	Equally effective groundwater alternative in the short term	Easily implemented; however, more difficult than G1	$113,331
P1: No Action	Equally effective pipeline alternative in the short term	Easiest pipeline alternative to implement	$9,578
P4: Institutional Controls, Pipeline Grouting, and Soil Excavation and Disposition with FRB Soils	Second least effective pipeline alternative in the short term	Second most difficult pipeline alternative to implement	$319,265
P5A:Excavation and Off-Unit Disposal (SRS Disposal)	Least effective pipeline alternative in the short term	Most difficult pipeline alternative to implement	$409,134

Reduction of Toxicity, Mobility, or Volume

No alternative completely reduces toxicity, mobility, and volume at the waste unit. Alternative S5 ranks the highest in this category for the soil alternatives because it achieves the greatest reduction in contaminant mobility. Alternatives S4 and S3 also reduce contaminant mobility, but to a lesser extent than Alternative S5. Alternative S1 (No Action) does not affect toxicity, mobility, or volume.

Alternatives G1 and G2 have no effect on toxicity, mobility or volume.

Alternative P5A, which removes contaminated material from the waste unit, ranks first in this category for process sewer line area alternatives. Alternative P4 ranks second because it reduces contaminant mobility. Alternative P1 (No Action) has no effect on toxicity, mobility, or volume.

Short-Term Effectiveness

Alternative S1 offers the most short-term effectiveness of the soil alternatives. Alternatives S3, S4, and S5 rank equally in this category as they all provide the same degree of worker exposure during implementation.

Both groundwater alternatives, Alternative G1 and Alternative G2 are equally effective in the short term.

Alternative P1 is most effective in the short term for the process sewer line area alternatives. Alternative P4 is moderately effective due to limited remedial worker exposure to contaminants. Alternative P5A is the least effective alternative due to potential worker exposure to contaminated material. None of the alternatives should affect the community during remediation. The site-specific health and safety plan addresses remedial worker risks from equipment operation for alternatives involving physical activities.

Implementability

Alternatives S1, S3, S4, and S5 are readily implemented; Alternatives S4 and S5 are more difficult because they will require testing to determine the appropriate grout mixtures.

Alternative G1 is the easiest to implement for groundwater, followed by Alternative G2.

Alternative P1 is the easiest pipeline alternative to implement, followed by Alternative P4. Alternative P5A is the most difficult to implement.

Cost

The No Action alternative, S1, is the least expensive of the soil alternatives (total present worth cost, $9,578; capital cost $0, and O&M costs, $9,578), followed by Alternatives S3 (total present worth cost $285,132; capital costs, $266,908; and O&M costs, $118,224), S4 (total present worth cost $1,227,644; capital cost, $ 1,209,470; and O&M costs, $18,224), and S5 (total present work costs, $1,460,929; capital costs, $1,441,705; and O&M costs, $18,224).

The least expensive groundwater alternative is No Action, G1 (no cost), followed by Alternative G2 (total present worth cost $113,331; capital costs $0; O&M costs, $113,331).

The No Action alternative for the process sewer line and pipeline soil, P1, is also the least expensive in its category ($9,578). Alternative P1 is followed by Alternatives P4 (total present worth cost, $319,265; capital costs, $309,687; O&M costs, $9,578) and P5A (total present worth cost, $409,134; capital costs, $409,134; O&M costs $0).

State and community Acceptance

Alternative S1 does not provide short and long-term protectiveness of human health and the environment and consequently, has not met state and Federal regulatory acceptance. Alternatives S3 and S4 do provide for reduced containment mobility, however, these alternatives do not provide a permanent reduction in contaminant mobility and have not met state and Federal regulatory acceptance. The state and Federal regulatory agencies have accepted and approved Alternative S5 because it is the least expensive in the long term that provides a most-effective permanent reduction in contaminant mobility and poses minimal risk to remedial workers and community. In addition, the Alternative S5 has met the community acceptance.

Both Alternatives G1 and G2 are equally protective of groundwater since no impact to the groundwater from the operation of the F-Area Basin has been discovered. However, alternative G1, in conjunction with institutional controls, will be protective of human health by preventing the ingestion of groundwater at less cost. Also, groundwater monitoring, which forms an integral part of the Alternative S5, when implemented in conjunction with Alternative S5, will ensure that no contaminant leaches out and enter the groundwater after the contaminated soil is grouted

and thereby, will protect the remedial workers as well as the community. The state and Federal regulatory agencies have accepted Alternative G1. In addition, this alternative has met with community acceptance.

Alternative P1 does not provide short and long-term protectiveness of human health and the environment and consequently, has not met state and Federal regulatory acceptance. Alternative P5A does provide for the protection of human health by permanent reduction in the contaminant mobility; however, this alternative is most difficult to implement since this alternative involves significant waste handling and transport. Consequently, Alternative P5A has not met state and Federal acceptance or community acceptance.

The state and Federal regulatory agencies have accepted and approved Alternative P4. This alternative when implemented in conjunction with Alternative S5, will provide a permanent reduction in contaminant mobility, pose minimal risk to the remedial workers and the community, and is the least expensive alternative. In addition, the alternative has met the community acceptance.

IX. THE SELECTED REMEDY

The selected remedies for the FRB OU are: (1) for the basin soils: Alternative S5: Institutional Controls, Grouting, a Low Permeability Cover, and Groundwater Monitoring; (2) for the former process sewer line: Alternative P4: Institutional Controls, Pipeline Grouting, Soil Excavation and Disposition in the Basin Soils, and; (3) for the groundwater: Alternative G1: No Action. The waste unit will be physically maintained and institutional controls will remain in place in perpetuity. Field conditions will be evaluated to determine the need for modifying the control program or to identify if further remedial action is appropriate during the five-year ROD review.

Since each remedy requires institutional controls, these controls are discussed here instead in the more detailed description of each selected remedies provided below. Implementation of institutional controls will involve both short- and long-term actions. For the short-term action, signs will be posted at the FRB OU indicating that this area was used for the disposal of waste material and contains buried waste. Additionally, existing SRS access controls will be used to maintain use of this site for industrial use only. In the long-term, if the property is ever transferred to non-Federal ownership, the U.S. Government will take those actions necessary pursuant to Section 120(h) of CERCLA. These actions will include a deed notification disclosing former waste management and disposal activities as well as any remedial actions

taken on the site and any continuing groundwater monitoring commitments. These requirements are also consistent with the intent of the RCRA deed notification required at final closure of the RCRA facility if contamination would remain at the unit. The deed notification shall, in perpetuity, notify any potential purchaser that the property has been used for the management and disposal of radioactive materials and hazardous substances. The deed shall also include deed restrictions precluding residential use of the property. However, the need for these deed restrictions may be reevaluated at the time of transfer in the event that contamination no longer poses an unacceptable risk under residential use. Any reevaluation of the need for deed restrictions would be done through an amended ROD with the Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC) approval. In addition, a certified survey of the area will be prepared by a registered land surveyor and will be included in the post-ROD documents. The survey will be reviewed and updated, as necessary, at the time the site is transferred and will be recorded with the appropriate county recording agency. The FRB OU is located in Aiken County.

Per the EPA-Region IV Land Use Controls (LUCs) Policy, a Land Use Control Assurance Plan (LUCAP) and a Land Use Control Implementation Plan (LUCIP) will be developed and submitted to the regulators for their approval. The LUCAP will be submitted under separate cover whereas the LUCIP will be submitted with the Remedial Work Plan/Remedial Design Report/Remedial Action Work Plan (RDWP/RDR/RAWP) for the FRB OU in accordance with the post-ROD document schedule is provided in Figure 16. The LUCAP will include the information requested in the EPA policy. The LUCIP details how SRS will implement, maintain, and monitor the land use control elements of the FRB OU ROD to insure that the remedy remains protective of human health.

The LUC objective necessary to ensure the protectiveness of the preferred alternative is:

Prevent unauthorized access/exposure to contaminated grout and basin soil

The institutional controls required to prevent unauthorized exposure to the contaminated grout and soil include the following:

- Controlled access to the FRB waste unit through existing SRS security gates and perimeter fences and the site use/site clearance programs
- Signs posted in the area to indicate that contaminated grout and soil are present in the waste unit

- Notification of contaminated grout and soil to any future landowner through deed notification, as required under CERCLA Section 120(h)

The present worth, capital, and Operation and Maintenance (O&M) costs for each selected remedy is provided Table 9.

Table 9. Selected Remedy Cost

Remedy	Present Worth Cost	Capital Cost	O&M Cost
Alternative S5* (Soils)	$1,461,000	$1,442,000	$19,000
Alternative F4 (Process Sewer)	$320,000	$310,000	$10,000
Alternative (G1* (Groundwater)	No Cost	No Cost	No Cost
Total Cost	$1,781,000	$1,752,000	$29,000

*Alternative S5 includes the costs for groundwater monitoring.

The selected remedy will meet all of the RAOs by eliminating the potential for direct radiation, exposure, ingestion of soils, and eliminating future impacts to groundwater. The selected remedies comply with all applicable or relevant and appropriate Federal and state requirements/regulations.

The SCDHEC has modified the SRS RCRA permit to incorporate the selected remedies.

Soils

Under the selected remedy (Alternative S5), deep basin soil will be grouted from approximately 0.6 m (2 ft) above the basin bottom to approximately 1.8 m (6 ft) below the basin bottom or approximately 4.3m. (14 ft.) below grade. The purpose of the grout is to prevent leaching of Sr-90, which is the only contaminant migration COC (CMCOC), to the groundwater above the MCL of 8.0 pCi/L. Furthermore, grouting the soil provides an additional layer of protection by offsetting the inherent uncertainty associated with the mathematical model used to predict contaminant migration. Grouting will also immobilize other deep contaminants which represent principal threat source material such as Cs-137, Ra-226, thallium, arsenic., etc and further reduce infiltration of water through the deeper contaminated soils. Tc-99 was originally identified in the RFI/RI/BRA as a CMCOC. Subsequent evaluation with the RESRAD model eliminated it as a concern. However, as is the case with other radioactive/non-radioactive contaminants, the selected remedy will also immobilize Tc-99. Grouting of the soils is preferred over only capping because it meets the CERCLA preference for treatment. A cover will be provided over the

stabilized soil to minimize storm water percolation and erosion. The cover is also very effective in reducing direct radiation exposure received from radionuclides in the shallow soil. This alternative includes institutional controls (discussed above) to prevent exposure of current and future workers to all the Human Health COCs in the waste unit and direct radiation from the waste unit. Since waste is left in place, the future use of land will be restricted to industrial use to prevent unrestricted residential use of the land.

In situ grouting reduces air emissions and is relatively simple to implement. However, *in situ* grouting results in a slight increase in waste volume. The volume of the basin, when clean soil is excavated prior to grouting, will be adequate to accommodate any increase in grouted soil volume. The estimate volume of grout/soil mixture is 6,600 m^3 (8,100 yd^3).

Process Sewer Line

The selected remedy for the process sewer line and associated soils will include pipeline and manhole grouting, and excavation and disposition of pipeline soils (approximate volume 240 m^3 or 300 yd^3) into the basin and institutional controls. In this alternative, the localized areas of the contaminated soil around the pipeline hot spots will be excavated. If necessary, the sections of pipeline associated with the hot spots will also be excavated. The excavated soil and pipeline will be treated in the basin by *in situ* grouting along with soil from the basin. Clean soil from SRS borrow areas will be used to fill excavated areas around the pipeline. Completion of this remedial action will meet all applicable or relevant and appropriate Federal and state requirements/regulations, and all the remedial action objectives by reducing risk associated with the process sewer line to acceptable levels. This alternative includes institutional controls (discussed above) to prevent exposure of current and future workers to all the Human Health COCs in the waste unit and direct radiation from the waste unit. Since waste is left in place, the future use of land will be restricted to industrial use to prevent unrestricted residential use of the land.

Groundwater

The selected remedy for the FRB OU groundwater is “No Action”. The history of the FRB, the results of the groundwater modeling, and the current groundwater data prove that the FRB associated groundwater poses no risk to human health or the environment, Through computer modeling and sampling it has been shown the FRB OU has not contributed to contamination in the groundwater. However, to ensure that the grout-waste mixture has accomplished the required immobility of contamination, a groundwater-monitoring program will be established under the

selected remedy for basin soils (Alternative S5). The groundwater will be monitored semiannually until it is confirmed that the remedial response action for the FRB OU has achieved the required stabilization of the contaminants.

Since waste is left in place in the FRB waste unit, the future use of land will be restricted to industrial use to prevent unrestricted residential use of the land and five-year ROD reviews will be required.

X. STATUTORY DETERMINATIONS

Based on the RI/BRA report, the FRB OU poses future risks and hazards to the on-unit resident, construction worker, and industrial worker. The future risks are associated with: external exposure to COC radionuclides by direct contact into the FRB OU soils; potential exposure to principal threat source material; ingestion of FRB OU soils and pipeline sediment and/or produce grown in soils contaminated with radionuclides; and ingestion of groundwater containing Sr-90 (which can leach out and migrate to groundwater) with concentrations above MCL. Therefore, institutional controls, *in situ* grouting of soils, and installation of a low permeability cover over the grouted soils in the basin are necessary for the former basin area soils. Institutional controls, pipeline grouting, excavation, and disposal of pipeline associated soils with basin area soils are necessary for the process sewer line area. No action is required for the groundwater; however, groundwater shall be monitored to confirm that the source remediation has achieved the required stabilization of contaminants. The grouting (using S/S treatment) will reduce the mobility of the radionuclides (the principal threat source material), thereby preventing migration of radionuclides to the groundwater. The soil cover provided over the grouted soil will shield radiation exposure from the radionuclides contained in the grouted soil in the basin and also prevent ingestion of soil and/or produce grown in FRB OU soils.

The selected remedy is protective of human health and the environment, complies with federal and state ARARs, and is cost-effective. The ARARs are met by minimizing the potential for contaminant migration into the groundwater by stabilizing the soil into a nonleachable form. (The size and location of the waste unit radioactive contaminants preclude a remedy in which contaminants could be excavated and treated effectively). For cost comparison among the considered alternatives and to determine the most cost-effective alternatives, cost estimates prepared for the alternatives were based on a variety of cost estimations data, including generic unit costs, vendor information, and prior similar estimates prepared for other SRS sites with almost identical characteristics. Cost estimates were prepared for capital costs, O&M costs, and

present worth costs. Finally, for selecting the cost-effective remedial action for the FRB OU, an analysis was performed by considering the following factors:

- the effective life of the remedial action
- the uncertainty regarding some of the COCs, especially radionuclides that could stay absorbed in the contaminated soil for over 1,000 years and could pose a future long-term unacceptable risk even beyond 100 to 200 years
- the preference for treatment versus containment per CERCLA requirements, and
- long-term versus short-term in situ management of radioactive wastes

Based on the analysis, the selected remedial action was determined as a cost-effective measure that would provide a permanent reduction of contaminant mobility, meet the statutory requirements of CERCLA, ensure future compliance with ARARs (MCLs or RBCs), and present a reasonable value for the protection of human health and the environment.

Contaminated soils represent principal threat source material and will be stabilized to prevent or mitigate exposure to highly toxic contaminants and permanently reduce mobility of highly mobile contaminants at depth. The selected remedy utilizes long-term permanent solutions and treatment technology to the maximum extent practicable and satisfies the preference for treatment.

Since soil and pipeline sediment is grouted below grade, long-term weathering and the potential for leaching of contaminants are minimized. Worker and public safety is ensured by minimizing contact with contaminated media.

Section 300.430 (f) (4) (ii) of the NCP requires that a five-year review of the ROD be performed if hazardous substances, pollutants, or contamination remain in the waste unit. The three parties (DOE, SCDHEC, and EPA) have determined that a five-year review of the ROD for the FRB OU will be performed to ensure continued protection of human health and the environment.

XI. EXPLANATION OF SIGNIFICANT CHANGES

A public comment and CAB recommendation were received on the Statement of Basis/Proposed Plan; raising a concern regarding the need to grout the soil in addition to capping the basin soil. A response to the concern is included in the Responsiveness Summary (Appendix A of this

document). No significant changes were made as a result of public comment. The selected alternatives from the Statement of Basis/Proposed Plan remain the selected remedial action.

XII. RESPONSIVENESS SUMMARY

The Responsiveness Summary is provided as Appendix A of this document.

XIII. POST-ROD DOCUMENTS SCHEDULE AND DESCRIPTION

1. The Post-ROD documents schedule is listed below and is illustrated in Figure 20.

2. Corrective Measures Implementation/Remedial Design Work Plan (CMI/RDWP), Revision 0, for the FRB OU will be submitted for EPA and SCDHEC review 2 calendar days after issuance of the ROD.

3. SRS revision of the CM/RDWP will be completed 30 calendar days after receipt of all regulatory comments.

4. Corrective Measures Implementation/Remedial Design Report/Remedial Action Work Plan (CMI/RDR/RAWP), Revision 0, will be submitted 75 calendar days after issuance of the ROD.

5. SRS revision of the CMI/RDR/RAWP will be completed 45 calendar days after receipt of all regulatory comments.

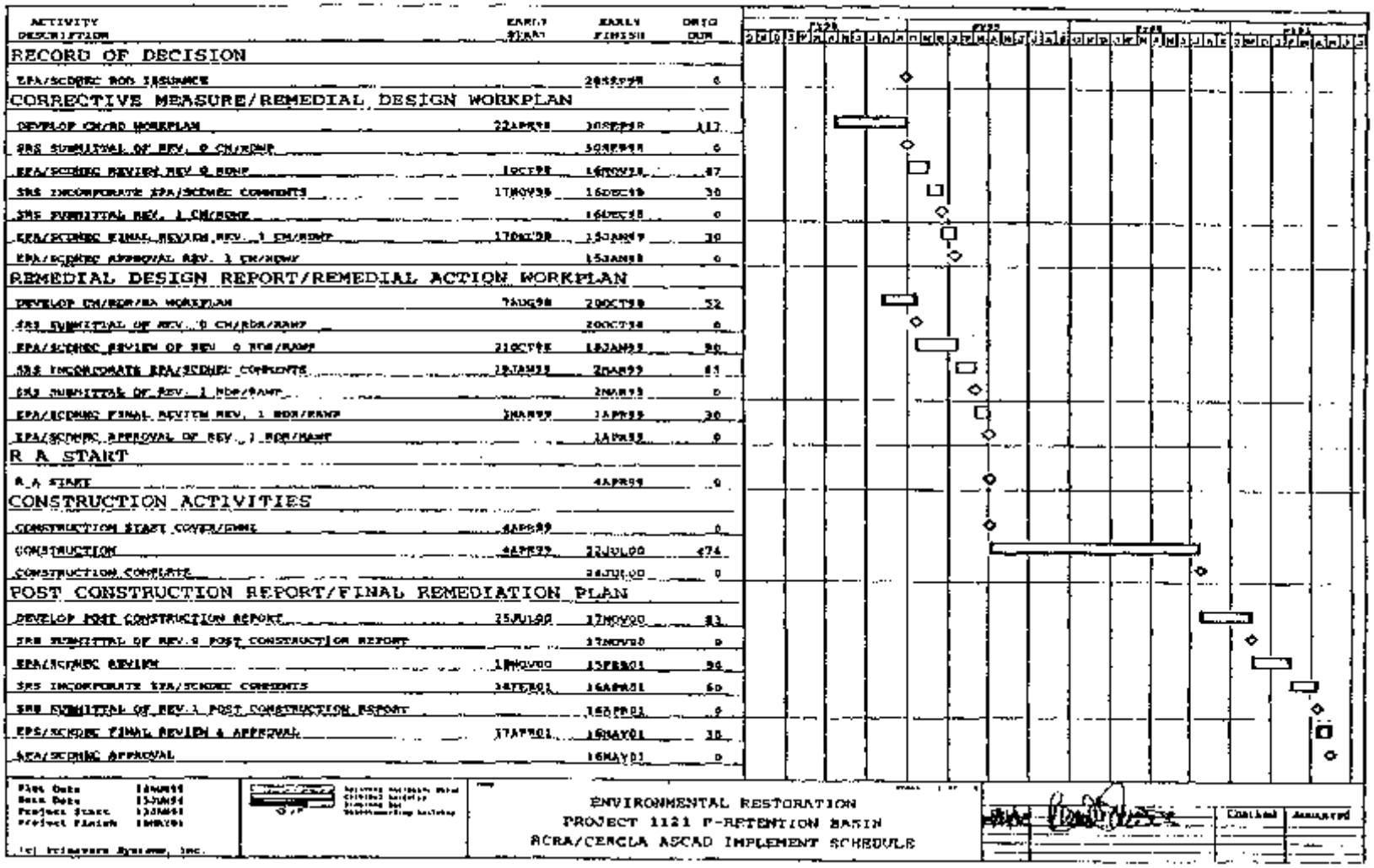
6. Remedial Action Start on the soils will begin following EPA and SCDHEC approval of the CMI/RDR/RAWP.

7. Post-Construction Report (PCR), Revision 0, will be submitted to EPA and SCDHEC after completion of the remedial action.

Post-ROD Document Description

A brief description of the post-ROD documents is provided. Corrective Measures Implementation/Remedial Design Work plan (CMI/RDWP)

Figure 20. FRB Post-ROD Document Schedule



Based on the data and information contained in the previous documents pertaining to FRB OU (including RI/BRA Report, Corrective Measures Study/Feasibility Study, Statement of Basis/Proposed Plan, and Record of Decision), CMI/RDWP will provide a description of the remedial action design for the FRB OU.

The remedial action design discussed in CMI/RDWP would include a basics cope description of the following tasks that will be performed during the remedial design:

- Topographic survey and preparation of site drawings
- Preparation of erosion control plan

- Development of acceptance criteria for the S/S process, and preparation of construction specifications for S/S activities

- Preparation of statement of work for final soil matrix design
  - Design of the soil cover system
  - Determination of institutional controls for the basin and process sewer line
  - Schedule for developing the LUCIP under EPA Region IV policy on Land use Controls at Federal Facilities
  - Preparation of groundwater monitoring plan
  - Preparation of health and safety and cover system maintenance plans

Corrective Measures Implementation/Remedial Design Report/Remedial Action Work Plan (CMI/RDR/RAWP)

This document will combine the contents and purposes of the two post-ROD documents: the Corrective Measures Implementation/Remedial Design Report (CMI/RDR) and the Corrective Measures Implementation/Remedial Action Work Plan (CMI/RAWP). This combined document will primarily outline and describe the remedial design and remedial action planned for the FRB OU and will address:

1. a remedial design summary highlighting the critical design inputs and outputs that are consistent with the remedial action objectives stated in the ROD; and

2. construction strategy summary highlighting the critical components of the construction phase, including the remedial action schedule, a design change procedure, requirements of health and safety aspects driving the construction phase and project closeout. The current schedule for completing post-ROD documents and RA start may require a phased approach to the completion of this document (e.g., validation of soil solidification mix design not completed until after RA start). This document will also include a brief discussion on the contents of the post-construction report. The CMI/RDR/RAWP will primarily include:
   - Site drawings showing the boundaries of the basin and locations of process sewer lines and manholes, etc.
   - Design Criteria including performance criteria and acceptance activities for S/S remedial Action
   - Design plans and specifications
   - Permitting requirements
   - Post-documentation identification and schedule to accommodate phased RA approach
   - Erosion control plan
   - Groundwater monitoring well maintenance plan
   - Land Use Controls Implementation Plan (LUCIP)
   - Remedial action schedule and remedial design change control
   - Waste management plan, including decontamination requirements
   - Health and safety plan
   - Maintenance plan, including institutional control requirements
   - Requirement for project closeout
   - Post-construction report description

XIV. REFERENCES

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WSRC, 1997b. *Remedial Investigation with the Baseline Risk Assessment Report for the F-Area Retention Basin* (281-3F) (U), WSRC-RP-96-356, Revision 1.2, Savannah River Site, Aiken, SC.

WSRC, 1997c. *Corrective Measures Study/Feasibility Study for the F-Area Retention Basin* (281-3F) (U), WSRC-RP-96-00906, Revision 1.2, Savannah River Site, Aiken, SC (November 1997).

WSRC, 1997d. *Statement of Basis/Proposed Plan for the F-Area Retention Basin* (281-3F) (U), WSRC-RP-97-00128, Revision 1.2, Savannah River Site, Aiken, SC (November 1997).

APPENDIX A

RESPONSIVENESS SUMMARY

Responsiveness Summary

The 45-day public comment period for the Statement of Basis/Proposed Plan (SB/PP) for the F-Area Retention Basin (281-3F) began on January 20, 1998, and ended on March 5, 1998. SRS briefed the public on the path forward for the remediation of the basin in a Citizens Advisory Board (CAB) subcommittee meeting held on February 23, 1998. At the meeting, a concern was raised over the need to grout the soil in addition to providing a low permeability cap over the basin area. Subsequently, an extension for the public comment period was granted extending the public comment period to April 4, 1998. A formal public comment (made by Todd V. Crawford) was received which questioned the risk reduction and necessity of the soil grouting. A formal CAB recommendation (see attached Recommendation No. 56) was also received on March 28, 1998. A response to these concerns is provided below. The public and CAB comments are italicized and the response is bolded.

Public Comment:

The Remedial Action Objectives are stated as:

- *Prevent future ingestion of shallow aquifer groundwater*

- *Prevent direct contact with and ingestion of soils*

- *Prevent direct contact with and ingestion of sediments from the abandoned process sewer line*

- *Prevent the transport of contaminants from subsurface soils to groundwater*

The first three of the above are met now and would be met in the future considering that institutional controls are part of all alternatives and land use plans clearly put the F-Area Retention Basin and associated pipelines in an industrial area.

The first of the Remedial Action Objectives above removes the concern about the last one. On top of that there is other contamination in the shallow groundwater in the vicinity which would negate interest in drinking the water.

The scenarios upon which the risk numbers are based are not stated in enough detail to evaluate. They must have been based on direct exposure to the contaminated soils, which are now under about 10 feet of clean dirt. Such direct exposure could not happen unless institutional controls were lost for the 200-Area plateau. If this happens the F-Area Retention Basin would be a minor problem compared to other locations in the 200-Area. If loss of institutional controls was assumed, the risk numbers would sure be misleading to the public.

Contaminates of concern include Arsenic. It is not clear if this came from the F-Area processes or is a result of early cotton farming. Or is the Arsenic and the Radium-226 from coal pile runoff? Is the K-40 from the processes or is it the naturally occurring K-40? Additionally, evaluation of the risk reduction as a function of the various alternatives for remedial action is not included. It appears that the main justification for the grouting of the basin soil under Alternative S5 is to reduce leaching but perhaps a cap on top of the current clean fill would be sufficient. The primary contaminate of concern for leaching is Sr-90 with a 28.6 year half life so caps may well make significant difference in concentrations reaching the groundwater. How much remediation is justified when nobody will be drinking the water?

CAB Recommendation:

Because the F-Area Retention Basin and associated pipelines are in the nuclear industrial area and will be under institutional controls followed by deed restrictions, and because this site has been buried for 20 years with no identified contaminant migration, the SRS Citizens Advisory Board believes that the Remedial Action Objectives can be met with less extensive remediation. CAB recommends a low-permeability cap for the basin, continued groundwater monitoring and grouting the inside of the pipeline. These changes should reduce the total remediation costs by about $1 million.

Response:

A risk assessment for the F-Area Retention Basin Source Operable Unit (FRB OU) was performed in accordance with CERCLA guidance. The relative risk values for the FRB OU indicate that remediation is required per the statutory requirements of CERCLA. Both the former basin and process sewer line areas represent a risk to a future on-unit resident as well as to a future industrial worker. Radionuclides including cesium-137, radium-226, actinium-228, and strontium-90 are the primary risk drivers for the direct radiation pathways and represent over 90 percent of the risk. These contaminants also present a future long-term groundwater risk

resulting from their leaching out from the soil and entering the groundwater at levels above applicable state regulations(i.e., MCLs).

Since the FRB OU poses unacceptable risk and a remedial action is appropriate, a Corrective Measures Study/Feasibility Study (CMS/FS) was performed to identify appropriate remedial alternatives. The alternatives were selected and screened in accordance with CERCLA guidance and a detailed analysis of the selected alternatives was performed using the nine evaluation criteria as required by the NCP. Alternative S5: Institutional Controls, Grouting, Low Permeability Cover, and Groundwater Monitoring was selected because it would provide a permanent reduction in contaminants (radionuclides) mobility and prevent contact with and ingestion of contaminated soil. To ensure the effectiveness of this alternative, groundwater monitoring downgradient of the grouted mass is also included in this alternative. This alternative is also very effective in reducing potential direct radiation exposure received from radionuclides and grouting the soil also provides an additional layer of protection by offsetting the inherent uncertainty associated with the mathematical model used to predict contaminant migration. EPA and SCDHEC approved both the CMS/FS and the SB/PP documents that justified the selected remedy. The selected remedy provides the best alternative because it meets EPA preference for treatment versus containment per CERCLA requirements and provides an additional layer of protection.

The quantifiable reduction of baseline risk is an essential consideration in remedy selection. All remedial alternative evaluations analyze the risk remaining after remediation. This is done through the setting of risk-based remediation goal options (RGOs). Not all cleanup objectives, however, are risk-based. The National Contingency Plan includes a preference for treatment of principal threat wastes. Therefore, to determine the future risk posed by the radionuclides (principal threat wastes) the risk-based modeling was performed during the development of the Remedial Investigation/Baseline Risk Assessment (RI/BRA) report for the FRB OU. It was determined that some of the contaminants of concern (COCs), especially radionuclides, could stay absorbed in the contaminated soil for over 1000 years and could pose a future long-term unacceptable risk even beyond 100 to 200 years. The selected remedy (Alternative S5) incorporates this preference as a key element of the prudent long-term management of radioactive waste in situ.

The soil cover provided over the former basin area and contaminated soil associated with the process sewer line area, without grouting the soil, could provide a permanent long-term solution by simply containing the contaminants if well maintained for an extended period of time.

However, in terms of total remediation cost, the soil cover would cost less initially but would likely need redesign/reconstruction two or three times during the entire remediation cycle, which could go beyond 100/200 years. In the long term, the cost of the soil cover would approximate the cost of the selected remedy. Hence, in situ grouting coupled with a low permeability cover was determined to be the best alternative that would provide permanent reduction of contaminant mobility, meet the statutory requirements of CERCLA, and also ensure future compliance with applicable state regulations (i.e., MCLs).

Savannah River Site Citizens Advisory Board
Recommendation No. 56
March 24, 1998
Remediation of F-Area Retention Basin

Background:

The F-Area Retention Basin is an unlined basin 120 by 200 feet, which collected lightly contaminated cooling water from the F-Area Canyon Facility as well as storm water drainage from the F-Area Tank Farm. The basin was used from 1955 to 1972. In 1978, its soil was sampled and analyzed, contaminated soil removed, and the basin closed. Closure consisted of filling the basin with about 7 to 10 feet of clean dirt and seeding the surface with grass.

Numerous environmental investigations were completed on the retention basin and the connecting process sewer line between 1993 and 1997. Extensive sampling data and analyses were published along with pathway and risk calculations. The most significant contaminates are Arsenic and Cesium-137. Also, fate and transport analyses have indicated that levels of certain radionuclides (e.g., technetium, strontium) could exceed acceptable concentrations in the groundwater under the basin. The risk analyses, under conservative assumptions, indicate a risk above the CERCLA guidelines only for an onsite resident exposed to the remaining contaminated soils in the basin. However, there is currently no risk to onsite workers or the offsite public. Further, this site is located in an industrial cleanup zone (see Motion 2).

Remedial Action Objectives for an onsite resident have been identified and remediation alternative have been evaluated.[2] These Remedial Action Objectives are: prevent future ingestion of shallow aquifer groundwater; prevent direct contact with and ingestion of soils (basin and pipeline); prevent direct contact with and ingestion of sediments from the abandoned process sewer line; and prevent the transport of contaminants from subsurface soils to groundwater (basin and pipeline). Remedial alternatives were evaluated for basin soils (4 alternatives), for groundwater (2 alternatives) and process sewer line and pipeline soils (3 alternatives). [(2,3)] All alternatives require institutional control and the recording of basin and pipeline locations as deed restrictions before releasing the land to the public. The preferred

[1] Remedial Investigation Report with the Baseline Risk Assessment for the F-Area Retention Basin (281-3F), final, WSRC-RP-96-356, Rev. 1.2, July 1997
[2] Corrective Measures Study/Feasibility Study for the F-Area Retention Basin (281-3F), Final, WSRC-RP-96-00906, Rev. 1.2, November 1997
[3] Statement of Basis/Proposed Plan for the F-Area Retention Basin (281-3F), Final, WSRC-RP-97-00128, Rev. 1.2, November 1997

alternatives are: for the basin soils – institutional controls, grouting and low permeability cover ($1,460,929); for groundwater – no action ($9,578); and for the process sewer line and pipeline soils – institutional controls, pipeline grouting and soil excavation and disposition with the basin soils ($319,265). The reduction in risk was not evaluated quantitatively for any of these alternatives; however, the relative risk reductions were evaluated qualitatively.

Recommendation:

Because the F-Area Retention Basin and associated pipelines are in the nuclear industrial area and will be under institutional controls followed by deed restrictions, and because this site has been buried for 20 years with no identified contaminant migration, the SRS Citizens Advisory Board believes that the Remedial Action Objectives can be met with less extensive remediation. We recommend a low-permeability cap for the basin, continued groundwater monitoring and grouting the inside of the pipeline. These changes should reduce the total remediation costs by about $1 million.

Because the amount of risk reduction for different remediation alternatives is critical in the selection of cost effective remediation strategies, the SRS Citizens Advisory Board recommends that in the future that all SRS remediation studies include analyses of the risk remaining after remediation for the most likely alternative and the most probable pathway and exposure scenarios.

Furthermore, the extensive analyses and documentation for the F-Area Retention Basin and associated pipeline probably cost as much or more than the planned remediation. This leads us to make the more general recommendation that the three agencies (DOE, EPA and SCDHEC) expeditiously implement the Plug-In-ROD approach to reduce future paperwork costs.

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 09/15/1998
Operable Unit: 41, 42, 52, 54
ROD ID: EPA/541/R-98/187

Media: Groundwater, Soil

Contaminant: PAH, Radioactive

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. SRS is a secured U.S. government facility with no permanent residents. SRS is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina.

SRS is owned by the Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided nuclear materials for the space program and for medical, industrial, and research efforts. Chemical and radioactive wastes are by-products of nuclear material production processes. The entire SRS facility was placed on the National Priorities List (NPL) in December 1989.

Operable Unit (OU1):

The M-Area Hazardous Waste Management Facility (HWMF) is a source-specific operable unit within the A/M Area Fundamental Study Area. The M-Area HWMF includes an unlined surface impoundment (settling basin), a portion of an inactive process sewer line, drainage and seepage areas, and a Carolina bay known as Lost Lake. The nearest plant boundary is approximately 5800 feet northwest of the M-Area HWMF.

The M-Area settling basin was constructed in 1958 to settle out metals discharged from M-Area manufacturing operations. The basin dimensions were approximately 330 feet by 280 feet by 17 feet with a volumetric capacity of approximately eight million gallons. Overflow from the settling basin was directed to a natural seepage area and ultimately to Lost Lake. In July 1985, a permitted wastewater treatment facility was placed in operation and discharges to the settling basin were discontinued.

A Record of Decision (ROD) addressing OU1 was completed in June 1992.

OU2:

The Metallurgical Laboratory HWMF is a source-specific operable unit within the A/M Area fundamental Study Area. The Metallurgical Laboratory HWMF includes an abandoned portion of a process sewer line, a seepage basin, a drainage outfall, and a Carolina bay. The nearest plant boundary is located approximately three-fourths of a mile to the northwest of this operable unit.

The Metallurgical Laboratory was used for corrosion testing on stainless steels and nickel-based alloys. This testing required degreasing and cleaning metal parts, etching sample identification information on the parts, and photographing the samples. No radioactive materials were known to have been discharged to the HWMF. During periods of heavy rainfall, wastewater and surface water overflowed a drainage outfall at the Metallurgical Laboratory Basin into the adjacent Carolina Bay. A RCRA closure plan for the basin and sewer line portions of the Metallurgical Laboratory HWMF was submitted and approved in June 1991. The intent of the closure plan is to ensure the basin and sewer line portions of the Metallurgical Laboratory HWMF will be closed in a manner that controls, minimizes, or eliminates post-closure migration of hazardous constituents and decomposition products to the vadose zone, groundwater, surface waters, or atmosphere.

A ROD addressing OU2 was completed in June 1992.

OU3:

The A/M Area, located in the northwest portion of SRS, contains nuclear fuel fabrication buildings, office buildings, and research areas. The A/M Area groundwater is a media-specific operable unit

within the A/M Area Fundamental Study Area. As a result of past waste disposal practices, the groundwater beneath A/M Area has been contaminated with organic solvents, primarily trichloroethylene (TCE) and tetrachloroethylene (perchloroethylene; PCE). Total plume size beneath the A/M Area, as currently defined, is approximately 1200 acres. The contamination in the A/M Area groundwater and the overlying unsaturated zone appears to be associated with releases from the following A/M Area source units: the A-014 Outfall, the M-Area Settling Basin/Lost Lake (M-Area HWMF), and the M-Area HWMF Process Sewer, and the 321-M Solvent Storage Area.

From 1952 to 1981, an estimated 13 million pounds of chlorinated solvents were used in the A/M Area to degrease fuel and target tubes used in SRS reactors. An estimated 50 to 90 percent of the solvents evaporated during degreasing operations. The remaining solvents were discharged as waste to the process sewer system. Additionally, significant quantities of chlorinated solvents were inadvertently spilled during handling and storage.

A ROD addressing OU3 was completed in June 1992.

OU4:

The Gunsite 720 Rubble Pit is located within SRS and is approximately 305 meters (100 feet) west of South Carolina Highway 125, 168 meters (550 feet) north of SRS Road A-2, and 2.5 kilometers (1.5 miles) from the nearest SRS boundary.

During the period from 1955 to 1960, to defend the SRS in the event of an air attack, the U.S. Army established onsite anti-aircraft artillery gun emplacements at several locations near the perimeter of SRS. The Gunsite 720 was one of those emplacements. In the early 1980s, while work was being performed in the area, nine empty, partially buried drums, labeled "duPont Freon 11" were found at the gunsite. The drums were excavated in July 1987, and placed on a pallet at the gunsite. The drums were excavated in July 1987, and placed on a pallet at the gunsite. The area around the drums was screened during excavation and the liquid (rainwater) that collected in the excavated drums was sampled prior to disposal. No evidence of hazardous substances was found. In October, 1989, the drums were removed from the unit.

A ROD addressing OU4 was completed in March 1997.

OU5:

The Gunsite 113 Access Road Unit is located in the northeast corner of SRS, adjacent to the access road leading to Gunsite 113, and is approximately 91.5 meters (300 feet) east of where SRS Road 8 crosses the SRS facility boundary.

The area appears to have been used as a surface disposal area for

spoil dirt and/or road construction debris. There is no documentation or record of any hazardous substance management, disposal, or any other type of waste disposal at this unit. There is no evidence that any recent disposal activities have occurred in this area or that disposal activities were more widespread. Also, there is no evidence of any burning or excavation at this waste unit.
A ROD addressing OU5 was completed in March 1997.

OU6:
The F-Area HWMF (basins F-1, F-2, and F-3) operated from 1955 until November 1988. During that time, the facility received waste effluents from F-Area chemical separation facilities processes such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads. The three basins had a combined maximum operating capacity of 20.5 million gallons of wastewater.
These basins were closed by dewatering, physically and chemically stabilizing the remaining sludges and placing a protective multi-layer cover system over them to reduce rainwater contact with basin bottoms.
Closure of the F-Area HWMF was begun in 1989 and completed in January 1991. The F-Area HWMF was certified closed in February 1991. Closure activities specifically included removal of standing water remaining in the basin; stabilization of the basin sludge with a layer of granite, limestone and blast furnace slag; construction of a low permeability cap over the basin; and restoration of the area.
A ROD addressing OU6 was completed in September 1993.

OU7:
The H-Area HWMF is a source specific operable unit within the H-Area Fundamental Study Area. The H-Area HWMF consists of three unlined, earthen surface impoundments located in the center of SRS, southwest of Road E and north of road 4 approximately 6 miles from the nearest site boundary.
The H-Area HWMF operated from 1955 until November 1988. The original H-Area HWMF consisted of basins H-1, H-2, and H-3 and operated from 1955 to 1962. In 1962 H-3 was replaced by H-4. At the time of closure, the H-Area HWMF had a combined maximum operating capacity of 26.5 million gallons of wastewater. The H-Area HWMF received waste effluents from H-Area chemical separation facilities processes such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads.
The four basins were closed by dewatering, physically and chemically stabilizing the remaining sludges and placing a protective multi-layer cover system over them to reduce rainwater contact with

basin bottoms.

OU8:
The F-Area HWMF is a source specific operable unit within the F-Area Fundamental Study Area. The F-Area HWMF is located in the center of SRS, Southwest of Road E and North of Road 4 approximately 16 miles from the nearest plant boundary. The F-Area HWMF consisted of three unlined earthen basins that had a combined maximum operating capacity of 20.5 million gallons of waste water during operation. It received waste effluents from F-Area chemical separations facilities such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads. Significant amounts of nitrates and caustics were received.
A ROD addressing OU8 was completed in April 1995.

OU9:
The H-Area HWMF consists of a series of three hydraulically connected unlined basins (H-1, H-2, and H-4). Basin H-4 was built in 1962 to replace basin H-3. Wastewater flow to the basins was terminated on November 7, 1988 in accordance with the requirements of RCRA. The H-Area HWMF received waste effluents from H-Area chemical separations facilities such as nitric acid recovery unit, waste storage system evaporator overheads, and general purpose overheads. The waste stream contained hazardous constituents and low levels of radionuclides.
A ROD addressing OU9 was completed in April 1995.

OU10:
The Fire Department Hose Training Facility (FDHTF) is located approximately 200 meters (700 feet) northeast of the intersection of Roads C and 6 and approximately six meters (20 feet) west and downgradient of a heat exchanger storage pad. The FDHTF is a source control and groundwater operable unit. The FDHTF was built between 1975 and March 1979 and operated by the SRS Fire Department between 1979 and 1982 to train personnel in fighting waste oil fires. Training exercises typically included pouring burnable oil into the unit, igniting the oil, and then having the fire department extinguish the fire with water from fire hydrants located adjacent to the unit. No known hazardous wastes were placed in the unit.
The SRS Fire Department discontinued use of the FDHTF and recommended the facility for cleanup and closure in March 1982. Available documentation indicates cleanup activities occurred on November 21, 1982 during which 14 loads of oil-contaminated soil were excavated from an area approximately 6 by 6 by 1 meter and

transported to the sanitary landfill. However, the date of this cleanup activity could not be verified.
A ROD addressing OU10 was completed in August 1998.

OU11:
The Central Shops Burning/Rubble Pit (631-6G) (BRP6G)is located in the Central Shops Area near the center of the SRS. It operated from 1951 through 1955 for the disposal and burning of waste materials. The unit consisted of a shallow unlined excavation, approximately 3m (10 feet) deep. Materials believed to be disposed of in the pit included waste oils, rags, paper, cardboard, plastics, degreasers, wood, rubber, and drummed organic solvents. These materials were periodically burned in the pit, usually on a monthly basis. The volume of waste disposed of at BRP6G was not recorded.
A ROD addressing OU11 was completed in May 1997.

OU12:
The M-Area West unit is located west of the M-Area Production Facility on a dirt road approximately 1.8 kilometers north of Silverton Road. There are no structures of any type located at or near M-Area West. The only nearby man-made feature is a dirt access road located about 30 to 40 feet west of the waste areas.
The unit consists of two small areas. Several drums and other small innocuous debris were found on the land surface adjacent to a dirt road approximately 1 kilometer west of the M-Area production facility. The total waste at the unit consisted of six empty 55-gallon drums, four 1-gallon cans and a 1-gallon glass jar. The cans and the jar were originally contained in one of the larger drums. With the exception of a crushed drum and small amounts of metal debris, all other materials were removed from the site in 1992.
There is no documented information available regarding past hazardous or non-hazardous waste disposal activities at M-Area West. Markings on the drums found at the unit suggest that they once contained oil and solvents, and that they are approximately 37 years old. There is no evidence that any recent disposal activity has occurred or that the disposal activity was more widespread. Also, there is no evidence of any burning or excavation at this waste unit.
A ROD addressing OU12 was completed in September 1995.

OU13:
The Silverton Road Waste Unit (SRWU) is located in the northwestern part of SRS in Aiken County, approximately 1.5 miles southwest of A/M Area. The SRWU was first used before construction of the SRS. Municipal, agricultural, and commercial trash, rubbish, garbage, debris, and refuse probably constituted the waste stream until the early 1950s. After procurement by the federal

government, the SRWU land continued to be used as an open dump for disposal of metal shavings, 55-gallon drums, cardboard drums, tires, lumber, etc. No records of waste disposal activities were kept. In 1974, the disposal of waste at the SRWU ceased, and the area was bulldozed, graded, covered with soil, and planted with grasses.
A ROD addressing OU13 was completed in March 1997.

OU14:
The F-Area Burning /Rubble Pits (FBRP) comprise a source unit located within the SRS, approximately 3000 feet west of F-Area and 1100 feet north of SRS Road C. Between 1951 and 1973, SRS used Pits 231-F and 231-1F to burn a variety of wastes which were considered non-hazardous at that time. Some of these waste materials (degreasers and solvents) are now considered to be hazardous based on ingestion or possible dermal contact. Waste was usually burned on a monthly basis. The chemical composition and volumes of the disposed waste are unknown, but waste materials burned included paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents.
A ROD addressing OU14 was completed in March 1997.

OU15:
The D-Area Burning/Rubble Pits (DBRP) are located in the western part of the SRS in Barnwell County, approximately 2600 feet west of D Area and 1.6 miles west of State Highway. Between 1951 and 1973, burning pits were used at SRS to burn a variety of hazardous and non-hazardous waste. The chemical composition and volumes of the disposed waste are unknown. Combustible materials, which were burned monthly, included paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents. No known or suspected radioactive materials were allowed in the burning pits. Burning of waste in the SRS pits was discontinued by October 1973. A layer of soil was then placed over the residue in the pits and they were subsequently used as rubble pits.
A ROD addressing OU15 was completed in March 1997.

OU16:
The Old F-Area Seepage Basin (OFASB) is located within the SRS, approximately 600 feet north of F Area and one mile east of Road C and is located in Aiken County. The Savannah River and associated swamps are located approximately six miles west of the basin. The OFASB is designated as Building Number 904-49G and covers a total area of 1.3 acres.
Between November 1954 and mid-May 1955, 9 to 14 million gallons of wastewater were discharged to the basin which served as an unlined seepage basin for the purpose of reducing radioactive

substance concentrations. Wastewater included overhead condensates from evaporators, laundry washwaters, non-reactor cooling water from F and H Areas, and possibly other chemicals.
A ROD addressing OU16 was completed in May 1997.

OU17:
The L-Area Oil and Chemical Basin (LAOCB) and L-Area Acid Caustic Basin (LAACB) are located south of L-Area in an area of low to moderate relief. They are situated on the southern flank of a hill approximately 300 feet south of the L-Area perimeter fence and 1,250 feet north of L Lake.
The LAOCB was designed and constructed as an unlined seepage basin in 1961 for the purpose of disposing of small volumes of wastes that were not appropriate for discharge to local streams, regular seepage basins, or the 200-Area waste management system. The exact quantity of waste water discharged to the LAOCB basin is not documented. Liquid wastes consisting of small volumes of slightly radioactive oil and chemical wastewater were sent to the LAOCB from throughout SRS, but came primarily from the reactor areas. Wastes were transported to the drainage pad in tank trucks, metal drums, skid tanks, and other containers. The Hot Shop (Building 717-G) discharged decontaminated wastewater containing radionuclides, detergents, and spent degreasing solvents through the pipeline to the basin.
A ROD addressing OU17 was completed in March 1997.

OU18:
The Burma Road Rubble Pit (BRRP) is located approximately one-half mile southwest of F-Area Separations Facility and one-tenth mile southwest of C Road. The BRRP is between Upper Three Runs Creek and Four Mile Creek.
The BRRP consists of two unlined earthen pits dug into surficial soil and filled with various waste materials. A small circular area of disturbed soil was detected adjacent to these pits and is considered to have been used as a source of backfill for the pits. It has been determined that the BRRP source control OU does not contribute contamination to the area groundwater or surrounding soils.
A ROD describing OU18 was completed in August 1998.

OU20:
The K-Area Bingham Pump Outage Pit (KBPOP) is situated in the Tobacco Road formation which extends from ground surface to a depth of 95 feet below ground surface. Between 1957 and 1958, miscellaneous construction debris generated by major modifications and repairs to the primary and secondary reactor cooling water systems was buried in the KBPOP. There were no pumps buried and

no liquid waste was disposed of in the KBPOP.
A ROD addressing OU20 was completed in March 1998.

OU23:
The F-Area Retention Basin (FRB) is located outside and south of the F-Area perimeter fence, approximately 1035 meters (3397 feet) from Fourmile Branch. The FRB, with an area of 0.6 acres, was designed and operated as an unlined, temporary container for potentially contaminated cooling water from the F-Area Canyon Facility and stormwater drainage from the F-Area Tank Farm. Cooling water from the Canyon Facility generally had low levels of radioactivity, while water from the Tank Farm is believed to have had only trace quantities of nonradionuclide chemicals. The quantities of water released to the retention basin and the level of various constituents contained within the water are unknown.
A ROD addressing OU23 was completed in September 1998.

OU27:
The D-Area Oil Seepage Basin is located on the Ellenton Plain, the highest of three terraces between the Savannah River to the west and the Aiken Plateau to the east. Construction of the D-Area Oil Seepage Basin trenches began in 1952. Employee interviews indicated the basin was used in the disposal of waste oil originating from D-Area Powerhouse operations to dispose of nonburnable waste and for the routine burning of office and cafeteria waste. Unknown amounts and types of waste were disposed into the basin. Records of the contents of the disposed drums do not exist. To date, there is no evidence to indicate the presence of radionuclides in the drums. Furthermore, employee interviews have indicated that no radionuclides were disposed within the trenches. In 1975, the D-Area Oil Seepage Basin was removed from service and backfilled with soil. Approximately one foot of standing liquid, plus an unknown number of 55-gallon drums possibly containing waste oil, remained in the basin when it was backfilled. The basin remains inactive and is covered with natural vegetation, including bushes and grasses, and is surrounded by trees.
RODs addressing OU27 were completed in March 1995 and August 1998.

OU29:
The TNX Area is a pilot scale test facility for the SRTC. The pilot scale facilities are used to provide technical support to various SRS production areas. From 1953 to August 1988, wastewater generated by research performed in the TNX Area was disposed of in seepage basins. In August 1988, wastewater was rerouted to the TNX Effluent Treatment Facility.

A ROD addressing OU29 was completed in November 1994.

OU32:
The Burial Ground Complex (BGC) is an area which occupies approximately 195 acres in the central part of SRS between F and H Separation Areas, on a nearly flat divide between Upper Three Runs Creek to the north and Four Mile Creek to the south.
The BGC includes the Old Radioactive Waste Burial Ground (ORWBG) and other OUs such as the Mixed Waste Management Facility (MWMF), the Low Level Radioactive Waste Disposal Facility (LLRWDF), Solvent Tanks S1-S22 (located in the ORWBG and currently being characterized), Solvent Tanks S23-S30, and Solvent Tank S32.
The ORWBG comprises a disposal area for solid radioactive waste produced at the SRS, as well as shipments from other U.S. DOE and Department of Defense facilities. The ORWBG has contributed to localizedshallow aquifer groundwater contamination. The plume of groundwater contamination from the ORWBG seeps into the old F-Area effluent stream which flows into Four Mile Creek which in turn flows into the Savannah River. Other RCRA/CERCLA units within the BGC are undergoing characterization and investigation to determine the impacts to the environment.
The ORWBG began receiving waste in 1952 and was filled in 1972. Examples of materials disposed of at the Old Radioactive Waste Burial Ground (ORWBG) include the incidental waste from laboratory and production operations, contaminated equipment, lead, spent deionizer resins, spent lithium-aluminum targets, irradiated process oil from pumps in the tritium facilities and reactor areas, mercury from gas pumps in tritium facilities, cadmium, scintillation fluid, and shipments from off-site.
A ROD addressing OU32 was completed in June 1996.

OU33:
The mixed waste management facility (MWMF) operated from 1969 until March 11, 1986. During that time, this facility, which comprises approximately 58 acres, received low-level radioactive waste materials produced at SRS. Some of these materials are classified as mixed waste containing both hazardous and radioactive components under the RCRA. These trenches were closed by precompacting and placing a protective multi-layer cover system over them to reduce rainwater contact with trench bottoms.
RCRA preventive actions at the MWMF were conducted pursuant to the requirements of RCRA. In 1985 a RCRA Closure Plan was submitted, and closure of the MWMF was begun in 1988 and completed in December 1990. The MWMF was certified closed in 1991. Closure activities specifically included precompaction,

construction of a low permeability cap over the trenches, and restoration of the area.
A ROD addressing OU33 was completed in September 1994.

OU34:
The Tank 105-C HWMF was installed in 1961 as part of an off-line heat exchanger repair program and was used as a temporary holding tank for liquid solution. Sumps from the heat exchanger cleaning area drained into Tank 105-C. Oil in the tank was probably attributable to oil leaks into these sumps. The reacted or spent oxalic acid solution that resulted from the rinsing process was pumped into an above ground neutralization tank in the stack area of the reactor building.
In October 1990, a RCRA Closure Plan was submitted to the SCDHEC. SRS received approval of the closure plan on January 16, 1991, with no revision required. Closure activities specifically included the neutralization of waste to a pH of less than 12.5, removal of as much waste as reasonably possible, and shipment of removed waste to an onsite storage/disposal facility. Any remaining waste and the tank void were stabilized with concrete.
A ROD addressing OU34 was completed in September 1994.

OU35:
Par Pond is a 2640-acre man-made reservoir located northeast of P Area and east of R Area in the eastern portion of SRS. The southern shore of the reservoir lies approximately 1.5 miles from the eastern SRS boundary. The southern shore of the reservoir lies approximately 200 feet north of Road B. Par Pond discharges through controlled releases into Lower Three Runs Creek, which in turn discharges into the Savannah River. The length of Lower Three Runs Creek from the outfall of Par Pond to the Savannah River is approximately 20 miles.
Par Pond was built to augment the cooling water requirements of both P and R Reactors. During the 1950s, an effluent pathway was constructed from R Reactor to Par Pond. The pathway consisted of the R Canal and Pond B. Releases in the form of process leaks, purges, and makeup cooling water have contaminated Par Pond with cesium-137 and other radioactive and non-radioactive contaminants. Mercury has been detected in fish from the Savannah River and SRS waterbodies since the analyses began in 1971, with comparable concentrations measured in onsite and offsite fish.
A ROD describing OU35 was completed in February 1995.

OU41:
OU41 contains the P-Area CP R/O Basin (P-CRPB). The P-CRPB is located approximately 330 feet southeast of the limited area fence

surrounding P Area in northwestern Barnwell County.
A ROD addressing OU41 was completed in September 1998.

OU42:
OU42 contains the C-Area CP R/O Basin (C-CRPB). The C-CPRB is located approximately 700 feet southeast of the limited area fence surrounding C Area in northwestern Barnwell County.
A ROD addressing OU42 was completed in September 1998.

OU45:
The Grace Road Site is located approximately 1.3 kilometers south of B-Area and about 244 meters east of the intersection of Grace Road and SRS Road 2. It consists of numerous drums and cans, concrete slabs, brick foundations, and miscellaneous debris. The unit also contained numerous drums and cans varying in size from ? gallon cans to 55-gallon drums and various car parts. Most of the debris was on the surface or partially buried in scattered locations across the unit. Markings on a few of the smaller drums and cans indicated that they once contained oil and grease. There is no evidence that any recent disposal activity has occurred or that the disposal activity was more widespread. Also, there is no evidence of any burning or excavation at this waste unit.
Between February and May 1992, all the debris, drums and concrete slabs were removed from the Grace Road Site. The items removed were either used at soil erosion control areas or were disposed of in the sanitary landfill. No records of any type of waste management activity have been found for the Grace Road Site.
A ROD addressing OU45 was completed in March 1997.

OU51:
The Motor Shops Seepage Basin (716-A) (MSSB) is located in A Area south of the railroad tracks near the automotive shop in Aiken County. A small drainage feature runs through the area approximately 91 meters (300 feet) to the east of the MSSB.
The MSSB was constructed and placed in service in 1977 to receive liquid waste from the 716-A Motor Shops oil/water separator. The MSSB was designed and constructed as an unlined seepage basin. The wastewater flowed into the basin from the northwest through two influent pipes from the Motor Shop and seeped naturally into the soil beneath the basin. Effluent discharges from the Motor Shops included wastewater with trace amounts of engine oil, grease, kerosene, ethylene glycol, and soapy water.
A ROD addressing OU51 was completed in June 1998.

OU52:
The K-Area CP R/O Basin (K-CPRB). The K-CPRB is located

approximately 500 feet west of the limited area fence surrounding K Area in northwestern Barnwell County.
A ROD addressing OU52 was completed in September 1998.

OU54:
The F-Area CP R/O Basin (F-CPRB) is located approximately 50 feet southeast of the limited area fence surrounding F Area in southwestern Aiken County.
A ROD addressing OU54 was completed in September 1998.

Remedy: The selected remedy is No Further Action with confirmatory groundwater monitoring at the site. The No Further Action Alternative means that no further remedial action will be performed. The waste has been removed, the remedial goals have been met, and the excavation has been covered with at least four feet of clean soil backfill. The no action alternative is appropriate for the pipeline, overflow areas, and water table aquifer. Annual confirmatory groundwater monitoring will be conducted for a period of five years to ensure that no further action with confirmatory groundwater monitoring at the site is the appropriate remedy.

Estimated Capital Cost: not provided
Estimated Annual O&M: not provided
Estimated Present Worth : not provided
Cost of groundwater monitoring and reporting program: $60,200.00

Text: Full-text ROD document follows on next page.

EPA 541-R98-187

<IMG SRC 981870>

United States Department of Energy

Savannah River Site

Record of Decision
Remedial Alternative Selection for the
C-, F-, K-, and P-Area Coal Pile Runoff Basins (189-C,
289-F, 189-K, and 189-P) (U)

WSRC-RP-97-850
Revision 1
July 1998

<IMG SRC 98187A>

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

Prepared for the U.S. Department of Energy under Contract No. DE-AC09-96SR18500

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

C-, F-, K-, and P-Area Coal Pile Runoff Basins
(189-C, 289-F, 189-K, and 189-P)

WSRC-RP-97-850
Revision 1
July 1998

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U.S. Department of Energy Under Contract DE-AC09-96SR18500

Savannah River Operations Office
Aiken, South Carolina

DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

C-, F-, K-, and P-Area Coal Pile Runoff Basins (189-C, 289-F, 189-K, and 189-P)
Savannah River Site
Aiken, South Carolina

The C-, F, K-, and P-Area Coal Pile Runoff Basins (189-C, 289-F, 189-K, and 189-P)(C-, F-, K-, and P-CPRBs) waste unit are listed as Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Units/Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) units in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS). The C-, F-, K-, and P-CPRBs comprise a single operable unit which was remediated under an early removal action during the summer of 1997.

Statement of Basis and Purpose

This decision document presents the selected remedial alternative for the C-, F-, K-, and P-CPRBs located at the SRS in Aiken, South Carolina. The selected alternative was developed in accordance with CERCLA. as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this specific RCRA/CERCLA operable unit.

Assessment of the Site

Slightly elevated levels of naturally occurring metals and radionuclides in the coal-laden sediments and shallow soils were confined to the 0-1 foot interval below the basin floor. These source materials were identified as low level thireat wastes. Under the Removal Site Evaluation Report/Wastewater Closure Plan for the C-, F-, K-, and P-Area Coal Pile Runoff Basins (189-C, 289-F, 189-K, and 189-P) (U) (WSRC 1997b), the coal-laden sediments and shallow soils were removed from each of the four basins during the summer of 1997. At least four feet of clean backfill was placed in each basin to restore the area to the surrounding grade. This removal action completely freed the four CPRBs of the source material for the constituents of concern and the sulfide minerals, which were reducing the pH of the infiltrate. Because the source material has been removed from the CPRBs, releases of hazardous substances will not occur from this operable unit and there is no imminent or substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

The preferred alternative for the C-, F-, K, and P-CPRBs operable unit is No Further Action with

a five-year
period of confirmatory groundwater monitoring at the K-CPRB.

Gross alpha and the sum of radium-226 and radium-228 have occasionally exceeded maximum contaminant
levels (MCLs) in the water table aquifer at the K-CPRB. Based on the groundwater monitoring history, no
significant groundwater contamination has originated from the C-, F-, and P-CPRBs. The probable condition
for the groundwater at all of CPRBs is no significant groundwater contamination resulting from the operation
of the CPRBs. As a result, no remedial action is deemed appropriate for the water table aquifer at the CPRBs.
Confirmatory groundwater monitoring, as discussed in Section IX of the ROD, will be conducted for five
years at the K-CPRB. Confirmatory monitoring should demonstrate that No Further Action is the appropriate
remedy. In the event that the probable condition is no longer appropriate, DOE, SCDHEC, and EPA (the
three parties to the Federal Facility Agreement) will evaluate the need for remedial action.

The South Carolina Department of Health and Environmental Control has modified the SRS RCRA permit
(SC1 890 008 989) to incorporate the selected remedy.

Statutory Determinations

The Removal Site Evaluation Report/Wastewater Closure Plan for the C-, F-, K-, and P-Area Coal Pile
Runoff Basins (189-C, 289-F, 189-K, and 189-P) (U) (WSRC 1997b) was reviewed and approved by the EPA
and SCDHEC's Division of Site Assessment and Remediation and the Industrial, Agricultural and Storm
Water Permitting Division. Following the completion of the removal action, SCDHEC inspected the four
CPRBs and approved the final closure of these basins.

Based on the Post Removal Action/Remedial Investigation Reportfor the C-, F-, K-, and P-Area Coal Pile
Runoff Basins (189-C, 289-F, 189-K, and 189-P) (U) (WSRC 1997d), all low level threat source material
was removed. The operable unit poses no significant risk to human health or the environment. Therefore, a
determination has been made that No Further Action is required at the C-, F-, K-, and P-CPRBs and that
CERCLA Section 121 is not applicable to this No Further Action ROD.

The selected remedy is protective of human health and the environment, complies with Federal and State of
South Carolina requirements that an legally applicable or relevant and appropriate to the remedial action,
and is cost-effective. This No Further Action remedy is a permanent solution. Because this remedy does not
result in hazardous substances remaining on-site above health-based levels, the five-year review will not
apply to this action.

<IMG SRC 98187B>

DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

C-, F-, K-, and P-Area Coal Pile Runoff Basins
(189-C, 289-F, 189-K, and 189-P)

WSRC-RP-97-850
Revision 1
July 1998

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U.S. Department of Energy Under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

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LIST OF ACRONYMS AND ABBREVIATIONS

ARARs	Applicable or relevant and appropriate requirements
BEHP	bis(2-Ethylbexyl)phthalate
BRA	Baseline Risk Assessment
C-CPRB	C-Area Coal Pile Runoff Basin
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
C-, F-, K-, and P-CPRBs	C-, F-, K-, and P-Area Coal Pile Runoff Basins
CMS	Corrective Measures Study
CMS/FS	Corrective Measures Study/Feasibility Study
COC	Constituent of Concern
COPC	Constituent of Potential Concern
CPRB	Coal Pile Runoff Basin
CrVI	Chromium VI
CSM	Conceptual site model
DOE	U.S. Department of Energy
DQO	Data Quality Objectives
EPA	U.S. Environmental Protection Agency
F-CPRB	F-Area Coal Pile Runoff Basin
FFA	Fedcral Facility Agreement
FS	Feasibility Study
HI	Hazard index
HQ	Hazard quotient
K-CPRB	K-Area Coal Pile Runoff Basin
MCL	Maximum contaminant level
mg/kg	Milligrams per kilograms
NCP	National Oil and Hazardous Substances Contingency Plan
NEPA	National Environmental Policy Act
NPL	National Priorities List
Ou	Operable unit
P-CPRB	P-Area Coal Pile Runoff Basin
PP	Proposed Plan
PRA/RIR	Post-Removal Action/Remedial Investigation Report

RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RG	Remedial Goal
RI	CERCLA Remedial Investigation
ROD	Record of Decision
SB	Statement of Basis
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulations
SRS	Savannah River Site
SWMU	Solid waste management unit
USC	Unit-specific constituent
WSRC	Westinghouse Savannah River Company

I. SAVANNAH RIVER SITE AND OPERABLE UNIT NAME, LOCATION, DESCRIPTION, AND PROCESS HISTORY

Savannah River Site Location, Description, and Process History

The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of western South Carolina. SRS is a secured U.S. Government facility with no permanent residents. SRS is located approximately 25 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina (Figure 1).

SRS is owned by the U.S. Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium,and other special nuclear materials for national defense and the space program.

Operable Unit Name, Location, Description, and Process History

The operable unit (OU) comprises the C-, F-, K-, and P-Area Coal Pile Runoff Basins (189-C, 289-F, 189-K, and 189-P) (C-, F-, K-, and P-CPRBs). The Federal Facility Agreement (FFA) lists the C-, F-, K, and P-CPRBs as Resource Conservation and Recovery Act/Comprehensive Environmental Response, Compensation and Liability Act (RCRA/CERCLA) units requiring evaluation to determine the actual or potential impact to human health and the environment. Figures 2, 3, 4, and 5 show the location of each CPRB in relation to its host area and associated facilities. Table 1 summarizes the historical information and sitc-specific data for each CPRB.

The C-CPRB is located approximately 700 feet southeast of the limited area fence surrounding C Area (Figure 2) in northwestern Barnwell County, South Carolina. Surface drainage in the area is

southwest to
an unnamed, intermittent tributary of Fourmile Branch. The water table at the C-CPRB is approximately 50
ft below surface, and the flow direction is to the southwest at a gradient of 1.3 ft per 100 ft.

The F-CPRB is located approximately 50 feet southeast of the limited area fence surrounding F Area
(Figure 3) in southwestern Aiken County. Surface drainage in southeastern F Area is toward the southeast
to an unnamed tributary of Fourmile Branch. The water table at the F-CPRB is approximately 80 ft below
surface, and the flow direction is to the southeast at a gradient of 1.5 ft per 100 ft.

The K-CPRB is located approximately 500 feet west of the limited area fence surrounding K Area (Figure
4) in northwestern Barnwell County. Surface drainage is toward the west-southwest to an unnamed
tributary of Indian Grave Branch. The water table is approximately 50 ft below surface, and the flow
direction is to the west-southwest at a gradient of 0.6 ft per 100 ft.

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Table 1. Summary of Historical Information and Site-specific Data for C-, F-, K-, and P-Area Coal
Pile Runoff Basins and Associated Facilities

Location Period of Period of Date Coal Coal Pile
Pipeline Coal Pile Typical Amount
Powerhouse Operation of was Runoff Basin
Length(ft)x Storage Area of Coal in

	Operation	Coal Pile	Removed	Length x Width	
Diameter(in)	Dimensions(ft)	Storage Area			
		Runoff Basin	from Coal	x Average	
Depth of Burial	Area(sq ft)	(tons)			
			Pile	Depth(ft)	(ft)
Area(acres)					
			Storage	Surface Area	
Extension					
			Area	(sq ft)	
during Removal					
				Surface Area	
Action (ft)					
				(acres)	
				Capacity(gals)	
C Area	1954-1984	1981-1985	1985	170' x 170' x 4'	
1300' x 18"	175' x 170'	3,600			
				28,900 sq ft	3-8'
30,000 sq ft	(from 1983 to				
				0.66 acres	
148'added	0.69 acres	1985 contained			
				864,000 gals	
across basin		less than 1000			
T)					
F Area	1953-1984	1981-1985	1985	270' x 270' x 5'	900'
x 30"	400' x 275'	10,000			
				72,900 sq ft	>2'
110,000 sq ft					
				1.67 acres	No
pipe added	2.53 acres				
				2,727,000 gals	
K Area	1954-1990	1981-1990	1997	290' x 300' x 4'	
1000' x 30"	480' x 250'	16,000			
				87,000 sq ft	3.5-
6.5'	120,000 sq ft	(from 1990 to			
				2.00 acres	348'
added	2.75 acres	1997 contained			
				2,603,000 gals	
across basin		less than 5000			
T)					
P Area	1953-1990	1981-1990	1997	290' x 290' x 4'	530'
x 36"	480' x 250'	16,000			
				84,100 sq ft	>2'
120,000 sq ft	(from 1990 to				
				1,93 acres	284'
added	2.75 acres	1997 contained			
				2,517,000 gals	
across basin		less than 2000			
T)					

The P-CPRB is located approximately 330 feet southeast of the limited area fence surrounding P Area (Figure 5) in northwestern Barnwell County. Surface drainage is toward the southeast to Meyers Branch. The water table is approximately 25 ft below surface, and the flow direction is to the southeast at a gradient of 1.88 ft per 100 ft.

Originally coal-fired power plants produced steam and electricity for Savannah River Site (SRS) activities. Stoking coal was stored in unsheltered stockpiles at each of the power plant locations. CPRBs were constructed in 1981 at C, F, K, and P Areas to protect surface water from coal pile contaminants such as suspended solids, sulfuric acid, metals, radionuclides, and semi-volatile organic compounds. The power plants at C, F, K, and P Areas have been inactive for several years.

II. SRS AND OPERABLE UNIT COMPLIANCE HISTORY

SRS Operational History

The SRS was created in 1951 with the primary mission of producing tritium, plutonium, and other special nuclear materials for our nation's defense program. Production of nuclear materials for the defense program was discontinued in 1988. SRS has provided nuclear materials for the space program, as well as medical, industrial, and research efforts up to the present. Chemical and radioactive wastes are byproducts of nuclear material production processes. These wastes have been treated, stored, and in some cases, disposed at SRS. Past disposal practices have resulted in soil and groundwater contamination in some areas.

SRS Compliance History

Hazardous Waste handled at SRS is regulated under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities have required federal operating or post-closure permits under RCRA. The SRS 1995 RCRA Renewal Permit (SC1 890 008 989) was issued on September 5, 1995 by the South Carolina Department of Health and Environmental Control (SCDHEC). Section IV of this hazardous waste permit contains corrective action requirements for non-regulated solid waste management units subject to RCRA 3004(u).

On December 21, 1989, SRS was included on the National Priorities List (NPL). This inclusion created a need to integrate the established RCRA 3004(u) Program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA, DOE has negotiated a Federal Facility Agreement (FFA) (WSRC 1993a) with the U.S. Environmental Protection Agency (EPA) and SCDHEC to coordinate remedial activities at SRS into one comprehensive strategy which fulfills these dual regulatory requirements.

Operable Unit Compliance History and Rentioval Action

The C-, F-, K-, and P-CPRBs are listed in the FFA as RCRA/CERCLA units requiring evaluation to determine the actual or potential impact to human health and the environment. The C, F, K-, and P-CPRBs were combined in a single operable unit under the Removal Site Evaluation Report/Wastewater Closure Plan for the C-, F-, K-, and P-Area Coal Pile Runoff Basins (189-C, 289-F, 189-K, and 189-P)(U) (WSRC 1997b)(RSER/WCP).

A RCRA Facility Investigation/CERCLA Remedial Investigation (RFI/RI) characterization was conducted for the K-CPRB in 1994 and 1995. The RFI/RI and Baseline Risk Assessment (BRA) conducted on the K-CPRB demonstrated that toxic metals, radionuclides, and semi-volatile compounds were largely confined to coal-laden sediments in the basin. These constituents, concentrated in the 0.0-1.0 ft interval of coal-laden sediments and soils within the basin, are naturally occurring constituents of coal. The results of the RFI/RI and Baseline Risk Assessment (BRA) were presented in the RFI/RI/BRA Report (WSRC 1997a). The report was submitted in accordance with the FFA and the approved implementation schedule approved by the EPA and SCDHEC in February 1997. In accordance with the FFA and the approved implementation schedule, the Corrective Measures Study/Feasibility Study (CMS/FS)(WSRC 1997c) for the K-CPRB was submitted by SRS and approved by EPA (June 13, 1997) and SCDHEC (August 7, 1997). A preliminary RFI/RI/BRA (WSRC 1996) was also conducted for the C-CPRB, the development of this document was discontinued after the RSER was approved with the K-CPRB as the lead site.

Because coal from the same sources was used in all four of these power plants and the CPRBs were all located in similar upland soils, the contaminant suite, the distribution of the contaminants, and the risks and hazards attributed to these contaminants are similar. The RFI/RI/BRA (WSRC 1997a) report for the K-CPRB and the preliminary RFI/RI/BRA for the C-CPRB (WSRC 1996) document the similarity of conditions in the two CPRBs. Thus it was not necessary to characterize the F- and P-CPRBs as rigorously as the C- and K-CPRBs, resulting in a considerable reduction in the time necessary to effect remediation of the four basins.

The coal-laden sediments and shallow soils were identified as low level threat source materials because the material represented relatively low risks to humans and the ecology, had a low to moderate potential for migration, and was easily contained or removed. Specifically, the risk assessment concluded that the

contaminants found in the 0.0-1.0 foot interval of basin sediments and soils contributed to a carcinogenic risk of 6.0×10^{-5} to possible future on-unit residents via the shallow soil ingestion pathway at the K-CPRB. The carcinogenic risks to future on-unit residents from the contaminants in the coal-laden sediments via the groundwater ingestion pathway based on the unit soil and groundwater data were calculated to be 7.0×10^{-6}.

Since the coal-laden sediments at the K-CPRB were determined to be the source of gross alpha contamination to the shallow groundwater, and the coal-laden sediments at the other basins were determined to be potential sources of groundwater contamination, it was appropriate to remove these low level threat source materials. In addition to mitigating groundwater contamination, the removal reduced the risk associated with exposure to sediment and near surface soils and is consistent with the statutory preference for treatment and a desire to alleviate or minimize the need for engineering/institutional controls.

Working under the RSER/WCP, during the summer of 1997, SRS removed the coal-laden sediments and soils in the C-, F-, K-, and P-CPRBs. The basins were backfilled to grade with clean soil. The remaining coal was also removed from the K-Area Coal Stockpile under the RSER/WCP. Before the removal action began, the remaining coal at the P-Area Coal Stockpile was transported to an active SRS power plant as a separate activity. The coal was removed from the coal stockpile areas in C and F Areas in 1985 (Table 1) and the former storage areas were used for other purposes.

The 1997 removal action is summarized in Table 2. Figures 6 through 9 show photographs of the basins before, during, and after the removal action. The 13,100 tons of coal, coal-laden sediment, and soils were transported to Southeastern Soil Recovery, Inc. where the material was thermally treated. This facility was approved under the CERCLA Offsite Rule. The residual material is being used for road base.

The C-, F-, K-, and P-CPRBs were cleaned out to a planar surface at least four feet below the proposed final grade. All coal was removed from the C-, F-, K-, and P-CPRBs and the K-Area Coal Stockpile. This eliminated the source of potential exposure to shallow soils for future industrial workers and on-unit residents and the source of potential groundwater contamination at the C-, F-, and P-CPRBs. The groundwater at the K-CPRB exhibits elevated gross alpha attributed to the operation of the K-CPRB. In the case of the K-CPRB, the prior removal action should prevent further groundwater contamination. The

action completely removed at least the 0-1 foot interval, which contained the highest concentrations of the constituents of concern (COCs) in the CPRBs. The basins were backfilled with a minimum of four feet of clean native soil, eliminating the potential for exposure of future workers and on-unit residents during future excavation activities. The backfill was graded to minimize ponding and to reduce infiltration and the potential for erosion; a vegetative cover was established to prevent erosion.

The buried, reinforced-concrete pipelines, which had conveyed stormwater runoff from the coal stockpiles to the CPRBs, were extended across the backfilled basins at the C-, K-, and P-CPRBs (Table 1) because these pipelines were still being used to manage stormwater runoff from the former coal stock piles and surrounding areas. After the coal was removed from the F-Area Coal Stockpile in early 1985, the upline end

Table 2. Summary of the Removal Actions at the C-, F-, K-, and P-Area Coal Pile Runoff Basins

Facility	Start Date	End Date	Coal-laden Sediments and Soil Removed(tons)	Fill Added(tons)
C-CPRB	May 20,1997	August 1, 1997	673.0	3300
F-CPRB	May 13, 1997	July 18, 1997	1725.0	16,050
K-CPRB	May 20, 1997	September 3, 1997	2691.3	15,300
K-Coal Pile	May 26,1997	August 8, 1997	4536.5	1800
P-CPRB	May 26,1997	August 19,1997.	3471.0	22,425
Totals		1.5 tons per cubic yard	13,096.8 tons	58,875 tons

of the F-CPRB pipeline was plugged. During the removal action, the basin end of the line was plugged. The F-CPRB pipeline is buried and will remain in place.

EPA approved the RSER/WCP on March 13, 1997. The RSER/WCP was also reviewed and approved on April 25, 1997 by the Industrial, Agricultural and Storm Water Permitting Division of SCDHEC and by the Federal Facility Agreement Section of the Bureau of Land and Waste Management of SCDHEC. On October 6, 1997, the Lower Savannah Environmental Quality Control District of SCDHEC inspected the C, F-, K-, and P-CPRBs and approved the closure of the basins. The Statement of Basis/Proposed Plan for the C-, F-, K-, and P-Area Coal Pile Runoff Basins (189-C, 289-F, 189-K, and 189-P)(U)(WSRC 1997e)

(SB/PP) was approved by EPA on January 21, 1998 and SCDHEC on January 26, 1998.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Both RCRA and CERCLA require the public be given an opportunity to review and comment on the draft permit modification and proposed remedial alternative. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternatives for addressing the C-, F-, K-, and P-CPRBs soils and groundwater. The Administrative Record File must be established at or near the facility at issue. The SRS Public Involvement Plan (PIP)(DOE, 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS PIP add resses the requircments of RCRA, CERCLA, and the National Environmental Policy Act, 1969 (NEPA). SCHWMR R.61-79.124 and Section 117(a) of CERCLA, as amended, require the advertisement

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opportunity to participate in the selection of the remedial action. The SB/PP, a part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the C-, F-, K-, and P-CPRBs.

The FFA Administrative Record File, which contains the information pertaining to the selection of the response action, is available at the EPA Region IV office in Atlanta, Georgia, and at the following locations:

U. S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208

171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

(803)777-4866

Reese Library
Augusta State University
2500 Walton Way
Augusta, Georgia 30910
(706) 737-1744

Asa H. Gordon Library
Savannah State University
Tompkins Road
Savannah, Georgia 31404
(912)356-2183

The public was notified of the public comment period on the SB/PP through the SRS Environmental Bulletin, a newsletter sent to approximately 3,500 citizens in South Carolina and Georgia. Notices were also published in the Aiken Standard, the Allendale Citizen Leader, the Augusta Chronicle, the Barnwell People-Sentinel, and The State newspapers. The public comment period was also announced on local radio stations.

The 45-day public comment period began on February 12, 1998 and ended on March 28, 1998. No comments were submitted on the SB/PP. A Responsiveness Summary, prepared to address public comments, is usually provided in Appendix A of the ROD and in the final RCRA Permit; as no comments were received on the SB/PP, Appendix A has been omitted from this ROD.

IV. SCOPE AND ROLE OF THE OPERABLE UNIT WITHIN THE SITE STRATEGY

The removal action at the C-, F-, K-, and P-CPRBs eliminated the potential for exposure of human and ecological receptors to low level threat waste in shallow soils and removed the source of potential groundwater contamination. Local groundwater at the C-, F-, K-, and P-CPRBs is not currently used as a drinking water source. Based on the groundwater monitoring history at the C-, F-, and P-CPRBs, no significant groundwater contamination has originated from these units. Gross alpha and the sum of radium 226 and radium-228 have occasionally exceeded maximum contaminant levels (MCLs) in the water table aquifer at the K-CPRB. These levels have shown a historical decline and with the source removed, the

expectation is that the sporadic exceedances will end. The No Further Action Alternative with confirmatory groundwater monitoring at the K-CPRB (EPA 1991) is appropriate because the confirmation sampling will address any remaining concerns.

The No Further Action Alternative means that no further remedial action will be performed on the CPRBs. The waste has been removed and the Remedial Goals (RGs) have been met. The excavation has been

covered with at least four feet of clean soil backfill. The CPRBs are located in areas which have been recommended for industrial use by the Citizens Advisory Board and the Savannah River Site Future Use Project Report (DOE 1996).

V. OPERABLE UNIT CHARACTERISTICS

A conceptual site model (CSM) was developed for the K-CPRB to identify the primary sources, primary contaminated media, migration pathways, exposure pathways, and potential receptors for the K-CPRB. The K -CPRB CSM, modified for a typical CPRB, is presented in Figure 10. The RFI/RI/BRA Reports for the C- (WSRC 1996) and K-CPRB (WSRC 1997a), RSER/WCP (WSRC 1997b), and PRA/RIR (WSRC 1997d) contain analytical data for all of the environmental media samples taken in the characterization of the C- and K-CPRBs. The PRA/RIR documents the confirmatory data obtained during the removal action at the F- and P-CPRBs. These documents are available in the Administrative Record (See Section III).

As previously stated in Section IV, the highest potential risk is primarily restricted to the coal-laden sediments and shallow soils within the CPRB. The RSER/WCP summarized the groundwater monitoring history at each of the four CPRBs and concluded that impacts on local groundwater had not exceeded Primary Drinking Water Standards at any of the CPRBs except the K- CPRB. Confirmatory groundwater monitoring and reporting for gross alpha and radium at the K-CPRB has been initiated with the scheduling of second quarter 1998 sampling at the KCB monitoring wells.

CPRB Primary Sources and Release Mechanisms

The primary source of potential contamination was coal-laden stormwater runoff discharged to the CPRBs from the coal storage areas via the gravity flow, reinforced-concrete CPRB pipelines (see Figure 12). After the power houses became inactive, no new coal was delivered to the coal storage areas and the available coal fines, which could be transported by stormwater runoff, were depleted from any remaining coal in the storage area. Because of the large volumes of runoff that passed through the pipelines after the C-, K-, and P-CPRBs became inactive, it is unlikely that any residual-coal remains in the pipelines.

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The primary release mechanisms are deposition inside the basin, deposition outside the basin from overflow, deposition on the pipeline interior surfaces, and leakage of the pipeline (see Figure 12). The most significant of these mechanisms is the release of unit contaminants as solid particles to the sediments and surface soil in the basin bottom.

CPRB Secondary Sources and Release Mechanisms

Secondary sources include the following media impacted by the coal-laden stormwater runoff: sediment and shallow (0-1 ft) soil in the CPRBs, surface water in the basin that accumulates from precipitation and runoff, surface and subsurface soil around the basin, and subsurface soil along the pipeline (see Figure 9).
The maximum concentrations of the major risk drivers such as arsenic and beryllium in the soils along the C- and K-CPRB pipelines are generally less than half the maximum concentrations found in the basin soils.
The highest risk to future residents from the soil along the K-CPRB pipeline is 1 x 10 -5 due to ingestion of excavated subsoil; the risk via all other exposure pathways is less than 1 x 10 -6. The highest hazard index for the K-CPRB pipeline is 1.0 to the child-resident by subsoil ingestion. During the RFI/RI at the K-CPRB, no carcinogenic or radiological constituents of concern (COCs) were recognized in the soils of the overflow area; only aluminum, antimony, and iron were identified as non-carcinogenic COCs. The hazard indices to future workers and possible residents were less than 1.0. All constituents detected in the soils of the C-CPRB overflow area were less than two times background or residential risk-based concentrations.
No action is warranted for the pipelines or overflow areas.

During the RFI/RIs conducted at the C- and K-CPRBs in 1994 and 1995, a total of five soil borings was performed in each basin. The BRA determined that the constituents of concern (before the removal action) for the K-CPRB soils were

- aldrin (via groundwater ingestion),
- antimony,
- arsenic,
- beryllium,
- bis(2-ethylhexyl)phthalate (via groundwater ingestion),
- chromium VI
- radium-226, and
- radium-228.

The COCs identified for the basin soils in the K-CPRB (antimony, arsenic, beryllium, chromium, radium-226, and radium-228) are all natural trace element constituents of coal. The maximum concentrations of the constituents of concern were confined to the 0-1 ft interval (removed under the RSER/WCP) with the exception of radium-226 and radium-228. In the K-CPRB, the maximum values for radium-226 (0.97 pCi/g) and radium-228 (2.23 pCi/g) were found in the 1-3 ft interval and the 3-5 ft interval, respectively; 2 x average background values for radium-226 and radium-228 in the deep (>5 ft) soils near the K-

CPRB
were 1.32 pCi/g and 2.4 pCi/g. Radium-226 is a daughter product of naturally occurring uranium-238, and

radium-228 is a daughter product of naturally occurring thorium-232. Both uranium-238 and thorium-232
are natural constituents of soils developed on the Coastal Plain sediments.

During the removal action, samples were collected from the 0-2 ft and 24 ft intervals below the cleanout
elevation in the F- and P-CPRBs. The maximum values for the COCs (WSRC 1997d) are all less the
maximum values reported from the 0-1 ft interval in the K-CPRB. The cleanout surface at each basin was
covered with at least four feet of clean backfill, eliminating all potential for exposure to the soil under the
future on-unit resident scenarios.

Secondary release mechanisms associated with these sources include direct contact, fugitive dust generation
from exposed surface soil, biotic uptake, and leaching to groundwater. The most significant of these
secondary release mechanisms am direct contact and leaching to unit groundwater. The quantified risks
associated with these and other exposure routes are summarized in Section VI.

At the K-CPRB, gross alpha has exceeded its MCL (15.0 pCi/L) in nine groundwater samples out of a total
of 18 analyzed for gross alpha from downgradient well KCB 3 since the first quarter of 1988. The
maximum value for gross alpha was 52.8 pCi/L in the third quarter of 1988; the most recent gross alpha
value was 17.5 pCi/L in the first quarter of 1996. The occurrence of elevated gross alpha is sporadic and
the levels appear to be declining (WSRC 1997b). Gross alpha has not exceeded its MCL in the other
downgradient wells (KCB 5 and 6). Many of the metals found in coal are in sulfide minerals; these
minerals weather to produce sulfuric acid. The sulfuric acid may accelerate the leaching of contaminants
from the coal-laden sediments or may leach contaminants from the Coastal Plain sediments, which are the
parent material of all the local soils. The alpha emitters (including radium-226) dissolved in the
groundwater may be from the coal or may have been leached from the Coastal Plain sediments by the acidic
coal pile leachate-, in either case, removing the coal and sulfide minerals and reducing infiltration will
reduce the levels of alpha activity in the local groundwater.

Summary of CPRB Primary and Secondary Sources

The characterization of the primary and secondary sources associated with the CPRBs indicates

that the principal human health risk drivers (arsenic and beryllium) are concentrated in the coal-laden sediments and soil in the 0-1 ft interval restricted to the basins. Radium-226 and radium-228, which are the only radiological risk drivers, are below the 2 x mean background screening criteria and are natural constituents of both the coal-laden sediments and the underlying soils. No man-made radionuclides, organic compounds, or metals were consistently identified in unit-soils at concentrations above screening levels that would indicate contamination from unit operations.

VI. SUMMARY OF OPERABLE UNIT RISKS

As part of the investigation/assessment process for the K-CPRB, the lead site for the C-, F-, K-, and P-CPRB operable unit, a BRA was performed using data generated during the assessment phase. Detailed information regarding the development of COPCs, the fate and transport of contaminants, and the risk assessment can be found in the RFI/RI/BRA (WSRC 1997a). The risk assessment is based on conditions that existed in the K-CPRB before the removal action. During the removal action, SRS completely removed the 0-1 ft interval, containing the highest concentrations of the COPCs and covered the remaining sub-basin soils with a minimum of four feet of clean backfill, eliminating the future residential exposure to excavated soil scenario.

An exposure assessment was performed to provide an indication of the potential exposures that might occur based on the chemical concentrations detected during unit-specific sampling activities. The current land use scenario is an inactive industrial site. The only current exposure scenario identified for the K-CPRB was for on-unit visitors, who may perform environmental research such as groundwater sampling on a limited and intermittent basis at the K-CPRB. Conservative future exposure scenarios identified for the K-CPRB included future on-unit industrial workers and future on-unit resident adults and children. The future residential scenario includes homegrown produce as an exposure point, which is not considered under the current on-unit visitor or future industrial worker scenarios. Risks and hazards from exposures under the two land use scenarios at K-CPRB are presented in Figure 10 and Table 3. All risks and hazards to current on-unit visitors were less than 1 x 10 -6 and 1.0, respectively (Figure 10).

The media evaluated in the BRA include soil inside the K-CPRB, soil along the K-CPRB pipeline, and soil

in the K-CPRB overflow area. Aluminum, antimony, and iron were the only human health COPCs recognized for the overflow area; these are all naturally occurring metals. Slope factors are not available
for these constituents. The overflow area does not represent significant risk or hazard to potential human or
ecological receptors, and no action is warranted for the overflow area. The calculated risks for the shallow
(0-1 foot) basin soils are evaluated under current and future land use scenarios in the following paragraphs.

Current Land Use - Carcinogenic Risks (K-CPRB)
Under the current land use scenario, human health risks were characterized for the current on-unit visitor
(see Figure 10). The highest estimated radiological cancer risk for any pathway was 3 x 10 -8 from ingestion
of shallow (0-1 ft) basin soils, including the coal-laden sediments. This risk level is below the EPA point of
departure 1 x 10 -6 and the risk range for NPL sites. Radiological cancer risks were not evaluated for current
on-unit visitors because no radionuclides were identified as COPCs.

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Current Land Use - Noncarcinogenic Hazards (K-CPRB)
Under the current land use scenario, noncarcinogenic hazards were characterized for the current on-unit
visitor. The RFI/RI/BRA (WSRC 1997a) shows that potential adverse noncarcinogenic health effects are
not likely to occur, because none of the hazard indices exceed a value of 1.0.

Future Land Use - Carcinogenic Risks (K-CPRB)
For the future on-unit worker, cancer risk from radiological constituents (naturally occurring radium-228)
exceeded the 1 x 10 -6 risk level for external radiation. The highest risk was 2 x 10 -5 for direct radiation
from excavated (0-5 ft) soils in the K-CPRB (see Table 3). Ingestion of radium-226 in groundwater drove a
risk of 2 x 10 -5 for future on-unit workers. Cancer risks for nonradiological carcinogens were all between 1
x 10 -6 and 1 x 10 -4. The highest risk for future on-unit workers was 6 x 10 -6 from ingestion of soil from the
0-1 ft interval. The risk from particulate inhalation of excavated (0-5 ft) soil was 2 x 10 -6 primarily driven
by chromium-VI (CrVI). The risk for ingestion of groundwater by future on-unit workers was estimated at
2 x 10 -6 driven by aldrin and bis(2-ethylhexyl)phthalate (BEHP). Aldrin was detected one time (J0.0164
ug/L in well KCB3). The "J" qualifier indicates that the analytical result is an estimated value; BEHP is a

constituent of vacuum pump oil and may be a laboratory contaminant.

For the future on-unit resident, cancer risks from exposure to external radiation exceeded the point of departure (1×10^{-6}) for K-CPRB excavated soils. Risks are estimated at approximately 2×10^{-5} (primarily radium-228) for external radiation exposure. Radium-226 was the dominant contributor to a radiological groundwater ingestion risk of 4×10^{-5}. Cancer risks for nonradiological carcinogens exceeded 1×10^{-6}. The risk to future residents from the ingestion of shallow soil was estimated at 6×10^{-5} driven by arsenic. The risk of 6×10^{-6} from inhalation of excavated K-CPRB soils is due primarily to CrVI. Groundwater ingestion produced a risk of 7×10^{-6} driven by aldrin and BEHP.

Future Land Use - Noncarcinogenic Hazards (K-CPRB)
For the future on-unit worker, the hazard indices (HIs) were less than 1.0 for all constituents and exposure pathways except groundwater ingestion (2.0) driven by nitrate and manganese. For the future on-unit resident, the HIs were less than 1.0 for adult residents for all constituents and exposure pathways except for groundwater ingestion (6.0) driven by nitrate and manganese. The HI for future resident children was 10.0 for groundwater ingestion, also driven by nitrate and manganese. Shallow-soil ingestion by future resident children results in an HI of 2.0 driven by iron and arsenic.

Ecological Risk Assessiment Results for the K-CPRB
The ecological risk assessment evaluated the likelihood of adverse ecological effects from exposure to chemicals associated with the K-CPRB. The ecological setting of the unit is not unique. There are no

known endangered, threatened, or special concern species on the unit, nor are the species that inhabit the unit rare in the region or considered to be of special societal value. The area of the unit is small and the habitat is low in diversity and productivity.

Based on characterization of the environmental setting and identification of potential receptor organisms, a CSM for the K-CPRB (available in the BRA) was developed to determine the complete exposure pathways through which ecological receptors could be exposed to COPCs. The focused evaluation addressed small mammals inhabiting the unit (represented by the oldfield mouse).

Interpretation of the ecological significance of the unit-related contamination at the K-CPRB indicated that

there was no likelihood of unit-related radiological or nonradiological constituents causing significant impacts to biotic communities in the vicinity of the unit. No ecological COCs were identified for the K-CPRB.

COCs and Human Health Risk-Based Remedial Goals

Primary COCs in the human health risk assessment are defined as constituents that either individually produce or significantly contribute to risk estimates that exceed a 1 x 10 -4 risk or an HI of 3 by selecting individual COCs exceeding a risk of 1 x 10 -6 or a hazard quotient (HQ) of 0.1 in any pathway. Secondary COCs which have a chemical-specific carcinogenic risk of at least 1 x 10 -6 risk and a noncarcinogenic hazard of 0.1 that contributes to a pathway hazard of 1.0 or greater. The K-CPRB soil poses a potential threat to human health through exposure to five secondary COCs and the groundwater poses a potential human health threat through exposure to two primary and 13 secondary COCs. The primary and secondary COCs for the K-CPRB soil and groundwater are presented in Table 4.

Remedial Goals (RGs) are human health risk-based calculations performed on COCs which are primary contributors of potential risk and/or adverse effects for the future resident scenario. Because the hypothetical future scenarios usually yield the most conservative RG, future resident and on-unit worker RGs are presented in Table 4 for the primary and secondary COCs identified for the K-CPRB soil and groundwater.

Contaminant Threat Review

A review of the contamination present in the sediments and shallow soils within the CPRBs indicates that these source materials are low level threat wastes. The sediments and shallow soils in the 0-1 foot interval contained low concentrations of naturally occurring metals and radionuclides, which contributed to human

Table 4. K-CPRB COCs and Risk/Based Remedial Goals

COC	Units	RGs to Achieve 1 x 10 -6 Risk and 1.0 HI Future Resident Adult and Child	RGs to Achieve 1 x 10 -6 Risk and 1.0 HI Future On-unit Worker	Maximum Detected Concentration
Primary Groundwater COCS				
Manganese	mg/L	0.075	0.51	1.76

Nitrate/Nitrite	mg/L	24.76	163.31	148
Secondary G'water COCS				
Aldrin	mg/L	3.9E-6	ND	0.000016
Aluminum	mg/L	15.53	102.13	62.3
Arsenic	mg/L	4.5E-5	0.03	0.012
Barium	mg/L	1.062	ND	0.46
Beryllium	mg/L	1.5E-5	ND	0.003
Bis(2ethylhexyl)pthalate	mg/L	4.5E-3	ND	0.033
Chloroform	mg/L	8.3E-4	ND	0.0042
Chromium (hexavalent)	mg/L	0.068	0.51	0.127
Iron	mg/L	4.64	30.66	74.1
Lead	mg/L	ND	ND	0.181
Nickel	mg/L	0.31		0.086
Vanadium	mg/L	0.108	0.72	0.173
Zinc	mg/L	4.67	ND	3
Secondary Soil COCs				
Aluminum	mg/kg	77649.4	ND	18000
Antimony	mg/kg	30.53	ND	9.71
Arsenic	mg/kg	18.64	ND	22.1
Iron	mg/kg	22421.4	ND	28500
Vanadium	mg/kg	542.6	ND	121

ND Not determined

health risks well below 1 x 10-3. These low level threat wastes have been completely removed from the
CPRBs and the basins have been backfilled to grade with clean soil.

Site-Specific Considerations
The RFI/RI/BRA was developed based on conditions that existed at the K-CPRB before the removal action.
The findings of the K-CPRB investigation indicated that a remedial action was apropriate to protect human
health and the environment. Site-specific considerations, based on the conclusions of the RFI/RI/BRA and
the PRA/RIR for the C-, F-, K-, and P-CPRBs, which indicate that risk to human health and the environment has been effectively mitigated include:

1) The shallow basin soils (0-1 ft) represented the greatest risk at the K-CPRB. Arsenic contributed 91%
of the greatest risk via soil ingestion, 6 x 10 -5 for future on-unit residents (1 in 17,000 people would

develop cancer due to exposure in a residential setting). Arsenic is a natural constituent of coal,
occurring in coal ash at an average of 500 parts per million (Mason 1966) or about 45.8 mg/kg in coal.
The average concentration of arsenic in the earth's crust is about 2 mg/kg. Arsenic was also widely
used as a pesticide by pre-SRS farmers. Beryllium, which contributed 9% of the soil

ingestion risk to future residents, is also enriched in coal: crustal abundance is 2.6 mg/kg, abundance in coal is 4.1 mg/kg. External radiation exposure, predominantly radium-228, resulted in a 2 x 10 -5 risk for a hypothetical future worker (i.e., 1 in 50,000 people would develop cancer due to exposure in an industrial setting) and 2 x 10 -5 risk for a hypothetical future resident. Radium-228 is a daughter of naturally occurring uranium-238. The removal action conducted at the C-, F-, K-, and P-CPRBs during the summer of 1997 removed the 0-1 ft interval, which contained the highest concentrations of the COCs, and added four feet of clean fill above the remaining sub-basin soil. No Further Action is necessary to protect human health or the environment.

2) The K-CPRB, pipeline is buried beneath 3.5 to 6.5 feet of soil; thus soil contamination from pipeline leaks is unlikely to be excavated under a residential setting. Carcinogenic and noncarcinogenic risks posed by the pipeline soils are due to naturally occurring metals such as aluminum, antimony, arsenic, beryllium and iron that are typical of coal and SRS soils. The shallow soils along the pipelines are estimated to contribute low to nonexistent risk, 5 x 10 -6 via ingestion to future residents and below 1 x 10 -6 and 1.0, respectively for future industrial workers. No Action is warranted at the K-CPRB pipeline.

3) The only COPCs for the surface soils in the K-CPRB overflow area were aluminum and iron. Carcinogenic risks for these constituents cannot be calculated because slope factors are not available. The hazard index for future residents is 0.38. No Action is appropriate for the CPRB overflow areas.

4) Thc gross alpha groundwater contamination at the K-CPRB appears to be declining as discussed in Section V. The coal-laden sediments were a source of sulfuric acid, radium-226, and other naturally occurring alpha emitters. The coal-laden sediments have been completely removed, so the gross alpha contamination in the groundwater should decline to below MCLs due to natural attenuation in the aquifer. A five-year program of confirmatory groundwater monitoring at the K-CPRB will be implemented with this ROD.

5) The C-, F- K-, and P-CPRBs are in areas which have been recommended as industrial in the Savannah River Site Future Use Project Report (DOE, 1996), precluding future residential use.

6) The similarity of conditions at the C-, F-, and P-CPRBs to those at the K-CPRB facilitated the consolidation of the C-, F-, K-, and P-CPRBs into a single operable unit with the K-CPRB as the lead

site. No Further Action is the appropriate remedial action for the C-, F-, K-, and P-CPRBs. No Action is appropriate for the pipelines and overflow areas.

VII. REMEDIAL ACTION OBJECTIVES FOR THE C-, F-, K-, AND P-CPRB OPERABLE UNIT

Remedial action objectives specify unit-specific contaminants, media of concern, potential exposure pathways, and remediation goals. The remedial action objectives are based on the nature and extent of contamination, threatened resources, and the potential for human and environmental exposure. Initially, preliminary remediation goals are developed based upon ARARs or other information from the RFI/RI/BRA. These goals should be modified, as necessary, as more information concerning the unit and potential remedial technologies becomes available. Final remediation goals will be determined when the remedy is selected and shall establish acceptable exposure levels that are protective of human health and the environment.

ARARs are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal, state, or local environmental law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. The only ARARs associated with the C-, F-, K-, and P-CPRBs are MCLs for gross alpha, total radium, and BEHP established under the Safe Drinking Water Act.

Threatened, endangered, or sensitive species are not found at the C-, F-, K-, and P-CPRBs and the unit does not offer attractive or unique cover or forage opportunities for wildlife. Thus, ecological receptors are not at significant risk from the C-, F-, K-, and P-CPRBs.

Soil COCs were identified in the RFI/RI/BRA for the K-CPRB, which was the lead site for the removal action. Table 5 compares the residual concentrations for the soil COCs after the removal action at each of the CPRBs to the RGs and 2 x mean background screening values derived at the K-CPRB. The average remaining concentrations of iron exceed the K-CPRB RGs in the F- and P-CPRBs; this may be due to localized variations in the mineralogy of the subsoils. Iron is a natural constituent of subsoil minerals such as plinthite. None of the maximum values for iron exceed the risk-based concentration for iron (610,000 mg/kg) for soil ingestion in an industrial setting. The maximum observed value for arsenic (J21.8 mg/kg) at the P-CPRB slightly exceeds the RG (18.64 mg/kg), the "J" qualifier indicates that this is an estimated value. This anomalous sample is from the 2-4 ft interval below clean out elevation and is now at least six feet below restored surface. The removal action has met the RGs established for the unit COCs and No Further Action is appropriate for the C-, F-, K-, and P-CPRBs.

Table 5. Comparison of Average and Maximum Concentrations for the Soil COCs Below Clean Out Elevation to RGs and 2 X Mean Background Screening Levels

Secondary Soil COCs by CPRB	Units	RGs to Achieve 1 x 10 -6 Risk and 1.0 HI Future Resident Adult and Child	2 x Mean Background Concentration	Average Concentration Below 1 ft Nondetects @ 0.5 Detection	Maximum Detected Concentration Below 1 ft
C-CPRB					
Aluminum	mg/kg	77649.4	14050	15890	24200
Antimony	mg/kg	30.53	2.04	3.024	6.31*
Arsenic	mg/kg	18.64	1.64	8.12	8.46
Iron	mg/kg	22421.4	21390	14829	21400
Vanadium	mg/kg	542.6	41.78	34.42	49.8
F-CPRB					
Aluminum	mg/kg	77649.4	14050	22050	35400
Antimony	mg/kg	30.53	2.04	2.92	ND
Arsenic	mg/kg	18.64	1.64	8.74	ND
Iron	mg/kg	22421.4	21390	23316	30300
Vanadium	mg/kg	542.6	41.78	52.4	71.5
K-CPRB					
Aluminum	mg/kg	77649.4	14050	7916	18300
Antimony	mg/kg	30.53	2.04	1.34	3.91*
Arsenic	mg/kg	18.64	1.64	1.23	4.58*
Iron	mg/kg	22421.4	21390	10927	41300
Vanadium	mg/kg	542.6	41.78	28.01	121.0
P-CPRB					
Aluminum	mg/kg	77649.4	14050	26838	75200
Antimony	mg/kg	30.53	2.04	3.62	7.68
Arsenic	mg/kg	18.64	1.64	9.96	21.8
Iron	mg/kg	22421.4	21390	23883	34000
Vanadium	mg/kg	542.6	41.78	53.47	74.9

* Only value above detection limit.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF THE ALTERNATIVES

After the removal of the source term, the only remaining viable alternative for remediating the C-, F-, K-, and P-Area Coal Pile Runoff Basins is No Further Action. The components of the removal action are the same as the most conservative alternative developed in the K-CPRB CMS/FS.

IX. THE SELECTED REMEDY

The selected remedy is identical to the preferred alternative in the SB/PP (Section V, paragraph 3, WSRC 1997). After the removal action, the selected remedy for the C-, F-, K-, and P-CPRBs is No

Further Action
with confirmatory groundwater monitoring at the K-CPRB (EPA 1991). The No Further Action Alternative

means that no further remedial action will be performed on the CPRBs. The waste has been removed, the RGs have been met, and the excavation has been covered with at least four feet of clean soil backfill. The No Action alternative is appropriate for the CPRB pipelines and overflow areas.

The probable condition for the groundwater at all of CPRBs is no significant groundwater contamination resulting from the operation of the CPRBs. As a result, no remedial action is deemed appropriate for the water table aquifer at the CPRBs. However, annual confirmatory groundwater monitoring will be conducted at the K-CPRB for a period of five years to ensure that No Further Action with confirmatory groundwater monitoring at the K-CPRB is the appropriate remedy. SRS will notify SCDHEC and EPA within 30 days of the second consecutive exceedance of MCL by any of the analytes. In the event that the probable condition is no longer appropriate, DOE, SCDHEC, and EPA (the three parties to the FFA) will evaluate the need for remedial action. There are no groundwater RAOs to be met for the water table aquifer at the K-CPRB since the selected remedy for ihe aquifer is no remedial action with confirmatory groundwater monitoring.

The K-CPRB is the only basin where impacts on local groundwater quality due to the operation of the CPRB have exceeded MCLs. Gross alpha and the sum of radium-226 and radium-228 have occasionally exceeded maximum contaminant levels; bis(2-ethylhexyl) phthalate exceeded its maximum contaminant level one time in a side gradient well. When the source material was removed from the basin, several of the analytes (such as arsenic and vanadium) listed in the CMS/FS were reduced to near background levels and were no longer a potential threat to groundwater quality. The following list of analytes will be monitored in wells KCB 1, 3, 5, and 6 during the second calendar quarter of each year, beginning in the year (1998) following completion of the removal action:

- beryllium
- bis(2-ethylhexyl) phthalate
- chromium VI
- gross alpha
- radium-226
- radium-228
- pH

A summary report, including the data and interpretation, will be submitted to SCDHEC and EPA during the first calendar quarter of the year following each monitoring event (the first report is due in January 1999). If none of these constituents exceeds its MCL during five consecutive monitoring and reporting cycles, SRS will request SCDHEC and EPA concurrence with suspending the monitoring program and decommissioning the wells or dispositioning them to other programs. The cost of this groundwater monitoring and reporting program will be approximately $60,200. No other costs will be incurred under the No Further Action Alternative.

The No Further Action remedy for the C-, F-, K-, and P-CPRBs and the No Action remedy for the pipelines and overflow areas are intended to be the final action for the C-, F-, K-, and P-CPRB operable unit. The SCDHEC has modified the SRS RCRA permit to incorporate the selected remedy.

X. STATUTORY DETERMINATIONS

Based on the PRA/RIR for the C-, F-, K-, and P-CPRBs (WSRC 1997d), the OU no longer poses significant risk to human health. Therefore, a determination has been made that the No Further Action alternative for the CPRBs and the No Action alternative for the pipelines and overflow areas are protective of human health and the environment, effective in both the long and short terms, comply with Federal and State of South Carolina requirements that are legally applicable or relevant and appropriate to the remedial action, and are cost-effective. Because no remedial action has been selected under this ROD, CERCLA Section 121 statutory requirements are not appropriate.

Section 300.430(f)(4)(ii) of the NCP requires that a five-year review of the ROD be performed if hazardous substances, pollutants, or contaminants remain in the waste unit. The three Parties, DOE, SCDHEC, and EPA, have determined that five-year reviews of the ROD for the C, F-, K-, and P-CPRBs operable unit will not be necessary to ensure continued protection of human health and the environment.

XI. EXPLANATION OF SIGNIFICANT CHANGES

The SB/PP and the draft RCRA permit modification provided for involvement with the community through a document review process and a public comment period (February 12, 1999 through March 28, 1999). No comments were received during the 45-day public comment period, thus there were no significant

changes
to the selected remedy as a result of public comments.

XII. RESPONSIVENESS SUMMARY

No comments were submitted during the public comment period.

XIII. POST-ROD DOCUMENT SCHEDULE

This is a No Further Action ROD; thus post-ROD documentation is not necessary for this operable unit. A
summary report, including the groundwater data for the KCB monitoring well network and interpretation of
the data, will be submitted to SCDHEC and EPA during the first calendar quarter of the year following the
monitoring event.

XIV. REFERENCES

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WSRC 1997b. Removal Site Evaluation Report/ Wastewater Closure Plan for the C-, F-, K-, and P-Area Coal Pile Runoff Basins (189-C, 289-F, 189-K, and 189-P) (U). WSRC-RP-96-897, Revision 1. Westinghouse Savannah River Company; Aiken, South Carolina (April).

WSRC 1997c. Corrective Measures Study/Feasibility Study for the K-Area Coal Pile Runoff Basin (189-K) (U). WSRC-RP-96-869, Revision 1.1. Westinghouse Savannah River Company; Aiken, South Carolina (July).

WSRC 1997d. Post Removal Action/Remedial Investigation Report for the C-, F-, K-, and P-Area Coal Pile Runoff Basins (189-C, 289-F, 189-K, and 189-P) (U). WSRC-RP-97-931, Revision 0. Westinghouse Savannah River Company; Aiken, South Carolina (November).

WSRC 1997c. Statement of Basis/Proposed Plan for the C, F-, K-, and P-Area Coal Pile Runoff Basins (189-C, 289-F, 189-K, and 189-P) (U). WSRC-RP-97-436, Revision 0. Westinghouse Savannah River Company; Aiken, South Carolina (November).

SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 12/29/1998
Operable Unit: 31
ROD ID: EPA/541/R-99/020

Media: Groundwater, Soil

Contaminant: Dioxins/Dibenzofurans, VOC

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. SRS is a secured U.S. government facility with no permanent residents. SRS is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina.

SRS is owned by the Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided nuclear materials for the space program and for medical, industrial, and research efforts. Chemical and radioactive wastes are by-products of nuclear material production processes. The entire SRS facility was placed on the National Priorities List (NPL) in December 1989.

Operable Unit (OU1):

The M-Area Hazardous Waste Management Facility (HWMF) is a source-specific operable unit within the A/M Area Fundamental Study Area. The M-Area HWMF includes an unlined surface impoundment (settling basin), a portion of an inactive process sewer line, drainage and seepage areas, and a Carolina bay known as Lost Lake.

The M-Area settling basin was constructed in 1958 to settle out metals discharged from M-Area manufacturing operations. The basin dimensions were approximately 330 feet by 280 feet by 17 feet with a volumetric capacity of approximately eight million gallons. Overflow from the settling basin was directed to a natural seepage area and ultimately to Lost Lake. In July 1985, a permitted wastewater treatment facility was placed in operation and discharges to the settling basin were discontinued. A Record of Decision (ROD) addressing OU1 was completed in June 1992.

OU2:
The Metallurgical Laboratory HWMF is a source-specific operable unit within the A/M Area fundamental Study Area. The Metallurgical Laboratory HWMF includes anabandoned portion of a process sewer line, a seepage basin, a drainage outfall, and a Carolina bay.

The Metallurgical Laboratory was used for corrosion testing on stainless steels and nickel-based alloys. No radioactive materials were known to have been discharged to the HWMF. During periods of heavy rainfall, wastewater and surface water overflowed a drainage outfall at the Metallurgical Laboratory Basin into the adjacent Carolina Bay. A RCRA closure plan for the basin and sewer line portions of the Metallurgical Laboratory HWMF was submitted and approved in June 1991. The intent of the closure plan is to ensure the basin and sewer line portions of the Metallurgical Laboratory HWMF will be closed in a manner that controls, minimizes, or eliminates post-closure migration of hazardous constituents and decomposition products to the vadose zone, groundwater, surface waters, or atmosphere. A ROD addressing OU2 was completed in June 1992.

OU3:
The A/M Area, located in the northwest portion of SRS, contains nuclear fuel fabrication buildings, office buildings, and research areas. The A/M Area groundwater is a media-specific operable unit within the A/M Area Fundamental Study Area. As a result of past waste disposal practices, the groundwater beneath A/M Area has been contaminated with organic solvents, primarily trichloroethylene

(TCE) and tetrachloroethylene (perchloroethylene; PCE). The contamination in the A/M Area groundwater and the overlying unsaturated zone appears to be associated with releases from the following A/M Area source units: the A-014 Outfall, the M-Area Settling Basin/Lost Lake (M-Area HWMF), and the M-Area HWMF Process Sewer, and the 321-M Solvent Storage Area.

From 1952 to 1981, an estimated 13 million pounds of chlorinated solvents were used in the A/M Area to degrease fuel and target tubes used in SRS reactors. Significant quantities of chlorinated solvents were inadvertently spilled during handling and storage. A ROD addressing OU3 was completed in June 1992.

OU4:
The Gunsite 720 Rubble Pit is located within SRS and is approximately 305 meters (100 feet) west of South Carolina Highway 125, 168 meters (550 feet) north of SRS Road A-2, and 2.5 kilometers (1.5 miles) from the nearest SRS boundary.

During the period from 1955 to 1960, to defend the SRS in the event of an air attack, the U.S. Army established onsite anti-aircraft artillery gun emplacements at several locations near the perimeter of SRS. The Gunsite 720 was one of those emplacements. In the early 1980s, while work was being performed in the area, nine empty, partially buried drums, labeled "duPont Freon 11" were found at the gunsite. The drums were excavated in July 1987, and placed on a pallet at the gunsite. In October, 1989, the drums were removed from the unit. A ROD addressing OU4 was completed in March 1997.

OU5:
The Gunsite 113 Access Road Unit is located in the northeast corner of SRS, adjacent to the access road leading to Gunsite 113, and is approximately 91.5 meters (300 feet) east of where SRS Road 8 crosses the SRS facility boundary.

The area appears to have been used as a surface disposal area for spoil dirt and/or road construction debris. There is no documentation or record of any hazardous substance management, disposal, or any other type of waste disposal at this unit. There is no evidence that any recent disposal activities have occurred in this area or that disposal activities were more widespread. Also, there is no evidence of any burning or excavation at this waste unit. A ROD addressing OU5 was completed in March 1997.

OU6:
The F-Area HWMF (basins F-1, F-2, and F-3) operated from 1955

until November 1988. During that time, the facility received waste effluents from F-Area chemical separation facilities processes such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads. The three basins had a combined maximum operating capacity of 20.5 million gallons of wastewater.

Closure of the F-Area HWMF was begun in 1989 and completed in January 1991. The F-Area HWMF was certified closed in February 1991. Closure activities specifically included removal of standing water remaining in the basin; stabilization of the basin sludge with a layer of granite, limestone and blast furnace slag; construction of a low permeability cap over the basin; and restoration of the area. A ROD addressing OU6 was completed in September 1993.

OU7:
The H-Area HWMF is a source specific operable unit within the H-Area Fundamental Study Area. The H-Area HWMF consists of three unlined, earthen surface impoundments located in the center of SRS, southwest of Road E and north of road 4 approximately 6 miles from the nearest site boundary.

The H-Area HWMF operated from 1955 until November 1988. The original H-Area HWMF consisted of basins H-1, H-2, and H-3 and operated from 1955 to 1962. In 1962 H-3 was replaced by H-4. At the time of closure, the H-Area HWMF had a combined maximum operating capacity of 26.5 million gallons of wastewater. The H-Area HWMF received waste effluents from H-Area chemical separation facilities processes such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads.

The four basins were closed by dewatering, physically and chemically stabilizing the remaining sludges and placing a protective multi-layer cover system over them to reduce rainwater contact with basin bottoms.

OU8:
The F-Area HWMF is a source specific operable unit within the F-Area Fundamental Study Area. The F-Area HWMF is located in the center of SRS, Southwest of Road E and North of Road 4 approximately 16 miles from the nearest plant boundary. The F-Area HWMF consisted of three unlined earthen basins that had a combined maximum operating capacity of 20.5 million gallons of waste water during operation. It received waste effluents from F-Area chemical separations facilities such as the nitric acid recovery

unit, waste storage system evaporator overheads, and general purpose evaporator overheads. Significant amounts of nitrates and caustics were received. A ROD addressing OU8 was completed in April 1995.

OU9:
The H-Area HWMF consists of a series of three hydraulically connected unlined basins (H-1, H-2, and H-4). Basin H-4 was built in 1962 to replace basin H-3. Wastewater flow to the basins was terminated on November 7, 1988 in accordance with the requirements of RCRA. The H-Area HWMF received waste effluents from H-Area chemical separations facilities such as nitric acid recovery unit, waste storage system evaporator overheads, and general purpose overheads. The waste stream contained hazardous constituents and low levels of radionuclides. A ROD addressing OU9 was completed in April 1995.

OU10:
The Fire Department Hose Training Facility (FDHTF) is located approximately 200 meters (700 feet) northeast of the intersection of Roads C and 6 and approximately six meters (20 feet) west and downgradient of a heat exchanger storage pad. The FDHTF is a source control and groundwater operable unit. The FDHTF was built between 1975 and March 1979 and operated by the SRS Fire Department between 1979 and 1982 to train personnel in fighting waste oil fires. No known hazardous wastes were placed in the unit.

The SRS Fire Department discontinued use of the FDHTF and recommended the facility for cleanup and closure in March 1982. A ROD addressing OU10 was completed in August 1998.

OU11:
The Central Shops Burning/Rubble Pit (631-6G) (BRP6G)is located in the Central Shops Area near the center of the SRS. It operated from 1951 through 1955 for the disposal and burning of waste materials. The unit consisted of a shallow unlined excavation, approximately 3m (10 feet) deep. Materials believed to be disposed of in the pit included waste oils, rags, paper, cardboard, plastics, degreasers, wood, rubber, and drummed organic solvents. These materials were periodically burned in the pit, usually on a monthly basis. The volume of waste disposed of at BRP6G was not recorded. A ROD addressing OU11 was completed in May 1997.

OU12:
The M-Area West unit is located west of the M-Area Production Facility on a dirt road approximately 1.8 kilometers north of

Silverton Road. There are no structures of any type located at or near M-Area West. The only nearby man-made feature is a dirt access road located about 30 to 40 feet west of the waste areas.

The unit consists of two small areas. Several drums and other small innocuous debris were found on the land surface adjacent to a dirt road approximately 1 kilometer west of the M-Area production facility. The total waste at the unit consisted of six empty 55-gallon drums, four 1-gallon cans and a 1-gallon glass jar. The cans and the jar were originally contained in one of the larger drums. With the exception of a crushed drum and small amounts of metal debris, all other materials were removed from the site in 1992.

There is no documented information available regarding past hazardous or non-hazardous waste disposal activities at M-Area West. Markings on the drums found at the unit suggest that they once contained oil and solvents, and that they are approximately 37 years old. There is no evidence that any recent disposal activity has occurred or that the disposal activity was more widespread. Also, there is no evidence of any burning or excavation at this waste unit. A ROD addressing OU12 was completed in September 1995.

OU13:
The Silverton Road Waste Unit (SRWU) is located in the northwestern part of SRS in Aiken County, approximately 1.5 miles southwest of A/M Area. The SRWU was first used before construction of the SRS. Municipal, agricultural, and commercial trash, rubbish, garbage, debris, and refuse probably constituted the waste stream until the early 1950s. After procurement by the federal government, the SRWU land continued to be used as an open dump for disposal of metal shavings, 55-gallon drums, cardboard drums, tires, lumber, etc. No records of waste disposal activities were kept. In 1974, the disposal of waste at the SRWU ceased, and the area was bulldozed, graded, covered with soil, and planted with grasses. A ROD addressing OU13 was completed in March 1997.

OU14:
The F-Area Burning /Rubble Pits (FBRP) comprise a source unit located within the SRS, approximately 3000 feet west of F-Area and 1100 feet north of SRS Road C. Between 1951 and 1973, SRS used Pits 231-F and 231-1F to burn a variety of wastes which were considered non-hazardous at that time. Some of these waste materials (degreasers and solvents) are now considered to be hazardous based on ingestion or possible dermal contact. Waste was usually burned on a monthly basis. The chemical composition and volumes of the disposed waste are unknown, but waste materials burned included

paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents. A ROD addressing OU14 was completed in March 1997.

OU15:
The D-Area Burning/Rubble Pits (DBRP) are located in the western part of the SRS in Barnwell County, approximately 2600 feet west of D Area and 1.6 miles west of State Highway. Between 1951 and 1973, burning pits were used at SRS to burn a variety of hazardous and non-hazardous waste. The chemical composition and volumes of the disposed waste are unknown. Combustible materials, which were burned monthly, included paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents. No known or suspected radioactive materials were allowed in the burning pits. Burning of waste in the SRS pits was discontinued by October 1973. A layer of soil was then placed over the residue in the pits and they were subsequently used as rubble pits. A ROD addressing OU15 was completed in March 1997.

OU16:
The Old F-Area Seepage Basin (OFASB) is located within the SRS, approximately 600 feet north of F Area and one mile east of Road C and is located in Aiken County. The Savannah River and associated swamps are located approximately six miles west of the basin. The OFASB is designated as Building Number 904-49G and covers a total area of 1.3 acres.

Between November 1954 and mid-May 1955, 9 to 14 million gallons of wastewater were discharged to the basin which served as an unlined seepage basin for the purpose of reducing radioactive substance concentrations. Wastewater included overhead condensates from evaporators, laundry washwaters, non-reactor cooling water from F and H Areas, and possibly other chemicals. A ROD addressing OU16 was completed in May 1997.

OU17:
The L-Area Oil and Chemical Basin (LAOCB) and L-Area Acid Caustic Basin (LAACB) are located south of L-Area in an area of low to moderate relief. They are situated on the southern flank of a hill approximately 300 feet south of the L-Area perimeter fence and 1,250 feet north of L Lake.

The LAOCB was designed and constructed as an unlined seepage basin in 1961 for the purpose of disposing of small volumes of wastes that were not appropriate for discharge to local streams, regular seepage basins, or the 200-Area waste management system.

The exact quantity of waste water discharged to the LAOCB basin is not documented. Liquid wastes consisting of small volumes of slightly radioactive oil and chemical wastewater were sent to the LAOCB from throughout SRS, but came primarily from the reactor areas. Wastes were transported to the drainage pad in tank trucks, metal drums, skid tanks, and other containers. The Hot Shop (Building 717-G) discharged decontaminated wastewater containing radionuclides, detergents, and spent degreasing solvents through the pipeline to the basin. A ROD addressing OU17 was completed in March 1997.

OU18:
The Burma Road Rubble Pit (BRRP) is located approximately one-half mile southwest of F-Area Separations Facility and one-tenth mile southwest of C Road. The BRRP is between Upper Three Runs Creek and Four Mile Creek.

The BRRP consists of two unlined earthen pits dug into surficial soil and filled with various waste materials. A small circular area of disturbed soil was detected adjacent to these pits and is considered to have been used as a source of backfill for the pits. It has been determined that the BRRP source control OU does not contribute contamination to the area groundwater or surrounding soils. A ROD describing OU18 was completed in August 1998.

OU20:
The K-Area Bingham Pump Outage Pit (KBPOP) is situated in the Tobacco Road formation which extends from ground surface to a depth of 95 feet below ground surface. Between 1957 and 1958, miscellaneous construction debris generated by major modifications and repairs to the primary and secondary reactor cooling water systems was buried in the KBPOP. There were no pumps buried and no liquid waste was disposed of in the KBPOP. A ROD addressing OU20 was completed in March 1998.

OU23:
The F-Area Retention Basin (FRB) is located outside and south of the F-Area perimeter fence, approximately 1035 meters (3397 feet) from Fourmile Branch. The FRB, with an area of 0.6 acres, was designed and operated as an unlined, temporary container for potentially contaminated cooling water from the F-Area Canyon Facility and stormwater drainage from the F-Area Tank Farm. Cooling water from the Canyon Facility generally had low levels of radioactivity, while water from the Tank Farm is believed to have had only trace quantities of nonradionuclide chemicals. The quantities of water released to the retention basin and the level of

various constituents contained within the water are unknown. A ROD addressing OU23 was completed in September 1998.

OU24:
The chemicals, metals, and pesticides pits (CMP) operable unit consists of the pit area, ballast area, vadose zone, groundwater hot spot and distal portion of the groundwater plume. This interim remedial action applies to the ballast area, the vadose zone, and the groundwater hot spot. The CMP Pits are located in the central portion of the SRS in Barnwell County more than seven miles from the site boundary. The unit consists of seven unlined pits, placed in two rows, that formerly occupied the top knoll at an approximate elevation of 310 feet above sea level. The CMP Pits were placed in operation in August 1971. The pits were designed to receive pesticides, chemicals and metals. The pits were backfilled and closed in December 1979.

After the pits were backfilled and closed in 1979, SRA initiated groundwater monitoring. Analytical results indicated the presence of TCE and PCE in the water table. Soil samples were also contaminated with volatile organic compounds to a depth of 65 feet. SRS initiated a remedial action in 1984 and excavated the contents of all of the pits. Pesticides and drums of buried chemicals were removed from the CMP Pits. Contaminated soil was excavated until total volatile organic compound concentrations were less than 100 mg/kg and pesticide concentrations were less than 25 mg/kg. However, elevated levels of some constituents remain at the CMP Pits.

The ballast area originally contained lighting ballast that were removed during the characterization activities in 1995. The contamination in this area is thought to be related to the 1984 drum and soil removal at the pits. Specifically, it is believed that the soil contamination relates directly to excavated soils that were misapplied to this area as if it were clean fill. The lighting ballasts observed at or near the surface were removed from the area and disposed of as potential PCB-contaminated waste material in keeping with all applicable federal, state and local government regulations and guidelines.

A RCRA Facility Investigation/Remedial Investigation (RFI/RI) and a Baseline Risk Assessment (BRA) were conducted for the unit between 1994 and 1997 and the resulted present in the RFI/RI/BRA report. A Corrective Measures Study/ Feasibility Study (CMS/FS) and Statement of Basis/Proposed Plan for the CMP Pits were submitted for US EPA and South Caroling Department of Health and

Environmental Control approval in January 1998. Subsequently, an Interim Action Proposed Plan was submitted in accordance with the FFA and the approved implementation schedule, and was approved by US EPA and SCDHEC in March 1999.

OU27:
The D-Area Oil Seepage Basin is located on the Ellenton Plain, the highest of three terraces between the Savannah River to the west and the Aiken Plateau to the east. Construction of the D-Area Oil Seepage Basin trenches began in 1952. Employee interviews indicated the basin was used in the disposal of waste oil originating from D-Area Powerhouse operations to dispose of nonburnable waste and for the routine burning of office and cafeteria waste. Unknown amounts and types of waste were disposed into the basin. Records of the contents of the disposed drums do not exist. To date, there is no evidence to indicate the presence of radionuclides in the drums. Furthermore, employee interviews have indicated that no radionuclides were disposed within the trenches. In 1975, the D-Area Oil Seepage Basin was removed from service and backfilled with soil. Approximately one foot of standing liquid, plus an unknown number of 55-gallon drums possibly containing waste oil, remained in the basin when it was backfilled. The basin remains inactive and is covered with natural vegetation, including bushes and grasses, and is surrounded by trees. RODs addressing OU27 were completed in March 1995 and August 1998.

OU29:
The TNX Area is a pilot scale test facility for the SRTC. The pilot scale facilities are used to provide technical support to various SRS production areas. From 1953 to August 1988, wastewater generated by research performed in the TNX Area was disposed of in seepage basins. In August 1988, wastewater was rerouted to the TNX Effluent Treatment Facility. A ROD addressing OU29 was completed in November 1994.

OU31:
The C-Area Burning/Rubble Pit (CBRP) is located in the central part of SRS. CBRP is in the Fourmile Branch watershed on a ridge between two unnamed tributaries of Fourmile Branch. The CBRP was constructed in 1951 for use as a burning pit and served as a repository for organic materials of unknown use or origin. Disposal of combustible wastes in the pit was discontinued in 1973. At that time, the pit contents were covered with a thin layer of soil. The pit was then used for the disposal of inert rubble, and when full, was backfilled with soil and sediments to grade level. The pit is presently inactive.

An Interim Action Proposed Plan was submitted in accordance with the FFA and the approved implementation schedule, and was approved by the Environmental Protection Agency (EPA) and the State in April 1998. The implementation of this interim action will be conducted concurrently with the pursuit of a final remedial action. An Interim Record of Decision addressing this OU was signed in December 1998.

OU32:
The Burial Ground Complex (BGC) is an area which occupies approximately 195 acres in the central part of SRS between F and H Separation Areas, on a nearly flat divide between Upper Three Runs Creek to the north and Four Mile Creek to the south.

The BGC includes the Old Radioactive Waste Burial Ground (ORWBG) and other OUs such as the Mixed Waste Management Facility (MWMF), the Low Level Radioactive Waste Disposal Facility (LLRWDF), Solvent Tanks S1-S22 (located in the ORWBG and currently being characterized), Solvent Tanks S23-S30, and Solvent Tank S32.

The ORWBG comprises a disposal area for solid radioactive waste produced at the SRS, as well as shipments from other U.S. DOE and Department of Defense facilities. The ORWBG has contributed to localized shallow aquifer groundwater contamination. The plume of groundwater contamination from the ORWBG seeps into the old F-Area effluent stream which flows into Four Mile Creek which in turn flows into the Savannah River.

The ORWBG began receiving waste in 1952 and was filled in 1972. Examples of materials disposed of at the Old Radioactive Waste Burial Ground (ORWBG) include the incidental waste from laboratory and production operations, contaminated equipment, lead, spent deionizer resins, spent lithium-aluminum targets, irradiated process oil from pumps in the tritium facilities and reactor areas, mercury from gas pumps in tritium facilities, cadmium, scintillation fluid, and shipments from off-site. A ROD addressing OU32 was completed in June 1996.

OU33:
The mixed waste management facility (MWMF) operated from 1969 until March 11, 1986. During that time, this facility, which comprises approximately 58 acres, received low-level radioactive waste materials produced at SRS. Some of these materials are classified as

mixed waste containing both hazardous and radioactive components under the RCRA. These trenches were closed by precompacting and placing a protective multi-layer cover system over them to reduce rainwater contact with trench bottoms.

RCRA preventive actions at the MWMF were conducted pursuant to the requirements of RCRA. In 1985 a RCRA Closure Plan was submitted, and closure of the MWMF was begun in 1988 and completed in December 1990. The MWMF was certified closed in 1991. Closure activities specifically included precompaction, construction of a low permeability cap over the trenches, and restoration of the area. A ROD addressing OU33 was completed in September 1994.

OU34:
The Tank 105-C HWMF was installed in 1961 as part of an off-line heat exchanger repair program and was used as a temporary holding tank for liquid solution. Sumps from the heat exchanger cleaning area drained into Tank 105-C. Oil in the tank was probably attributable to oil leaks into these sumps. The reacted or spent oxalic acid solution that resulted from the rinsing process was pumped into an above ground neutralization tank in the stack area of the reactor building.

In October 1990, a RCRA Closure Plan was submitted to the SCDHEC. SRS received approval of the closure plan on January 16, 1991, with no revision required. A ROD addressing OU34 was completed in September 1994.

OU35:
Par Pond is a 2640-acre man-made reservoir located northeast of P Area and east of R Area in the eastern portion of SRS. The southern shore of the reservoir lies approximately 1.5 miles from the eastern SRS boundary. Par Pond discharges through controlled releases into Lower Three Runs Creek, which in turn discharges into the Savannah River.

Par Pond was built to augment the cooling water requirements of both P and R Reactors. During the 1950s, an effluent pathway was constructed from R Reactor to Par Pond. The pathway consisted of the R Canal and Pond B. Releases in the form of process leaks, purges, and makeup cooling water have contaminated Par Pond with cesium-137 and other radioactive and non-radioactive contaminants. Mercury has been detected in fish from the Savannah River and SRS waterbodies since the analyses began in 1971, with comparable concentrations measured in onsite and offsite fish. A ROD describing

OU35 was completed in February 1995.

OU41:
OU41 contains the P-Area CP R/O Basin (P-CRPB). The P-CRPB is located approximately 330 feet southeast of the limited area fence surrounding P Area in northwestern Barnwell County. A ROD addressing OU41 was completed in September 1998.

OU42:
OU42 contains the C-Area CP R/O Basin (C-CRPB). The C-CPRB is located approximately 700 feet southeast of the limited area fence surrounding C Area in northwestern Barnwell County. A ROD addressing OU42 was completed in September 1998.

OU45:
The Grace Road Site is located approximately 1.3 kilometers south of B-Area and about 244 meters east of the intersection of Grace Road and SRS Road 2. It consists of numerous drums and cans, concrete slabs, brick foundations, and miscellaneous debris. The unit also contained numerous drums and cans and various car parts. Most of the debris was on the surface or partially buried in scattered locations across the unit.

Between February and May 1992, all the debris, drums and concrete slabs were removed from the Grace Road Site. No records of any type of waste management activity have been found for the Grace Road Site. A ROD addressing OU45 was completed in March 1997.

OU51:
The Motor Shops Seepage Basin (716-A) (MSSB) is located in A Area south of the railroad tracks near the automotive shop in Aiken County. A small drainage feature runs through the area approximately 91 meters (300 feet) to the east of the MSSB.

The MSSB was constructed and placed in service in 1977 to receive liquid waste from the 716-A Motor Shops oil/water separator. The MSSB was designed and constructed as an unlined seepage basin. The wastewater flowed into the basin from the northwest through two influent pipes from the Motor Shop and seeped naturally into the soil beneath the basin. Effluent discharges from the Motor Shops included wastewater with trace amounts of engine oil, grease, kerosene, ethylene glycol, and soapy water. A ROD addressing OU51 was completed in June 1998.

OU52:
The K-Area CP R/O Basin (K-CPRB). The K-CPRB is located

approximately 500 feet west of the limited area fence surrounding K Area in northwestern Barnwell County. A ROD addressing OU52 was completed in September 1998.

OU54:
The F-Area CP R/O Basin (F-CPRB) is located approximately 50 feet southeast of the limited area fence surrounding F Area in southwestern Aiken County. A ROD addressing OU54 was completed in September 1998.

OU57:
The Ford Building Waste Unit (643-11G) (FBWU) is located near the center of the SRS. The FBWU is a source of control and groundwater operable unit in the Fourmile Branch watershed. The FBWU is located in the industrial buffer zone of N Area (Central Shops) and will remain industrial use in the future in accordance with SRS Citizen Advisory Board industrial (Nuclear Use) activity. Operations with regulated radioactive equipment probably occurred at the FWBU. The nearby Ford Building was used for the reconfiguration and repair of reactor heat exchangers and other process equipment that had been decontaminated prior to receipt at the facility. There are no records of waste disposal for the FBWU. However, in the past, objects identified on the surface of the waste unit included shoe covers, step-off pads, coveralls, and rubber gloves. In addition, a sign typically used to designate a radiologically controlled area marked the site. All surface debris was removed from the unit in an undocumented removal sometime prior to 1992. Based on pre-Work Plan analytical data, cesium-137 was detected at elevated levels in the surface and subsurface soils. A time-critical removal action as implemented in early 1997 to address these secondary sources of contamination. A ROD addressing OU57 was completed in May 1999.

Remedy: The preferred alternative for Pit Area soil (Alternative S-3, Native Soil Cover) consists of placing a layer of clean soil over the entire surface area of the C-Area Burning/Rubble Pit (CBRP). This additional layer of soil will act as a barrier to prevent soil exposure to future human and ecological receptors and will also reduce precipitation infiltration to minimize the further migration of trichloroethylene from the CBRP soils to the groundwater.

The selected groundwater remedy, Alternative GW-3, in-situ air sparging (with soil vapor extraction), would involve operation of an air sparging system that would inject air into the bottom of the contaminated groundwater plume. The contaminants would then pass

into the injected air, as it moves upward through the plume and, in turn, would flow into the unsaturated soil (vadose zone) above the water table. These volatilized groundwater volatile organic compounds (VOCs) would be extracted via vacuum wells by a soil vapor extraction system as they rise into the vadose zone. Additionally, VOCs residing in the vadose zone would also be extracted via these same vacuum wells. The extracted soil vapors would be processed through a liquid-phase separator to remove condensate. The offgas would then either be treated or released into the atmosphere in accordance with release requirements. Installation of the air sparging/soil vapor extraction system is targeted to remove high concentrations of trichloroethylene in the upper water table that could be in a free phase.

Simultaneous institutional controls would involve the installation and maintenance of long-term monitoring systems for groundwater, surface water, and biota to monitor the rate of attenuation of organic contamination at the site. Monitoring would continue for an indefinite period until sampling indicated remediation is successful in reducing groundwater contaminant levels below applicable or relevant and appropriate requirements. Existing site access controls will be used to restrict the public and limit utilization of the site to industrial workers.

Estimated Capital Costs: $975,000
Estimated Annual O&M Costs: $244,000
Estimated Present Worth Costs: $2,195,000

Text: Full-text ROD document follows on next page.

PB99-964002
EPA541-R99-020
1999

EPA Superfund
Record of Decision:

Savannah River Site (USDOE)
C Area Burning/Rubble Pit (131-C) (U)
Aiken, SC
12/23/1998

Department of Energy
Savannah River Operation Office
P.O. Box A
Aiken, south Carolina 29802

Mr. K. A. Collinsworth, Manager
Federal Facility Agreement Section
Division of Site Assessment and Remediation
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

Mr. J. L. Crane, Manager
SRS Remedial Project
Waste Management Division
United States Environmental Protection Agency, Region IV
61 Forsyth Street, SW
Atlanta, GA 30303

Dear Mr. Collinsworth and Mr. Crane:

SUBJECT: Submittal of the Record Copy of the Signed Interim Record Of Decision for the C-Area Burning/Rubble Pit (131-C), WSRC-RP-98-4039, Revision.1

Enclosed, please find a signed copy of the C-Area Burning/Rubble Pit Interim Record of Decision for your records. SRS will make the distribution of the Administrative Record file(s) and publish the notice of availability.

Please contact me at (803) 725-7032 if you have any questions.

Sincerely,

Brian T. Hennessey
Environmental Restoration Division
SRS Remedial Project Manager

BTH/HMH:kbs
OD-99-244
Enclosures

1. Interim Record of Decision for the C-Area Burning/Rubble Pit (131-C), WSRC-RP-98-4039, Revision. 1

MAR 30 1999

c: A. B. Gould, DOE-ECD, 703-A
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M. D. Sherritt, SCDHEC-Columbia
G. K. Taylor, SCDHEC-Columbia
SRS Administrative Record Files (Palmer, 730-2B, 1000)*
*w/enclosures

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ERD Files, 730-2B, Rm. 1000*
EPD Files, 742-A (A. Odom)
*w/enclosures

United States Department of Energy

Savannah River Site

OU-31
Interim Record of Decision
Remedial Alternative Selection for the C-Area Burning/Rubble Pit Operable Unit (131-C)(U)

WSRC-RP-98-4039
Revision 1
September 1998

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

Prepared for U.S. Department of Energy Under Contract No. DE-AC09-96SR18500

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Printed in the United States of America

Prepared for the
U. S. Department of Energy
by
Westinghouse Savannah River Company
Aiken, South Carolina

INTERIM RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION (U)

C-Area Burning/Rubble Pit Operable Unit (131-C) (U)

WSRC-RP-98-4039
Revision 1
September 1998

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
for the
U.S. Department of Energy Under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

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DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

C-Area Burning/Rubble Pit Operable Unit 131 -C (CBRP)
Savannah River Site
Aiken, South Carolina

The CBRP source control and groundwater operable unit (OU) is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Unit/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unitin Appendix C of the Federal Facility Agreement (FFA) (FFA 1993) for the Savannah River Site (SRS).

Statement of Basis and Purpose

This decision document presents the selected interim remedial action for the CBRP located at the SRS in Aiken, South Carolina. The interim action was selected in accordance with CERCLA, as amended and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File that includes all basis documents for this specific RCRA/CERCLA unit.

The proposed interim action will consist of a native soil over the CBRP pit and a vadose zone and groundwater treatment system. The treatment system willbe operated and evaluated for approximately 1 year with incorporation of the results integrated into the final Corrective Measures Study/Feasibility Study (CMS/FS) which will include a detailed review of remediation technologies for the final remedial action. A complete description of the action is provided in the following sections.

This interim action, for the CBRP, is not a final action but is justified to minimize the impact of the CBRP on the Fourmile Branch watershed. It will be consistent with any planned future actions. A final Record of Decision (ROD) will follow additional study by SRS, regulator approval, and public involvement and will document the final CERCLA decision for the OU. Further, upon agreement among the U. S. Department of Energy (DOE), Environmental Protection Agency (EPA), and the South Carolina Department of Health and Environmental Control (SCDHEC), on the disposition of all source control and groundwater operable units within this watershed, a final comprehensive Record of Decision (ROD) for the watershed will be pursued with further public involvement.

Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the interim response action selected in this Interim Record of Decision (IROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

The DOE, EPA and SCDHEC have determined that an interim action principally designed to control the migration of high concentrations of solvents, in the saturated zone, is appropriate for the CBRP. Specifically, this interim action has two main objectives:

- Prevent direct contact with COC contaminated soils and reduce infiltration to minimize further migration of CMCOCs to the groundwater from soils within and beneath the CBRP; and

- Treat the area in the vicinity of the pit within the 25,000 ug/L VOC isoconcentration contour within the groundwater, with an objective to reduce concentrations and control the migration of VOCs within the 25,000 ug/L VOC contour.

The remedial action objectives for the interim action will be achieved by

- installing a soil cover over the source;
- performing soil vapor extraction (SVE) in the vadose zone beneath the pit; and
- performing air sparging (coupled with SVE) in the 25,000 ug/L contour of the groundwater plume

Specifically, the preferred alternatives for the Pit area at the CBRP OU are: Alternative S-3: Native Soil Cover and Alternative GW-3: In-Situ Air Sparging with Soil Vapor Extraction (AS/SVE). No final COCs were identified for the Mounded Area and soil adjacent to the Drainage Ditch, therefore, no alternatives were developed for these areas.

The Native Soil Cover will address surficial exposure to low level threat wastes (i.e., low concentration dioxin contamination in the near surface pit soil and organic contamination in the deep soil) in the pit area. The alternative will meet the soil Interim Remedial Action Objectives (IRAOs) to prevent direct contact with final constituents of concern (COCs) in contaminated soils and reduce infiltration to minimize further migration of contaminant migration COCs (CMCOC)

to the groundwater from soils within and beneath the CBRP. As part of the final ROD, the native soil cover would be maintained and institutional controls will remain in place in perpetuity or until the waste no longer poses a threat to human health or the environment.

AS/SVE will address principal threat wastes (i.e., highly concentrated TCE in the aquifer sediments immediately adjacent to the pit in the upper zone of the water table aquifer) and VOC vadose zone contamination. AS/SVE will meet the groundwater IRAOs to treat the principal threat area in the vicinity of the pit, within the 25,000 ug/L VOC isoconcentration contour, with an objective to reduce concentrations and control the migration of VOCs within the 25,000 ug/L VOC contour.

Implementation of the preferred alternatives will require both near- and long-term actions. For the near term, surface and subsurface soil contamination will be addressed by the installation of a native soil cover over the CBRP source unit. The soil cover will be compacted to reduce infiltration, sloped to promote runoff, and will have a layer of vegetation to prevent erosion. The soil cover will prevent future contact by workers, residents, and ecological receptors with the dioxin contamination in the soil. The soil cover will also minimize further migration of contaminants from the soil to the groundwater by reducing infiltration. In addition to continued inspection and maintenance of the cover, signs will be posted at the CBRP to indicate that the area was used for the disposal of hazardous substances and existing SRS access controls will be used to maintain the site for industrial use only.

Over a longer period of time, groundwater contamination will be addressed through controlled sparging of air into the groundwater. The injected air will volatilize the organic compounds in the groundwater that will move into the vadose zone and also volatilize the organic contaminants in the deep soil. Organic vapors from both the groundwater and deep soil will be extracted from the soil above the shallow groundwater aquifer using vacuum wells connected to a soil vapor extraction (SVE) system. The extracted soil vapors will be processed through a liquid-phase separator to remove condensate. The offgas will then either be released into the atmosphere or treated to meet release requirements. Until the IRAOs are achieved, groundwater monitoring will be performed.

The CBRP Corrective Measures Implementation/Remedial Design/Remedial Design Report/Remedial Action Work Plan (CMI/RD/RDR/RAWP) post-IROD document was submitted to the regulatory agencies on June 19, 1998. The CMI/RD/RDR/RAWP details the actions to be taken for implementing the soil cover and AS/SVE remedies including a summary description of the scope of work for the remedial action design, monitoring requirements, a detailed implementation/submittal schedule for subsequent post-IROD documents, and an anticipated field activities start date.

Statutory Determinations

This interim action is protective of human health, and the environment and will reduce the principal threats posed by the CBRP. Relative to its overall effectiveness with respect to the nine selection criteria established by the NCP, the selected alternatives are cost effective. This interim action will not identify final remedial goals; but the selected interim alternatives are consistent with the interim remedial action objectives and any final action. Pursuant to the EPA IROD guidance (EPA 1989) and checklists, the alternative selection focused upon the key ARARs listed below which apply to the limited scope of the interim action. The alternative selection also considered final action ARARs to ensure the interim action is compatible. The final action will comply with Federal and State applicable or relevant and appropriate requirements. Although this interim action is not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action does utilize treatment and thus is a furtherance of that statutory mandate.

- Fugitive Particulate Emissions (40 CFR 50.6 and SC R61-62.6, Section III)
- SC Toxic Air Pollutant regulations (SC R61-62.1, Section II, paragraph 3)
- SC Well Construction regulations (SC R61-71)

Because this action does not constitute the final remedy for the CBRP, the statutory preference of remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, although partially addressed in this remedy, will be addressed by the final response action. Subsequent actions are planned to fully address the threats posed by the conditions at the CBRP. This interim action is not designed or expected to be a final action for the groundwater, but the selected remedy represents the best balance of tradeoffs among alternatives with respect of pertinent criteria, given the limited scope of the action. The soil cover will likely be acceptable for the final action for soils at the unit.

SCHWMR R.61-79.124 and Section 117(a) of CERCLA, as amended, require advertisement of the draft permit modification and the proposed plan, respectively. Because this is an interim remedial action, a permit modification is not required to be included with this IROD. A final permit modification will include the final selection of remedial alternatives under RCRA, will be sought for the entire CBRP OU with the final SB/PP and will include the necessary public involvement and regulatory approvals. This IROD also satisfies the RCRA requirements for an Interim Measures Work Plan.

Section 300.430 (f)(4)(ii) of the National Oil and Hazardous Substances Contingency Plan (NCP) requires that a five year review of a ROD be performed if hazardous substances, pollutants, or contaminants remain in the waste unit. The SRS RCRA permit (SRS 1995 RCRA Renewal Permit, SCI 890 008 989) is reviewed every five years and was most recently reviewedon September 5, 1995. Because this remedy will result in hazardous substances remaining on site above health-based levels, a review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment within 5 years after commencement of the remedial action. Because this is an interim action ROD, review of this site and of this remedy will be ongoing as SRS continues to develop final remedial alternatives for the CBRP.

9/23/98
Date

Thomas F. Heenan
Assistant Manager for Environmental Quality
U. S. Department of Energy, Savannah River Operations Office

12/23/98
Date

Richard D. Green
Division Director
Waste Management Division
U. S. Environmental Protection Agency - Region IV.

3/[illegible]/99
Date

R. Lewis Shaw
Deputy Commissioner
Environmental Quality Control
South Carolina Department of Health and Environmental Control

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INTERIM DECISION SUMMARY
REMEDIAL ALTERNATIVE SELECTION (U)

C-Area Burning/Rubble Pit Operable Unit (131-C) (U)

WSRC-RP-98-4039

Revision 1

September 1998

Savannah River Site

Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company

for the

U.S. Department of Energy Under Contract DE-AC09-96SR18500

Savannah River Operations Office

Aiken, South Carolina

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LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
AS	Air Sparging
AS/SVE	In-Situ Air Sparging/Soil Vapor Extraction
bls	below land surface
BRA	Baseline Risk Assessment
CBRP	C-Area Burning/Rubble Pit Operable Unit (131-C)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfm	cubic feet per minute
CFR	Code of Federal Regulations
CMCOC	contaminant migration constituent of concern
CMI/RD/RDR/ RAWP	Corrective Measures Implementation/Remedial Design/Remedial Design Report/Remedial Action Work Plan
CMS/FS	Corrective Measures Study/Feasibility Study
COC	constituent of concern
COPC	constituent of potential concern
CPT	cone penetrometer technology
CRSB	C-Reactor Seepage Basin
CSM	conceptual site model
DOE	U. S. Department of Energy
DQO	data quality objective
EPA	U. S. Environmental Protection Agency
FFA	Federal Facility Agreement
FR	Federal Register
Ft	Feet
HpCDD	1,2,3,4,6,7,8 heptachlorodibenzo-p-dioxin
HQ	Hazard Quotient
IAPP	Interim Action Proposed Plan
IRAOs	Interim Remedial Action Objectives
IROD	Interim Record of Decision
M	Meters
MCL	Maximum Contaminant Level
NCP	National Oil and Hazardous Substances Contingency Plan
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OCDD	octachlorodibenzo-p-dioxin

I. SAVANNAH RIVER SITE AND OPERABLE UNIT NAME, LOCATION, DESCRIPTION, AND PROCESS HISTORY

Savannah River Site Location, Description, and Process History

The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of western South Carolina. SRS is a secured U.S. Government facility with no permanent residents and is located approximately 25 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina (Figure 1).

The Savannah River Site is owned by the U.S. Department of Energy (DOE). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense and the space program. Chemical and radioactive wastes are by products of nuclear material production processes.

Operable Unit Name, Location, Description, and Process History

The Federal Facility Agreement (FFA) (FFA 1993) for the SRS lists the C-Area Burning/Rubble Pit (CBRP), 131-C, as a Resource Conservation and Recovery Act (RCRA)/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit. Consequently, the unit requires further evaluation, using an investigation/assessment process that integrates and combines the RCRA Facility Investigation (RFI) process with the CERCLA Remedial Investigation (RI), to determine the actual or potential impact to human health and the environment.

DOE is issuing this Interim Record of Decision (IROD). The DOE functions as the lead agency for SRS remedial activities, with concurrence by the U.S. Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC). The purpose of this IROD is to document the preferred interim remedial actions for the CBRP which will consist of a native soil cover over the CBRP pit and a vadose zone and groundwater treatment system. The cover and treatment system are detailed in Section IX.

The CBRP is located in the central part of SRS. It is west of C-Area Reactor and north of Road A-7. Adjacent to the road, there is a concrete Drainage Ditch. CBRP is in the Fourmile Branch watershed on a ridge between two unnamed tributaries of Fourmile Branch. At its closest point, one tributary is approximately 900 feet away.

I. SAVANNAH RIVER SITE AND OPERABLE UNIT NAME, LOCATION, DESCRIPTION, AND PROCESS HISTORY

Savannah River Site Location, Description, and Process History

The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of western South Carolina. SRS is a secured U.S. Government facility with no permanent residents and is located approximately 25 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina (Figure 1).

The Savannah River Site is owned by the U.S. Department of Energy (DOE). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense and the space program. Chemical and radioactive wastes are by products of nuclear material production processes.

Operable Unit Name, Location, Description, and Process History

The Federal Facility Agreement (FFA) (FFA 1993) for the SRS lists the C-Area Burning/Rubble Pit (CBRP), 131-C, as a Resource Conservation and Recovery Act (RCRA)/Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) unit. Consequently, the unit requires further evaluation, using an investigation/assessment process that integrates and combines the RCRA Facility Investigation (RFI) process with the CERCLA Remedial Investigation (RI), to determine the actual or potential impact to human health and the environment.

DOE is issuing this Interim Record of Decision (IROD). The DOE functions as the lead agency for SRS remedial activities, with concurrence by the U.S. Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC). The purpose of this IROD is to document the preferred interim remedial actions for the CBRP which will consist of a native soil cover over the CBRP pit and a vadose zone and groundwater treatment system. The cover and treatment system are detailed in Section IX.

The CBRP is located in the central part of SRS. It is west of C-Area Reactor and north of Road A-7. Adjacent to the road, there is a concrete Drainage Ditch. CBRP is in the Fourmile Branch watershed on a ridge between two unnamed tributaries of Fourmile Branch. At its closest point, one tributary is approximately 900 feet away.

Figure 1. Map of Savannah River Site Showing the Location of C-Area Burning/Rubble Pit

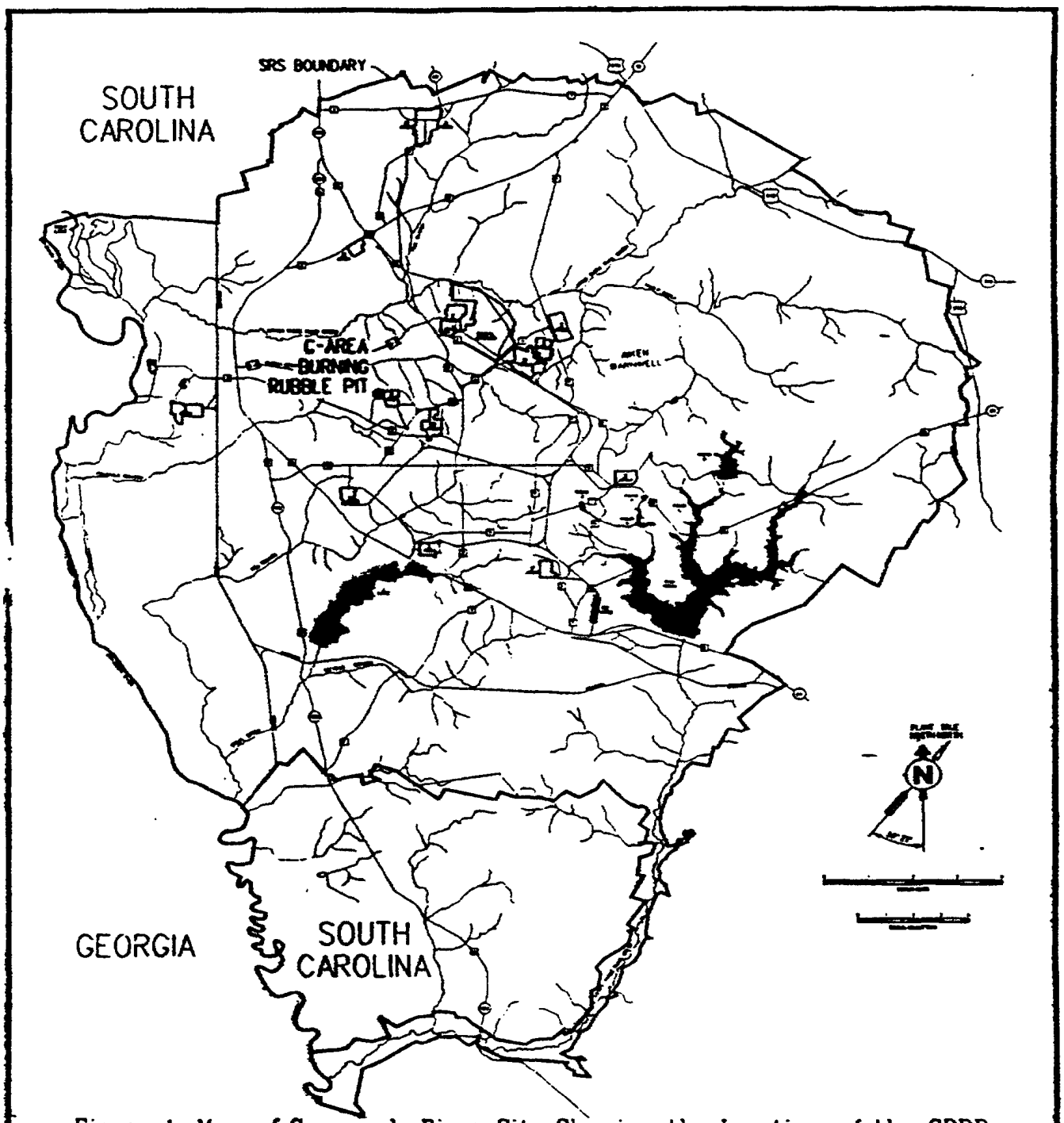


Figure 1. Map of Savannah River Site Showing the Location of the CBRP

Fourmile Branch stream is located approximately 3,200 feet northwest of the CBRP and discharges into the Savannah River floodplain and associated swamps. Figure 1 shows the location of the CBRP in relation to other facilities at SRS. Figure 2 shows the location of the CBRP in relation to C-Area reactor.

The CBRP was a shallow, unlined excavation (approximately 25 feet wide and 350 feet long) with depths of approximately 8 to 12 feet. It had a volume of approximately 3,240 cubic yards. The CBRP was constructed in 1951 for use as a burning pit. During the operation of the pit, it served as a repository for organic materials (i.e., waste oils, wood, paper, plastics, and rubber) of unknown use or origin. Disposal records, including the chemical composition, origin, use and volume of the disposed wastes, were not kept for this unit during its period of operation. Disposal of combustible wastes in the pit was discontinued in 1973. At that time, the pit contents were covered with a thin layer of soil. The pit was then used for the disposal of inert rubble and, when full, was backfilled with soil and sediments to grade level. The pit is presently inactive (WSRC 1997a).

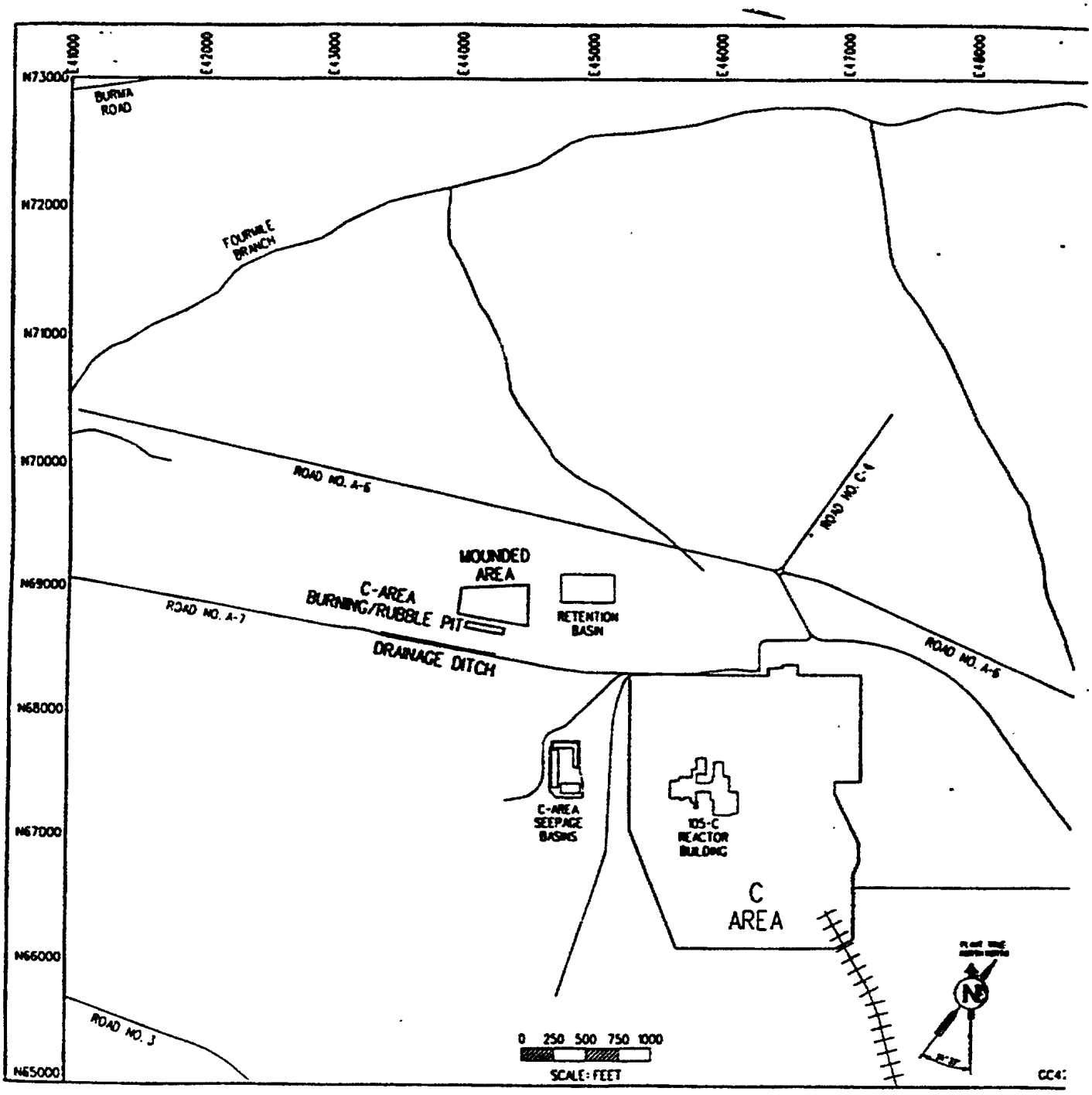
A Mounded Area, approximately 30 feet high, 270 feet wide, and 525 feet long, is located directly north of the CBRP. This man-made mound contains soil and debris from the initial construction of the C-Area Reactor. It is covered with native soils excavated to construct a large retention basin to the cast of the CBRP. This Mounded Area was not used for burning, and no known hazardous materials were disposed in this area. A Drainage Ditch occurs to the south of the pit, paralleling Road A-7.

II SITE AND OPERABLE UNIT COMPLIANCE HISTORY

SRS Operational History

The primary mission of SRS was to produce tritium, plutonium-239, and other special nuclear materials for U.S. defense programs. Production of nuclear materials for the defense programs was discontinued in 1988. SRS has provided nuclear materials for the space program as well as for medical, industrial, and research efforts to the present. Chemical and radioactive wastes are byproducts of nuclear material production processes. These wastes have been treated, stored, and in some cases, disposed at SRS. Past disposal practices have resulted in soil and groundwater contamination.

Figure 2. Location of C-Area Burning/Rubble Pit



SRS Compliance History

Waste materials handled at SRS are regulated and managed under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities have required federal operating or post-closure permits under RCRA. SRS received a hazardous waste permit from the SCDHEC; the permit was most recently renewed on September 5, 1995. Part IV of the permit mandates corrective action requirements for nonregulated solid waste management units subject to the requirements specified in Section 3004(u) of RCRA.

On December 21, 1989, SRS was included on the National Priorities List (NPL). This inclusion created a need to integrate the established RFI Program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA, DOE has negotiated a FFA (FFA, 1993) with EPA and SCDHEC to coordinate remedial activities at SRS into a single comprehensive strategy which fulfills these dual regulatory requirements.

Operable Unit Compliance History

As previously stated the CBRP is listed in the FFA as a RCRA/CERCLA unit requiring further evaluation to determine the actual or potential impact to human health and the environment. An RFI/RI characterization and a Baseline Risk Assessment (BRA) were conducted for the unit between 1994 and 1997 and the results presented in the RFI/RI/BRA report. The RFI/RI/BRA, Rev. 1.1 (WSRC 1997a) report was submitted in accordance with the FFA and the approved implementation schedule in December 1997. A final revision (Rev 1.3) is scheduled for submittal in April 1999. Sufficient data has been collected to identify a high concentration (hot spot) source of contamination under and adjacent the CBRP. Per EPA guidance, on presumptive response strategies for groundwater (EPA 1996), groundwater response actions should be implemented in a phased approach with provisions for monitoring and evaluating their performance. Subsequently, SRS developed an SRS Early Action Strategy (10/21/97). Consistent with this EPA guidance and SRS's Early Action strategy, a CBRP interim action is documented herein to install a soil cover and an In-Situ Air Sparging/Soil Vapor Extraction (AS/SVE) system to remove principal threat wastes (i.e., high concentrations of trichloroethylene (TCE)).

An Interim Action Proposed Plan (IAPP) (WSRC 1998a) was submitted in accordance with the FFA and the approved implementation schedule, and was approved by EPA and SCDHEC in April 1998. A presentation was made to the Citizens Advisory Board at an open public meeting in May 1998, and the public comment period

ended in May 1998. The implementation of this interim action will be conducted concurrently with the pursuit of a final remedial action.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Both RCRA and CERCLA require that the public be given an opportunity to review and comment on the draft permit modification and proposed remedial altemative. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternatives for addressing the CBRP soils and groundwater. The Administrative Record File must be established at or near the facility at issue.

The SRS Public Involvement Plan (DOE 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS Public Involvement Plan addresses the requirements of RCRA, CERCLA, and the National Environmental Policy Act, (NEPA 1969). The *IAPP for the C-Area Burning/Rubble Pit (131-C)* (WSRC 1998a), which is pan of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the CBRP.

The FFA Administrative Record File, which contains the information pertaining to the selection of the response action, is available at the Atlanta EPA office and at the following locations:

U.S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

Similar information is available through the repositories listed below:

Reese Library
Augusta State University
2500 Walton Way
Augusta, Georgia 30910
(706) 737-1744

Asa H. Gordon Library
Savannah State University
Tompkins Road
Savannah, Georgia 31404
(912) 356-2183

SCHWMR R 61-79.124 and Section 117(a) of CERCLA, as amended, require advertisement of the draft permit modification and any proposed remedial or interim action and an opportunity for the public to participate in the selection of a remedial or interim action. Because this is an interim remedial action, a permit modification is not required to be included with this IROD. The final permit modification will (1) include the final selection of remedial alternatives under RCRA, (2) be sought for the entire CBRP Operable Unit with the final Statement of Basis/Proposed Plan (SB/PP) and (3) will include the necessary public involvement and regulatory approvals. This IROD also satisfies the RCRA requirements for an Interim Measures Work Plan.

The RCRA Administrative Record File for SCDHEC is available for review by the public at the following locations:

The South Carolina Department of Health and Environmental Control
Bureau of Land and Waste Management
8901 Farrow Road
Columbia, South Carolina 29203
(803) 896-4000

Lower Savannah District Environmental Quality Control Office
215 Beaufort Street, Northeast
Aiken, South Carolina 29802
(803) 648-9561

The public was notified of the public comment period through mailings of the *SRS Environmental Bulletin*, a newsletter sent to citizens in South Carolina and Georgia, and through notices in the *Aiken Standard, the Allendale Citizen Leader*, the *Augusta Chronicle*, the *Barnswell People-Sentinel*, and *The State* newspapers. The public comment period was also announced on local radio stations.

The IAPP 30-day public comment period began on 4/17/98 and ended on 5/16/99. The IAPPwas presented to the Citizen Advisory Board in an open public meeting on 5/6/98. A Responsiveness Summary was prepared to address comments received during the public comment period and the open public meeting on 5/6/98. The Responsiveness Summary is provided in Appendix A of this Interim Record of Decision (IROD). It will also be available in the final RCRA permit

IV SCOPE AND ROLE OF THE OPERABLE UNIT WITHIN THE SITE STRATEGY

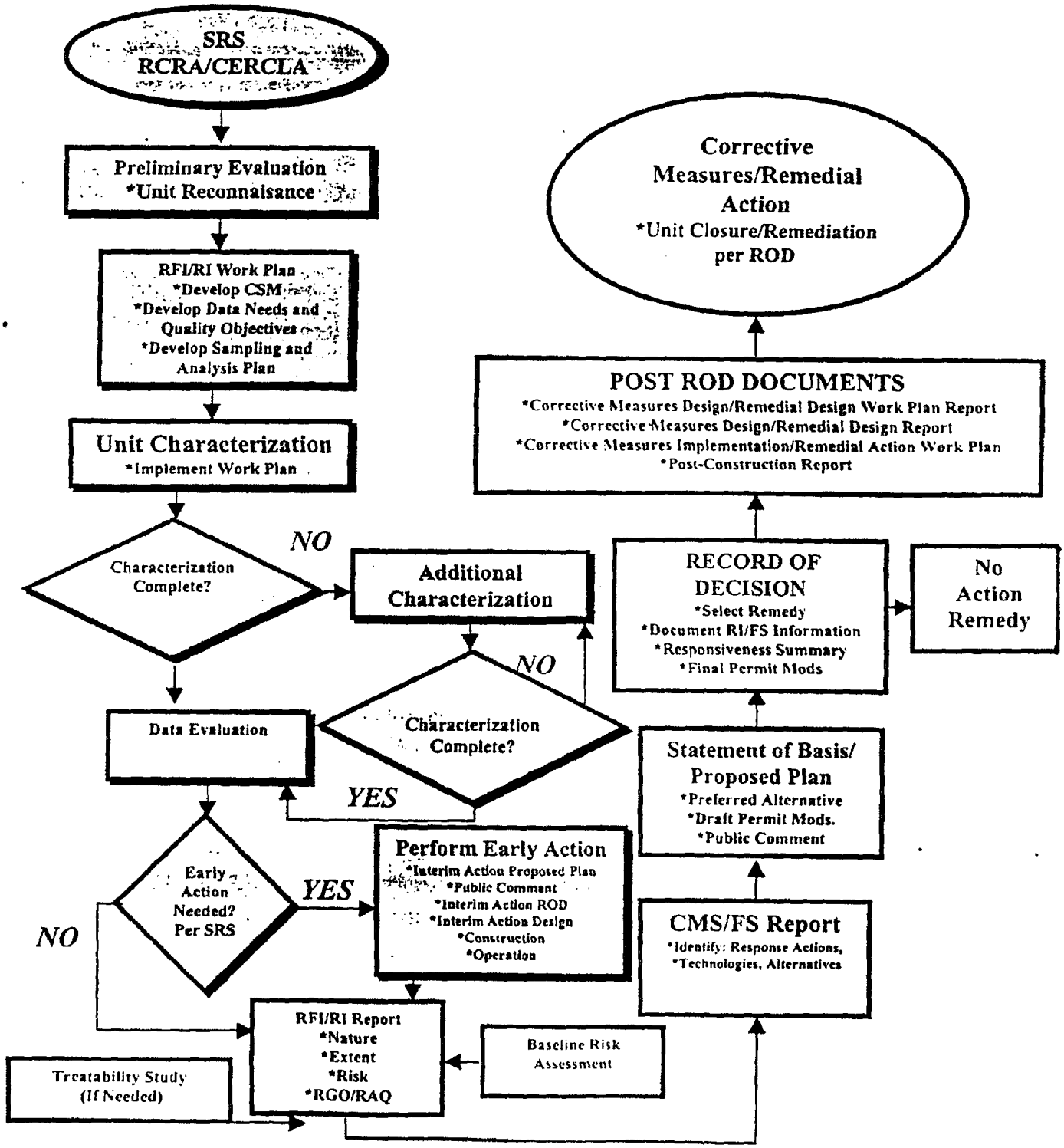
RCRA/CERCLA Programs at SRS

RCRA/CERCLA units (including the CBRP) at SRS are subject to a multi-phase remedial investigation process that integrates the requirements of RCRA and CERCLA as outlined in the RFI/RI Program Plan (WSRC 1993). The RCRA/CERCLA processes aregenetically summarized in Figure 3. Figure 3 is consistent with the SRS ER RI/FS Early Action Strategy (10/21/97) which was developed with regulatory concurrence.

The generic phases include (1) the investigation and characterization of potentially impacted environmental media (such as soil, groundwater, and surface water) comprising the waste-site and surrounding areas; (2) the evaluation of risk to human health and to the local ecological community; (3) the screening of possible remedial actions to identify the selected technology which will protect human health and the environment; (4) implementation of the selected alternative; (5) documentation that the remediation has been performed competently; and (6) the evaluation of the effectiveness of the technology. The steps of this process are iterative in nature, and include decision points which involve concurrence among the DOE (as owner/manager), the EPA and SCDHEC (as regulatory oversight), and the public.

As outlined in Figure 3,and consistent with the above generic phases, the overall strategy for addressing the CBRP is to (1) perform a RF/RI to characterize the waste unit that will identifyhe nature and extent of contamination and the media of concern; (2) perform a baseline risk assessment (BRA) to evaluate media of concern, constituents of concern (COC), exposure pathwaysand characterize potential risks; (3) evaluate the possible remedial alternatives and acquire community involvement in the remedial selectionand document the process in the Corrective Measures Study/FeasibilityStudy (CMS/FS) and Proposed Plan (PP); and (4) evaluate and perform a final action to remediate, as needed, the identified media.

Figure 3. RCRA/CERCLA Logic and Documentation for the CBRP Interim Action



The interim action described in this MOD was developed and planned concurrently with RFM process. Figure 3 illustrates the general decisions related to the recognition that an early action was appropriate. The following sections succinctlydescribe the steps of the RFM process. To date, the interim action has progressed through the shaded areas of Figure 3 concluding with the "Perform Early Action" block.

RFI/RI Work Plan

Based on the data reviewed and collected during the unit preliminary screening and process knowledge, a conceptual site model (CSM) was developed to determine the contaminated media sources release mechanisms, migration pathways, exposure routes, and potential human and ecological receptors. Section V provides the unit-specific CSM for the CBRP OU and a summary of the characteristics of the primary and secondary sources and release mechanisms for the units, consistent with RFMU Work Plan. The approved RFLW Work Plan for the CBRP (WSRC 1994, WSRC 1998b) outlined the specific characterization activities for the CBRP.

Unit/Site Characterization (RFI/RI)

The primary need for the RFMU unit characterization is to establish unit-specific constituents (USCs) that pose potential risk through various exposure routes and detennine their distribution in source media associated with the unit. These characterization data provide the contaminant profile and mass information necessary to determine the potential for contaminant migration to off-unit receptors. Even though characterization activities are ongoing at CBRP, a good general understanding of the containimfion is available. For a more complete discussion 'of the present characterization, see Section V, and the latest revision to the RFMUMRA (WSRC 1997a).

Baseline Risk Assessment

The intent of the BRA is to develop risk information necessary to assist in the decision-making process for vemedial sites. Because characterization is ongoing, a final risk assessment has not been completed. However, risk can be quantified based upon known data, coupled with potential scenarios for current and future human and ecological receptors through multiple exposure routes as identified in the CSM. A summary of the preliminary findings of the latest revision of the BRA (WSRC 1997a) for the CBRP are presented in more detail in Section VI.

Preliminary Alternatives Analysis (PAA)

A Preliminary Alternative Analysis (PAA) was conducted to support the development of a Corrective Measures Study/Feasibility Study (CMS/FS) for the CBRP, which will be submitted in early 2001. The preliminary alternative analysis was developed to eventually document the alternative selection process for a final remedial remedy. Consequently, the preliminary alternative analysis is very complete with respect to the range of alternatives and their consistency with final alternatives. The 1APP used the PAA as a basis for selecting appropriate interim action alternatives for CBRP contaminated soil and groundwater. A summary of the results of the PAA conducted for the CBRP is provided in Section VII, and a summary of the comparative analysis of the alternatives is provided in more detail in Section VIII.

Interim Action Proposed Plan (IAPP)

T'he culmination of the interim response action selection process is the Interim Action Proposed Plan (IAPP). The purpose of die IAPP is to facilitate public participation in the remedy selection process through the solicitation of public review, and comment on all the remedial alternatives described. The 1APP describes all remedial options that were considered in detail in the PAA and explicitly identifies DOE's preliminary preferred alternative(s) for remedial action and the rationale for the selection. The IAPP was subsequently approved by the regulatory agencies. The basis for the selection and additional design and operational details for the approved remedy are provided in Section IX.

Interim Record of Decision

The Interim Record of Decision (IROD) documents the interim remedial action plan for a unit and consists of three basic components: a Declaration, the Decision Summary, and the Responsiveness Summary. The purpose of the Declaration is to certify that the remedy selection process was carried out in accordance with the requirements of CERCLA and, to the extent practicable, the NCP.

The Decision Summary is a technical and information document that provides the public with a consolidated source of information about the history, characteristics, and risks posed by a unit, followed by a summary evaluation of the cleanup alternatives considered. The Responsiveness Summary presents comments received during the public comment period (4/17/98 through 5/16/98) on the LAPP and a response to each comment or criticism, whether submitted in writing or orally. The Responsiveness Summary for the CBRP is

provided in Appendix A and an explanation of significant changes resulting from public comment is provided in Section XI.

Records of Decision are typically accompanied with RCRA Permit modifications for SRS waste units. SRS has a hazardous waste permit firom SCDHEC (SRS 1995 RCRA Renewal Peirmit, SCI 890 008 989), which includes all SRS RCRA waste units and is renewed every five years. Ile final ROD for the CBRP will include a RCRA permit modification.

IROD Documentation

The post-IROD documentation consists primarily of the design documents required prior to initiating a remedial action. Specific post-IROD documents include the Corrective Measure Implementation/Remedial Design/Remedial Design Report/ Remedial Action Work Plan, and the Post-Construction Report. A discussion of the schedules that apply to these docurnents is provided in the IAPP and Section XIII of this IROD.

C-Area Interim Remedial Strategy

The CBRP is one of the OUs located within the Fourmile Branch watershed (Figure 2). Several source units within this watershed will be evaluated to determine impacts, if any, to associated streams and wetlands. It is the intent of SRS, EPA, and the SCDHEC to manage these sources of contamination to minimize impact to the watershed.

During the CBRP characterization process, it was recognized that the highest concentrations of contaminants and the contaminants with the highest risk were primarily associated with volatile organic compound (VOC groundwater contamination. However, it was also recognized that the full extent of the groundwater contamination had not been completely characterized during the latest revision of the RCRA Facility Investigation/Remedial Investigation (RFI/RI). Further, tritium groundwater contamination has also been identified in die vicinity of the CBRP but appears to be source from the C-Area Reactor Seepage Basin based on historical groundwater monitoring of the C-Area Reactor Seepage Basin and the latest revision of the CBRP RFI/RI/BRA. Due to the complexity of this unit and the current uncertainties with the hydrogeology (known tritium and VOC plumes), further characterization will be conducted concurrently with this interim action. In addition to the groundwater characterization activities the potential impact to Fourmile Branch and Twin Lakes surface water and sediments from the current release of twit contaminants is being investigated. The characterization results associated with the CBRP will be included in the final RFI/RI/BRA Report.

Concurrent with the final RFI/RI/BRA and final remedial selection remedial process, an interim action is planned and is the subject of this document. The interim action is concordant with the SRS Early Action Strategy (10/21/97), regulatoryguidance on presumptive response strategies for groundwater (EPA 1996), and a preference for treatment of principal threat waste.

The interim action will include the installation of an AS/SVE treatment system. The system will be operated and evaluated for approximately 1 year with incorporation of the results into the final Corrective Measures Study/Feasibility Study (CMS/FS) which will include a detailed review of remediation technologies for the final .remedial action. A native soil cover will also be installed to act as a barrier to prevent soil exposure to future human and ecological receptors and will also reduce precipitation infiltration to minimize the further migration of TCE from the CBRP soils to the groundwater.

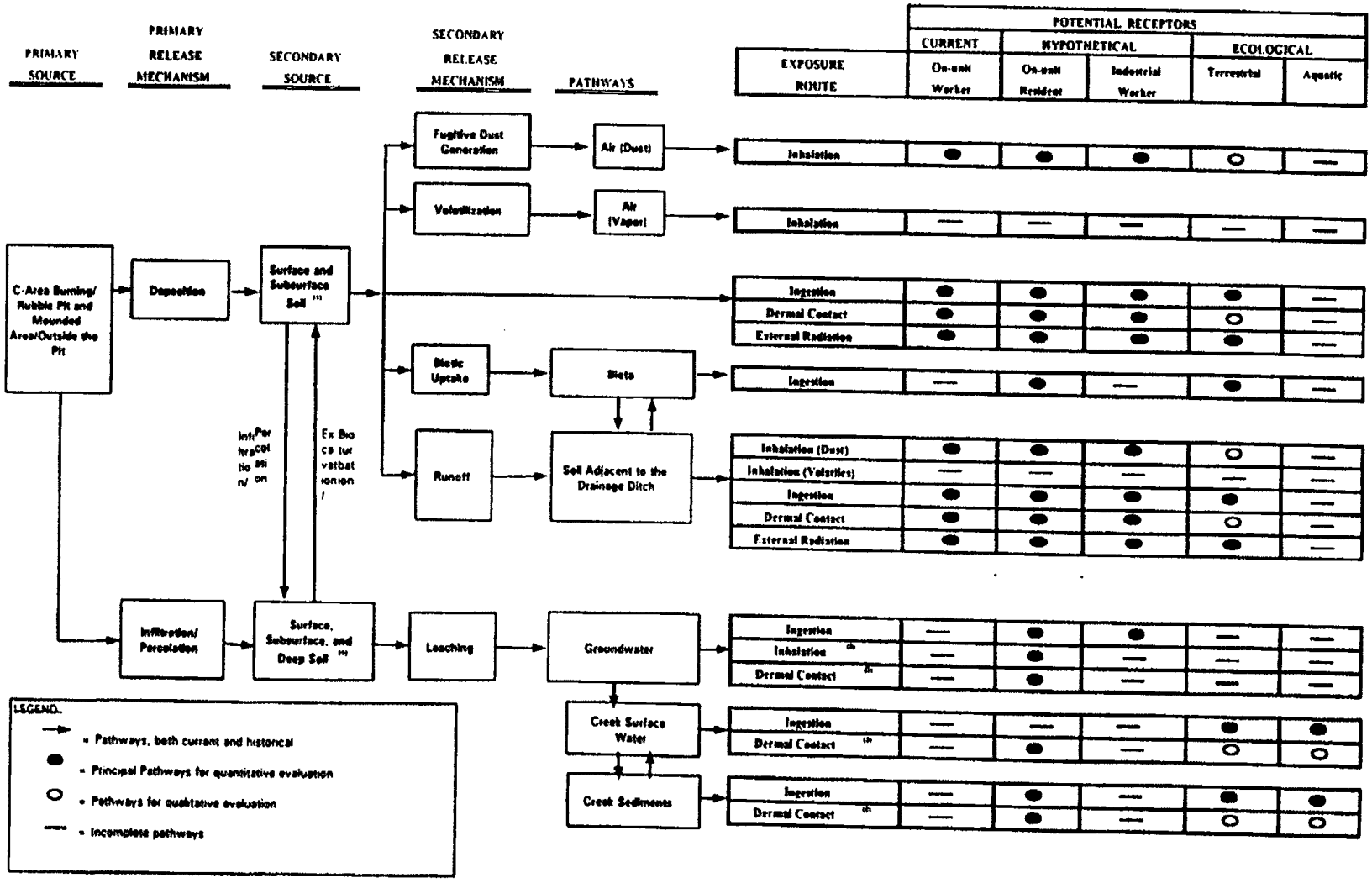
This interim action for the CBRP is not a final action but will be pursued to minimize the impact of the CBRP on the Fourmile Branch watershed. The interim action with however be consistent with any planned future action. A final ROD will follow additional study by SRS, regulator approval, and public involvement and with document the final remedial decision for the OU. Further, upon agreement between die DOE, EPA, and SCDHEC, on the disposition of all source control and groundwater operable units within this watershed, a final comprehensive ROD for the watershed will be pursued with further public involvement.

V. INTERIM ACTION OPERABLE UNIT CHARACTERISTISCS

A CSM was developed for the CBRP that identifies the primary sources, primary contaminated media, migration pathways, exposure pathways, and potential receptors. The CSM for the CBRP is presented in Figure 4 and is based on the data presented in the RCRA/CERCLA documentation for these units and the latest characterization data.

The Data Summary Reports (WSRC 1996, WSRC 1997b, WSRC 1997c) and the latest revision of the RFI/RI/BRA Report (WSRC1997a) contain detailed analytical data and interpretation of environmental impact for all media samples taken in the characterization of the CBRP. The RFI/RI/BRA also includes the specific

Figure 4. Revised Conceptual Site Model for the CBRP



(1) Subsurface soil evaluated for future receptors only

(2) Showering scenario includes both inhalation and dermal contact pathways

methodologies for determining: Unit Specific Constituents (USCs) for nature and extent evaluations; Preliminary Contaminant Migration Constituents of Concern (CMCOCs) important for contaminant migration evaluations. preliminary Constituents of Concern (COCs) for human health and ecological risk evaluations; and final COCs. The data summary reports and RFI/RI/BRA are available in the Administrative Record File (See Section III).

The following sections provide a detailed discussion of the primary and secondary sources and release mechanisms, the nature of contamination, and the extent of contamination in the vicinity of the pit. Section VI provides a detailed discussion of operable unit risks.

Primary Sources and Release Mechanisms

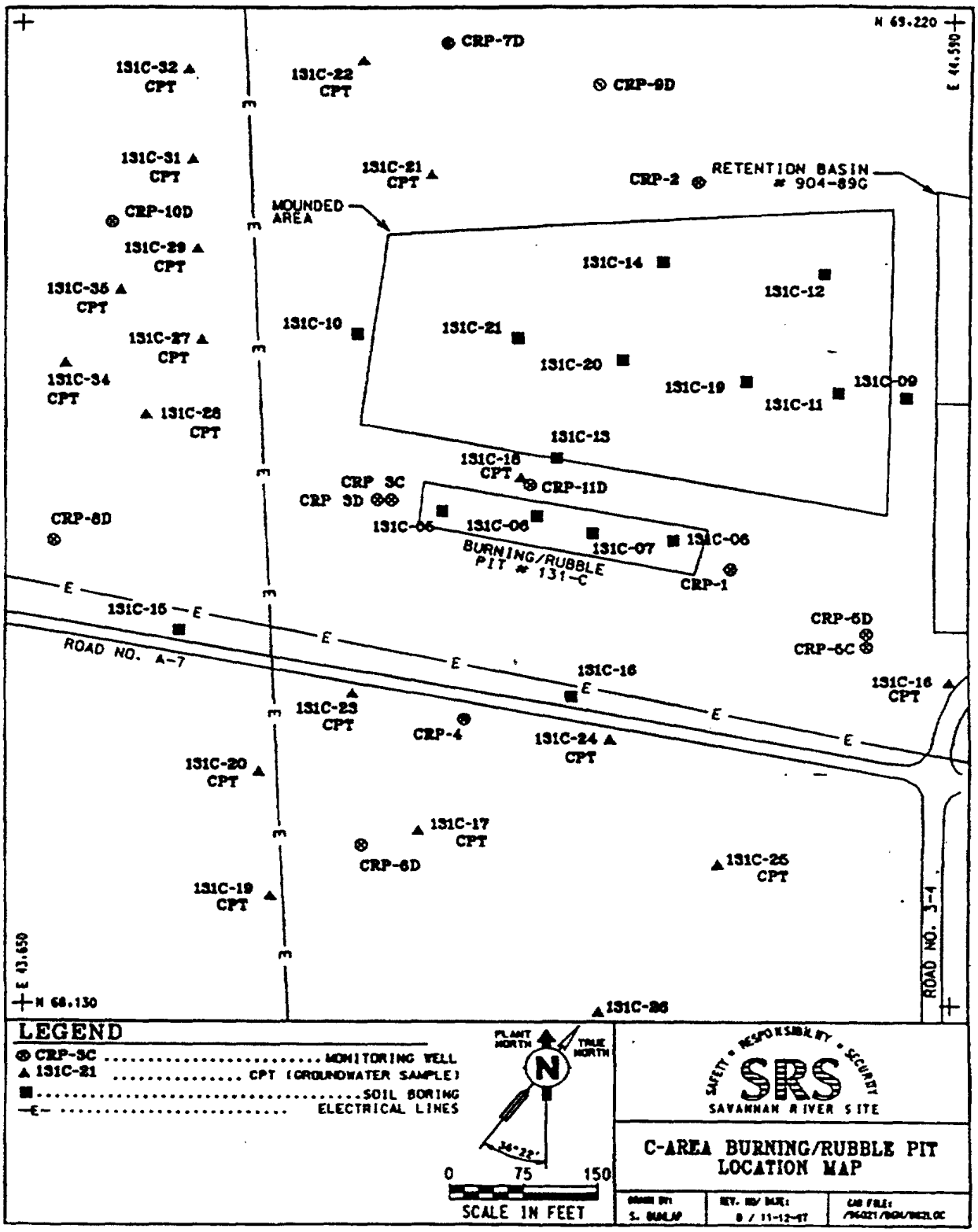
The primary sources were organic liquids of unknown use and origin, waste oils, paper, plastics, and rubber disposed in the pit during its operational history. Residual liquids are no longer present and the CBRP has been filled to grade with native soils. The primary release mechanisms arc deposition inside the CBRP and infiltration/percolation to surface, subsurface and deep soil. There are no documented occurrences of CBRP overflow. Disposal records, including composition, origin, and use of materials disposed were not kept for this unit during its period of operation. These disposed materials are consistent with the constituents identified in pit samples and visual observations made during the investigation.

Secondary Sources and Release Mechanisms

Secondary sources include surface and subsurface soil in the Pit Area. As illustrated in Figure 4, secondary release mechanisms associated with these sources include volatilization from soil and water within the pit, fugitive dust generation from exposed surface soil, biotic uptake, runoff and leaching to groundwater.

A detailed sampling and analysis plan was prepared and implemented to investigate these secondary Sources. The field investigations conducted from September 1994 to July 1997 included soil, groundwater, and associated background sampling activities and provided data on the nature and extent of constituents present in soils and groundwater. Soil and groundwater sample locations are illustrated in Figure 5. The sample analysis information was grouped into Pit Area Soil and Groundwater (upper zone of the water table aquifer, and lower zone of the water table aquifer). These characterization results are summarized below.

Figure 5. CBRP Groundwater and Soil Sampling Locations



Pit Area Soil

To evaluate the potential effect of runoff from the CBRP, soil samples were collected from soil adjacent to the Drainage Ditch that parallels Road A-7 (See Figure 2). No significant contamination was identified in the Mounded Area or the soil adjacent to the Drainage Ditch in the vicinity of the CBRP. Within the Pit Area, three soil intervals were selected for analysis: the upper I foot (surface soil), the uppermost 4 feet (subsurface soil), and from the surface to the depth of the deepest soil boring (all depths). The conclusions of these analyses indicate soils within and beneath the pit are primarily contaminated with VOCs (principally TCE) and low concentrations of dioxins and metals. A complete discussion of the final COCs for soils is provided in Section VI.

The pit contains a total of approximately 1,300 cubic yards of soils that are contaminated with varying concentrations of VOCs, dioxins and metals. However, characterization data indicates that the western half of the pit (approximately 650 cubic yards) is the area of highest TCE contamination. The maximum concentration of TCE identified within the pit soils is 4.01 ug/L. Ile maximum concentration of TCE identified in soils beneath the western portion of the pit is 286 ug/L.

The presence of TCE at higher concentration in the soils beneath the pit (compared to pit soils) indicates that sampling did not intercept the highest concentration of TCE in pit soils. This situation is not unusual in highly heterogeneous waste units like burning rubble pits. The presence of relatively high concentrations of TCE in the vadose zone soils indicates that these soils may be a source of contaminants to the groundwater and should be considered in contaminant migration modeling and probably the alternatives analysis. Because concentrations of TCE in the vadose zone are likely to be highly variable it is difficult to estimate a volume of TCE laden soils within the vadose zone.

Groundwater

The water table in the C Reactor Area can be subdivided into the upper and lower water table. The lower water table is separated from the upper water table by a thin discontinuous stratigraphic unit of interbedded sands and clayey sands. The upper water table in the vicinity of the CBRP is located approximately 60 feet below the land surface and is approximately 20 feet thick. Sediments of the upper water table consist principally of interbedded sand, silty sands, and clayey sands. The lower water table aquifer consists principally of less muddy sands with higher potential rates of water flow (higher hydraulic permeabilities).

Based on the results of seven groundwater sampling events between December 1995 and July 1997, several constituents in the lower zone and the upper zone of the water table aquifer had a maximum concentration greater gun two times the average background concentration or equivalent to the Maximum Contaminant Level (MCL). A complete list of these constituents are provided in the RFI/RI/BRA (WSRC 1997a). The characterization of the groundwater in the vicinity of the pit indicates that the principal contaminants are PCE, TCE and tritium.

Figure 6 illustrates the contour of the TCE plume in the upper zone of the water table aquifer based on known well and Cone Penetrometer Techniques (CPT) data collected after the latest revision of the RFI/RI/BRA. The extent of the plume to the northwest has not been fully characterized but is estimated based on hydraulic conductivity and the groundwater gradients of the area. Assuming an average porosity of 0.2, the volume of impacted groundwater depicted in Figure 6 is estimated to be 6.0 X 10^7 gallons.

Among the contaminants in the upper zone of the water table aquifer, TCE is the most pervasive. It was measured at a concentration of 1,660 ug/L in a monitoring well adjacent to the pit, and at concentrations as high as 130,000 ug,/L in CPT sampling locations adjacent to the pit. The CPT data m the upper zone of the water aquifer indicates that maximum TCE concentrations are high enough to suggest a high probability of free phase (undissolved) TCE in the upper water table aquifer. The ftee phase is likely present in the form of micro-droplets within the pore spaces of the aquifer. In addition, the free phase TCE can be absorbed onto aquifer particles.

Although the downgradient extent has not been completely defined, sufficient data has however, been collected identifying the hot spot source of contamination (e. g, >25,000 ug/L VOC). The volume of impacted >25,DDO ug/L VOC groundwater is estimated to be 3.0 X 10^6 gallons. The hot spot source is driving an interim action while characterization is finalized for the selection of a final ROD. The low concentrations of TCE measured downgradient in the lower water table aquifer well, in the vicinity of the pit, suggest that TCE has not migrated into the lower zone of the water table aquifer.

The presence of a TCE plume beneath the CBRP is consistent with the soil sampling results. The presence of TCE indicated by the elevated concentration in the vadose zone beneath the pit (at approximately 30 feet bls) indicates a continuing potential source for TCE to migrate to the groundwater. Characterization information on the groundwater VOC hotspot and distal plume is summarized as follows:

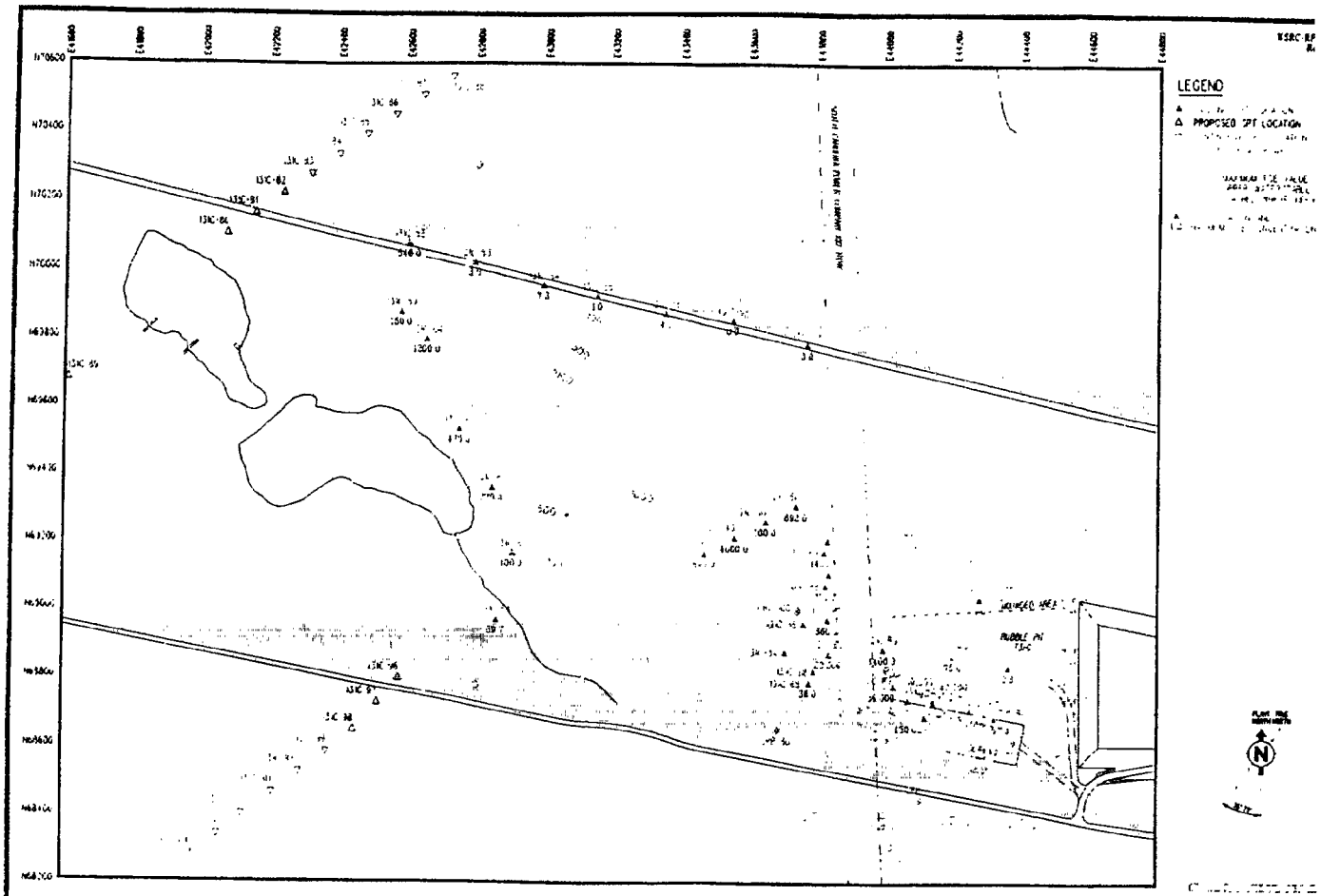


FIGURE 6 C AREA BURNING RUBBLE PIT TIE PLUME CONTOUR MAP

- Groundwaterin the upper water table is contaminated with high concentrations of TCE, and lesser amounts of tetrachlorocthylene (PCE), dichloromethane and tritium. TCE concentrations are high enough to suggest a high probability of free-phase (undissolved) TCE in the upper water table.

- Figure 6 illustrates the distribution of TCE emanating from the Pit Area. The high concentrations are consistent with the presence of elevated TCE concentrations in vadose zone soils beneath the pit, as described above.

- High groundwater WE concentrations compared to the vadose zone maximum of 286 ug/l indicates free phase TCE is likely to be present in the vadose zone beneath the western end of the pit.

- Vertical migration of free-phase TCE to the lower water table is hindered by only a thin layer of interbedded sands and clayey sands.

- Groundwater in the lower water table is slightly contaminated with VOCs. However, the lower water 0 table is contaminated with relatively high activities of tritium from an upgradient source.

- Vinyl chloride (23 ug/L maximum) and chloroform (1.6 ug/L maximum) have been detected on a very limited basis as pari of ongoing CPT characterization of the distal portion of the plume. Vinyl chloride and chloroform have not been identified in the groundwater adjacent to the pit and are therefore probably the product of naturally occurring reductive dechlorination of TCE within the distal portion of the plume.

Tritium detected in the groundwater at the CBRP is not consistent with contaminants found in CBRP soils above the water table or the CSM (Figure 4). Therefore, other sources in the vicinity, such as the industrial activities in C-Area, are thought to be contributing togroundwater contamination at the CBRP. Tritium is present at 19,400 picocuries, per liter (pCi/L) in the upper zone of the water table aquifer upgradient to the Pit Area and at significantly higher levels (94,400 pCi/L) in the lower zone of the water table aquifer at the same location. It is also present at significantly higher levels upgradient of the Pit Area (94.400 pCi/L) than it is down-gradient of the Pit Area, (52,900 pCi/L) in the lower zone of the water table aquifer. Side gradient (south) of the Pit Area, the tritium concentration is 215,000 pCi/L. This indicates the tritium is from a source other than the CBRP, since the

concentrations generally decrease along the flow path and are higher in the deeper aquifer. Figure 7 illustrates the known tritium and VOC contamination in the upper water table in the C Reactor Area.

Groundwater analytical data in general indicate an upgradient source of the tritium within the upper and lower zones of the water table aquifer, such as the C-Area Reactor Seepage Basin (CRSB) or C-Area industrial facilities. Tritium activities are as high as 22,500,000 pCi/L immediately adjacent to the CRSB. As depicted in Figure 7, the tritium plume emanating from the CRSB appears to migrate parallel to the CBRP VOC plume with a small lateral separation between the two plumes in the vicinity of the CBRP. The two plumes converge approximately 400 feet downgradient from the CBRP and ultimately overlap. Based on these observations, tritium in the groundwater is not believed to be a result of past activities at the CBRP and, therefore, will not be addressed hereafter within this IROD. The source of the tritium and its impact on the environment is, however, the subject of ongoing characterizations (RFI/RI/BRA) of the C-Area Reactor and CBRP areas. A work plan to conduct additional characterization of this source has been submitted. Field investigations at this unit are scheduled to begin on June 30, 1998.

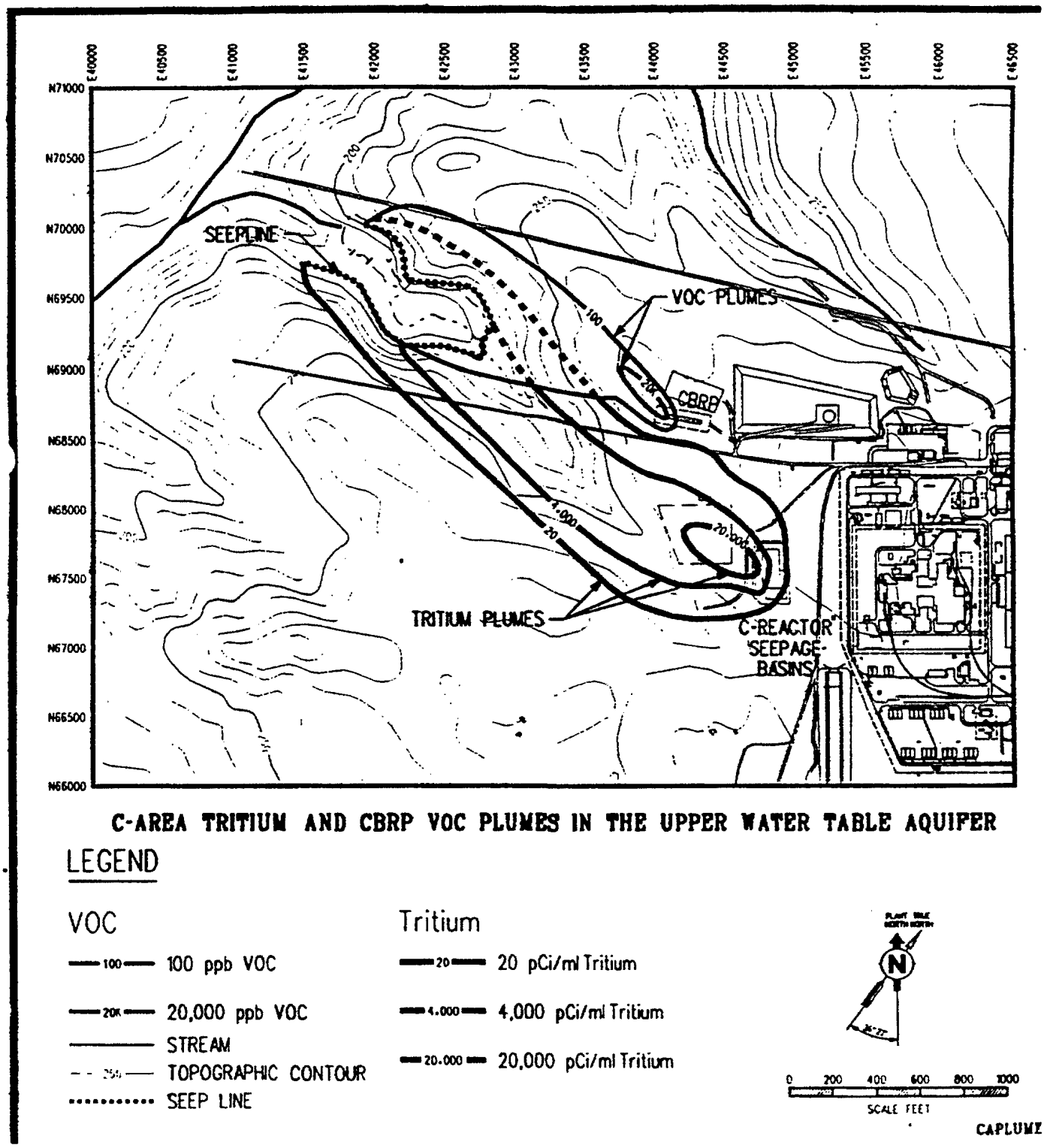
Fate and Transport Analysis

Predictive modeling techniques (i. e., SESOIL model) were used to determine whether chemicals present in the soils of the waste unit could migrate to the groundwater at concentrations greater than the MCL or the risk-based concentration (RBC) if no MCL is available. The predictive modeling runs were performed to simulate a potential migration period of 1,000 years. If the potential contaminant was predicted to exceed the MCL or RBC, the contaminant was considered a preliminary Contaminant Migration COC (CMCOC). Only TCE was retained as a final CMCOC.

VI. SUMMARY OF INTERIM ACTION OPERABLE UNIT RISKS

As part of the unit investigation/assessment process a baseline risk assessment (BRA) was performed using data generated during the assessment. The risk assessment was performed to: 1) systematically identify constituents of potential concern (COPC), preliminary constituents of concern (PCOC), and final constituents of concern (COC); and 2) assess the potential for adverse human health and ecological effects to occur from exposure to constituents at the waste unit (without any institutional controls or remedial actions).

Figure 7. C-Area Tritium and CBRP VOC Plumes in the Upper Water Table



Detailed information regarding the COC screening process, fate and transport constituents of concern (i.e., CMCOC), and the risk assessment process can be found in the latest revision of the RFI/RI/BPA report (WSRC 1997a). The latest version of the BRA does provide a realistic risk assessment with respect to most impacted media; however, recent groundwater characterization data and surface water and sediment evaluations from Fourmile Branch and Twin Lakes has not been assessed in the report. Sufficient characterization data and risk information is, however, available to support this interim action. The human health and ecological risks for current and future land use scenarios were evaluated and are presented below.

Human Health Risk Assessment

The human health risk assessment considered both current and future land uses and individuals likely to be exposed. Current exposures were evaluated for an on-unit worker who may occasionally be in the area. Future exposures were evaluated for a hypothetical industrial worker and residents. The resident scenario is the most sensitive land use. The CBRP is located in an area that has been recommended for future industrial (nuclear) use. (DOE 1996) Currently, the industrial area nearest to the CBRP is the C-Area Reactor, located approximately 2,500 feet to the southeast.

Exposure parameters were based on unit-specific data and default values published by EPA. EPA methods were used in conducting the risk assessment. Soil was evaluated for ingestion, inhalation, dermal and external radiation. Groundwater was evaluated for inhalation, ingestion and dermal contact, and produce was evaluated for ingestion. Risks were quantified for adverse noncancer and cancer effects.

As part of the RI evaluation, if the level of a constituent in a given medium exceeds a state or federal chemical-specific ARAR, that constituent is also included as a COC. For drinking water obtained from groundwater or surface water, the MCL is the controlling ARAR. The preliminary COCs generated from the results of the human health risk assessment for the Pit Area and the CBRP groundwater are detailed in the RFI/RI/BRA. (WSRC 1997a).

Land Use

Current exposure was considered for the on-unit worker who may occasionally be in the area. Groundwater exposures were not evaluated because the CBRP and surrounding area are undeveloped, and there are no drinking water wells currently located in the surrounding area. Therefore, the risk assessment for current land use focused

only on soil at the Pit Area. There are no unacceptable risks for the on-unit worker. Risks for all exposure routes are less than 1 x 10^6, indicating that under current conditions carcinogenic risk from chemicals and radionuclides is insignificant at the unit.

Future Use

Future exposures were evaluated for the hypothetical industrial worker and resident. The resident scenario is the most sensitive land use. The CBRP is located in an area that has been recommended for future industrial (nuclear) use. Currently, the industrial area nearest to the CBRP is the C-Area Reactor, located approximately 2,500 feet to the southeast. Groundwater was included as part of the risk assessment for the future land use scenario. Soil and the upper and lower zones of the water table aquifer were evaluated individually and are detailed below.

Pit Area Soil

The characterization of the primary and secondary sources associated with the CBRP indicates the soils are contaminated with inorganics, SVOCs, VOCs, pesticides, PCBs and radionuclides. Preliminary COCs were identified by comparing USCs with applicable or relevant and appropriate requirements (ARARs), analyzing for fate and transport in the environmental setting, and assessing the human health and ecological risk. Details are provided in the BRA portion of the latest revision of the RFI/RI/BRA (WSRC 1997a).

Upon completion of an analysis of uncertainties in the RFI/RI/BRA, only the two dioxins (HpCDD and OCDD) were retained as final COC's for the unit resident scenario, at the Pit Area. TCE is not a risk-based COC in the shallow soils (0 to 4 ft), but was detected in deeper soils as a contaminant migration constituent of concern (CMCOC) (i.e., soils contaminated with TCE at sufficient concentrations to continue to be a migration threat to groundwater via precipitation infiltration) . Those constituents retained as final COCs and CMCOCs and their risks are listed in Table 1 and are detailed in the latest revision of the RFI/RI/BRA (WSRC 1997a).

Upper Zone of the Water Table Aquifer

The ongoing RFI/RI investigation determined the groundwater in both the upper and lower zones of the water table aquifer at the CBRP is contaminated. For the upper zone of the water table aquifer, the human health risk evaluation identified preliminary COCs for the hypothetical future on-unit resident and for the hypothetical future on-unit industrial worker. Those groundwater constituents which were retained as preliminary COCs are detailed

in the latest revision of the RFI/RI/BRA (WSRC 1997a). In the uncertainty analysis, PCE and TCE were retained as final COCs for the future resident scenario. TCE was retained as a final COC for the future industrial worker scenario. Dichloromethane was not identified as a human health COC but was retained as a final COC for exceedance of the MCL. These final human health COCs and their risks are listed in Table 1.

Lower Zone of the Water Table Aquifer

The ongoing RFI/RI investigation determined the groundwater in both the upper and lower zones of the water table aquifer at the CBRP is contaminated. For the lower zone of the water table aquifer, the human health risk evaluation identified preliminary COCs for the hypothetical future on-unit resident and for the hypothetical future on-unit industrial worker. Those groundwater constituents which were retained as preliminary COCs are detailed in the latest revision of the RFI/RI/BRA (WSRC 1997a). Upon completion of the uncertainty analysis, only tritium was retained as a final COC for the lower zone of the water table aquifer. However, as discussed in Section V, the source of the tritium is upgradient of the CBRP and is believed to be from the C-Reactor Seepage Basins (CRSB). Because tritium is not sourced from the CBRP, it is not a final COC for the CBRP. As no final COCs are sourced from the CBRP, no remedial actions for the lower zone of the water table aquifer were recommended by the CBRP Interim Action Proposed Plan (WSRC 1998a).

Ecological Risk Assessment

The ecological risk assessment defined the likelihood of harmful effects or the risk to ecological receptors from exposure to contaminants at the CBRP. Receptors include both terrestrial plants and animals and their habitats. Constituents in the upper 4 feet of soil were screened because this medium was the principal one resulting in exposures to plants and animals. Based on characterization of the environmental setting and identification of potential receptor organisms, a CSM was developed to deterrnine the complete exposure pathways through which ecological receptors could be exposed to COPCs,

The ecological risk assessment was completed for two scenarios. The current land use evaluated potential effects only from exposure to the top 1-foot of soil in CBRP. Evaluation of the effects of the future land use scenario considered the soil interval from the surface to a depth of 4 feet. Upon completion of the uncertainty analysis, only HpCDD in the Pit Area was retained as a final ecological COC for shrews in surface soils.

TABLE 1. FINAL HUMAN HEALTH AND ECOLOGICAL COCS AND CMCOCS

Media	Unit	COCs*	Basis/Receptor	Risk/Hazard Quotient
Soil	Pit Area	TCE	Migration to groundwater	**
		OCDD***	Risk to future resident	4×10^{-6}
		1,2,3,4,6,7,8-HpCDD***	Risk to future resident	3×10^{-6}
			Ecological risk to small burrowing animals (i.e., shrew)	NA/14.3
	Mounded Area	None	NA	NA
	Soil adjacent to Drainage Ditch	None	NA	NA
Groundwater	Upper zone of the water table aquifer	TCE	Risk to future resident; risk to future worker; exceedance of MCL	4×10^{-4}**** / 20 6×10^{-5}/2.7
		PCE	Risk to future resident; exceedance of MCLs	1×10^{-6}
		Dichloromethane	Exceedance of MCL	*****
	Lower zone of the water table aquifer	None	NA	NA

NA - Not Applicable

*Note:- Tritium was identified as a contaminant in the upper water table (up and sidegradient of the CBRP) but is not considered a COC because it is not sourced from the CBRP. Tritium and PCE were identified as contaminants in the lower water table (upgradient of the CBRP) but are not considered COCs because they are not sourced from the CBRP.

**CMCOC. based upon exceedance of MCL, not risk-based.

***Risk for future industrial worker does not exceed 1×10^{-6} The highest residential risk from either the surface of the subsurface soils is listed above in Table 1. Risk for HpCDD in the subsurface soils (0-4') is 1.7×10^{-6} Risk for OCDD in the surface soils (0-l') is 3.4×10^{-6}

****This table is based upon 1997 monitoring well data only. 1998 CPT data indicates maximum TCE concentrations are at 130,000 ug/L. Assuming this preliminary unvalidated CPT data would not be screened from risk protocols, a risk of 3×10^{-2} would be projected.

* * * * * COC due to exceedance of MCL, but not a risk-based COC.

Risk Conclusions

The overall conclusions of the BRA include the following:

- Mounded Area soils and the soil adjacent to the Drainage Ditch do not pose a significant risk to hypothetical human or ecological receptors, and, therefore, do not require remedial action. These areas are, therefore, dropped from further discussion within this IROD.

- Low concentrations of dioxins in soils within and beneath the pit pose minimal human health and ecological risks. Dioxin is a risk-based COC.

- TCE is not a risk-based COC in the shallow soils (0 to 4 feet), but was detected in deeper soils as a contaminant migration constituent of concern (CMCOC) (i.e., soils contaminated with TCE at sufficient concentrations which allow them to continue to be a migration threat to groundwater via precipitation infiltration).

- Groundwaterin the upper water table is sufficiently contaminated with VOCs so that it represents a significant risk to humanhealth, with TCE concentrations over 5,000-times the drinking water standard and MCL of 5 ug/L.

Contaminant Threat Review

A review of the final human and ecological COCs present within the soils and groundwater at the CBRP indicate that the wastes represent low-level and principal threat wastes. The contaminants within the soils and groundwater can be categorized as follows:

- Low concentrations of dioxins and metals in surface soils are thought to be a low level threat waste because the material represents relatively low risks to humans and moderate risks to the ecology, has a low potential for migration, and is easily contained

- Based on current data presented in Table 1, the relatively low concentrations of VOCs in soils within and beneath the pit appear to be low-level threat waste because they do not pose a risk to human or ecological receptors, have a low potential for significant migration (based upon contaminant migration modeling) and are easily contained. However, based upon high groundwater concentrations, principal threat waste is probably present in the vadose zone which the proposed interim action should address.

- The highly concentrated TCE in the aquifer sediments immediately adjacent to the pit in the upper zone of the water table aquifer are thought to represent a principal threat. The risk to humans from TCE in the groundwater is thought to be significantly higher than those presented in Table 1, which were based on the then available 1997 monitoring well data. Preliminary unvalidated 1998 CPT data indicates maximum TCE concentrations are at 130,000 ug/L versus the 1997 monitoring well data of 1,660 ug/L. Assuming this preliminary unvalidated CPT data would not be screened from risk protocols, a significantly higher risk would be projected. The high concentrations of TCE (130,000 ug/L) are thought to suggest the presence of free-phase TCE which is potentially mobile.

In conclusion, SRS believes that interim remedial actions should be considered for the >25,000 ug/L VOC areas of the groundwater plume and vadose zone in an effort to minimize the further migration of this principal threat. A thorough discussion of the specific remedial action objectives is provided in Section VII.

The actions suggested in this IROD (Section IX) are consistent with a bias for treatment of principal threat materials because

- treatment technologies are feasible and available in a reasonable time frame;

- the small volume and simplicity of the site make implementation technically and economically practicable;

- implementation of the treatment does not increase the risks to humans (including workers and the surrounding community) or the environment; and

- implementation will not result in severe effects across environmental media.

II INTERIM REMEDIAL ACTION OBJECTIVES (IRAOS) AND DESCRIPTION OF THE CONSIDERED ALTERNATIVES FOR THE CBRP OPERABLE

Interim Remedial Action Objectives

The IRAOs are specific early action goals developed to reduce risk to human health and the environment. These interim goals are used to ensure that the selected interim remedial alternatives will impact exposure pathways and media in a fashion that will reduce risk to human health and the environment. This IROD uses the interim remedial action objectives to initially evaluate the applicability of the remedial alternatives. IRAOs specify unit-specific contaminants, media of concern, potential exposure pathways, and remediation goals. The IRAOs are based on the nature and extent of contamination, threatened resources, and the potential for human and environmental exposure.

Based upon the human health, ecological, and contaminant migration risks (see Table 1) posed by the dioxins in the subsurface soil and the TCE in the deep soil of the Pit Area, the general soil IRAO is to:

- prevent direct contact with COC contaminated soils and reduce infiltration to minimize further migration of CMCOCs to the groundwater from soils within and beneath the CBRP.

The largest contribution to groundwater hazards is from TCE in both the future resident and future industrial worker scenarios (see Table 1). PCE poses significant risk in the future resident scenario only. Although dichloromethane poses no significant risk to human health, it is a COC to be remediated because concentrations in the shallow groundwater exceed the MCL. Based on the risks posed by these VOCs in the shallow groundwater, the general groundwater IRAO is to:

- treat the area in the vicinity of the pit, within the 25,000 ug/L VOC isoconcentration contour, with an objective to reduce concentrations and control the migration of VOCs within the 25,000 ug/L VOC contour.

As previously stated, this IROD is tailored to the limited scope and purpose of the interim action and does not specify the final acceptable exposure levels for the site. Specifically, this IROD will not identify final remedial goals; but the selected interim alternatives, will be consistent with the IRAOs and any final action. The interim

action RAOs will be used to develop the final action RAOs as more information from the ongoing RFI/RI/BRA and planned interim action operations concerning the unit and potential remedial technologies becomes available. Remediation goals will ultimately be determined as part of the final remedial action determination and will establish acceptable exposure levelsthat are protective of human health and the environment (CERCLA 300.430(e)(2)(i)). The final remedial goals will be consistent with applicable or relevant and appropriate requirements (ARARs) and will mitigate any reasonable risk to human health and the environment. This alternative selection approach is consistent with regulatory guidance on preparing interim action proposed plans and records of decision (EPA 1989).

This IROD uses the IRAOs to initiallyevaluate the applicability of remedial alternatives. As detailed in Section IV, a PAA was conducted to support the development of a CMS/FS for the CBRP. This IROD used the PAA as a basis for selecting appropriate interim action alternatives for CBRP contaminated soil and groundwater. The detailed analysis of alternatives in the preliminary alternative analysis identified five alternatives for soils and five alternatives for groundwater. The "S" associated with the alternatives refers to soil alternatives. The "GW" refers to groundwater alternatives. The total cost of each alternative including a breakdown of the capital and operation/maintenance costs is provided in Table 2.

Description of Considered Alternatives

Soil Alternatives

Alternative S-1: No Action

The "No Action" option is required by the NCP to serve as the baseline for comparison with other remediation methods. No Action is not actually a technology but is a general response action. Under the No Action alternative, natural attenuation mechanisms may reduce contaminant concentrations to levels below proposed concentration-based remediation goals. Under this alternative, no remedial actions would be conducted to remove, treat, or otherwise lessen the toxicity, mobility, or affected volume of contaminated media. Maintenance of the existing vegetative and soil cover would cease, and the media would be allowed to deteriorate naturally.

TABLE 2. SOIL AND GROUNDWATER INTERIM AMON ALTERNATIVES AND CAPITAL AND OPERATIONS AND MAINTENANCE (O&M) COSTS*

	ALTERNATIVES	CAPITAL COST (SK)	O&M COST (SK)	TOTAL COST (SK)
SOIL				
S-1	No Action	0	0	0
S-2	Institutional Controls	0	61	61
S-3	**Native Soil Cover****	175	20	195
S-4	Thermal Desorption/Incineration	548	200	748
S-5	Offsite Disposal	785	0	785
GROUNDWATER				
GW-1	No Action	0	0	$0
GW-2	Institutional Controls	347	60	407
GW-3	In-Situ Air Sparging- (with SVE)	800	1,200	$2,000
GW-4	In-Situ Methane Biodegradation (with SVE)	1.000	1,500	$2,500
GW-5	Ex Situ Air Stripping (pump and treat)	500	700	$1,200

*Until characterization is complete and the effectiveness of the interim action system is evaluated, the overall cost for a final action is difficult to assess. Characterization in the vicinity of the CBRP and preliminary engineering for the interim system are sufficiently complete to support the above cost analysis. In accordance with the IRAOs groundwater alternatives GW-3, GW4, and GW-5 are focused on a smaller area of treatment and a shorter time duration. The area of treatment selected is the 25.000 ug/L area shown in Figure 6. The duration selected was 5 years.

****Preferred Alternative**

The No Action alternative would not be protective of human health or the environment. would not eliminate potential future routes for human exposure, and would not be protective of human health because of the potential for soil exposure to a worker, and would not provide control of leaching of contaminants to groundwater. The No Action alternative would require no construction and could, therefore, be implemented immediately. The estimated cost associated with the No Action alternative is $0.

Alternative S-2: Institutional Controls

Institutional controls are administrative measures taken to minimize the potential. for human exposure. Administrative institutional controls consist of filing deed restrictions or notifications and performing 5-year remedy reviews. Deed restrictions and notifications inform potential future buyers or developers of the hazardous waste disposal activities previously conducted at the unit and limit the types of future activities that could be conducted on the property (e.g., restrictions on excavation and land use).

Institutional controls are effective in further minimizing the potential for human exposure to CBRP contaminants and are relatively easy to implement. In addition, costs associated with institutional controls are considered low relative to other remedial responses. Institutional control costs include surveying, filing deed restrictions or notifications, and preparation of 5-year remedy reviews. Five-year remedy reviews are required for any waste site that has provisions that prevent unrestricted land use or leaves wastes in place. Under the alternative, the soils within and below the pit would continue to be an ecological risk and a source of TCE groundwater contamination. The estimated cost associated with the alternative is $61,300.

Alternative S-3: Native Soil Cover

This alternative consists of placing a layer of clean soil over the entire surface area of the CBRP. This additional layer of soil will act as a barrier to prevent soil exposure to future human and ecological receptors and will also reduce precipitation infiltration to minimize further migration of TCE from the CBRP soils to the groundwater. Therefore, this alternative satisfies the remedial action objectives and would be protective of human health and the environment by forming a physical barrier to prevent ingestion and direct exposure to contaminated soil.

A low permeability engineered cover would be sufficient to minimize infiltration, intrusion, and surface erosion. The cover design would be approved by both EPA and SCDHEC prior to construction. The cover would include

in area of approximately 0.6 acres (27,000 square feet). A soil cover is a performance-based engineering approach since it does not reduce the total mass of COCs.

The thickness of the soil cover is determined by the contaminants present in the waste unit, the potential impact to groundwater,and the future land use proposed for the waste unit. Subject to final design development and approval, the soil cover will be a two-layer system consisting of a compacted sandy clay layer and a vegetative layer placed on top. The vegetative layer would be maintained to prevent erosion from wind or rain. Thickness of the sandy clay layer will be a minimum thickness of 2 feet.

Hydraulicconductivity will be approximately 1.0×10^{-5} cm/sec, The surface slope of the cover will be a minimum of 3 percent and a maximum of 5 percent. Side slopes will be no steeper than 4:1 (H:V). A minimum 6-in vegetative layer will be added to minimize soil erosion of cover. Infiltration will be reduced by no less than 60 percent. The cover would greatly reduce the leaching of soil contaminants to the groundwater, where MCLs would be exceeded; but the deep soils (4 to 60 feet) below the pit would continue to be a source of TCE groundwater contamination. As part of the final ROD, the native soil cover would be maintained and institutional controls will remain in place in perpetuity or until the waste no longer poses a threat to human health or the environment.

Costs associated with Alternative S-3 include labor and materials to install the earthen cover and to implement institutional controls common to all soil alternatives. Costs also include operation and maintenance costs of the cover and institutional controls. The estimated cost associated with this alternative is $194,800.

Alternative S-4: -Thermal Desorption/Incineration (with Compacted Backfill Cover)

Dioxin risks were shown for the 0 to 1.2 in (0 to 4 feet) soil layer; thus, this layer would need to be remediated. This option consists of removing the upper 1.2 m (4 feet) of soil, passing it through a rotary kiln to vaporize (desorb) the dioxins present. The vapor stream is sent through an incinerator that decomposes dioxins to harmless materials. The remediated soil can be returned to the CBRP and the unit can be released for unrestricted use.

The compacted backfill would be sufficiently impervious to mitigate infiltration and promote runoff of surface water. Two feet of native soil would be loosely placed over the compacted backfill. The Pit Area would be seeded to revegetate the unit. Erosion control measures would be implemented until vegetation became established. Administrative controls similar to those of Alternative S-3 would be implemented.

Alternative S-4 would be protective of human health and the environment, including ecological receptors. Virtually all contamination in Pit Area surface and subsurface soils would be permanently destroyed by the treatment and the compacted backfill with a native soil cover would sufficiently reduce leaching of contamination in lower levels. Alternative S-4 would eliminate the harmful human exposure and bio-uptake scenarios of dioxins in the human health risk assessment and prevent groundwater from exceeding MCLs.

The equipment and materials necessary for this alternative are readily available. The desorption/incineration units are mobile and require no construction, and the alternative could, therefore, be implemented immediately. Backfilling the excavated area and construction of the cover would require readily available earth-moving equipment and experienced labor. The deep soils (4 to 60 feet) below the pit would continue to be a source of TCE groundwater contamination. The estimated cost for Alternative S4 is prohibitively expensive at $748,000.

Alternative S-5: Offsite Disposal (With Compacted Backfill Cover)

Alternative S-5 would involve excavation of contaminated surface and subsurface soils within the Pit Area and shipment offsite to a licensed disposal facility. The excavated soil would either be placed directly into lined and covered haul trucks or into lined and scaled containers for transport. The soil would be excavated to a depth of 4 feet. The excavated area would be backfilled with native soil from a local borrow pit. Contaminated soils deeper than the excavated 4 feet depths are insignificant to human health and ecological risk, however, they do present a leaching concern. To prevent significant leaching of contaminants to the groundwater, the native soil backfill would be compacted to a height 2 feet above grade level, similar to the compacted backfill of Alternative S-4. A 6-inch vegetative cover of loose native soil would be placed over the compacted backfill. Vegetation over the cover would be established to prevent erosion.

Administrative controls similar to those of Alternative S-3 would be implemented. Land use restrictions filed at the time the property is transferred to nonfederal ownership would require appropriate precautions and authorization before soil in and beneath the backfill cover could be disturbed. Deed notifications would serve to inform future residents and industries that the area was once used to manage hazardous materials, and that disturbance of the backfill area and soil cover and soil up to 4 feet below the natural grade should be avoided. The institutional controls would also ensure any continuing groundwater monitoring and cover maintenance commitments are met.

Alternative S-5 would be protective of human health and the environment. Virtually all of the contamination present in Pit Area surface and subsurface soils to a depth of 4 feet would be permanently removed from the unit. Removal of the Pit Area soil would eliminate the hazardous source material, thereby eliminating risk to future residents and ecological receptors. The deep soils (4 to 60 feet) below the pit would continue to be a source of TCE groundwater contamination.

Alternative S-5 is implementable. Construction would involve the use of available materials and conventional earth-moving equipment. The cost for this alternative includes excavation, transportation, and waste disposal of the contaminated soil (i.e., top 4 feet). Estimated present worth cost associated with Alternative S-5 is prohibitively expensive at $785,400.

Groundwater Alternatives

Alternative GW-1: No Action

Under this alternative, no remedial efforts would be conducted to remove, treat, or otherwise lessen the toxicity, mobility, or affected volume of contaminated media, This alternative assumes that the unit would potentially be released for unrestricted use. The No Action alternative would not be protective of human health or the environment and would not eliminate potential future routes for human exposure, Potential future releases are not reduced or eliminated. The unit would continue to be a source of contaminated groundwater and would not provide protection of the environment at points of exposure. The No Action alternative would require no construction and could, therefore, be implemented immediately. The estimated cost associated with the No Action alternative is $0.

Alternative GW-2: Institutional Controls

Under this alternative, a monitoring program for groundwater would be implemented. The monitoring program would monitor the rate of attenuation of contamination at the site from natural processes such as degradation and dispersion. The nearest point of exposure is determined to be at the nearest point of discharge to the surface streams (a tributary of the Fourmile Branch). Monitoring would continue until contaminant concentrations reach acceptable levels as defined by remediation goals.

Existing SRS institutional controls would prevent exposure of environmental or human receptors to contaminants by enforcing land use and groundwater use restrictions. The existing SRS institutional controls would also restrict access by the public to the area affected by the waste unit contamination.

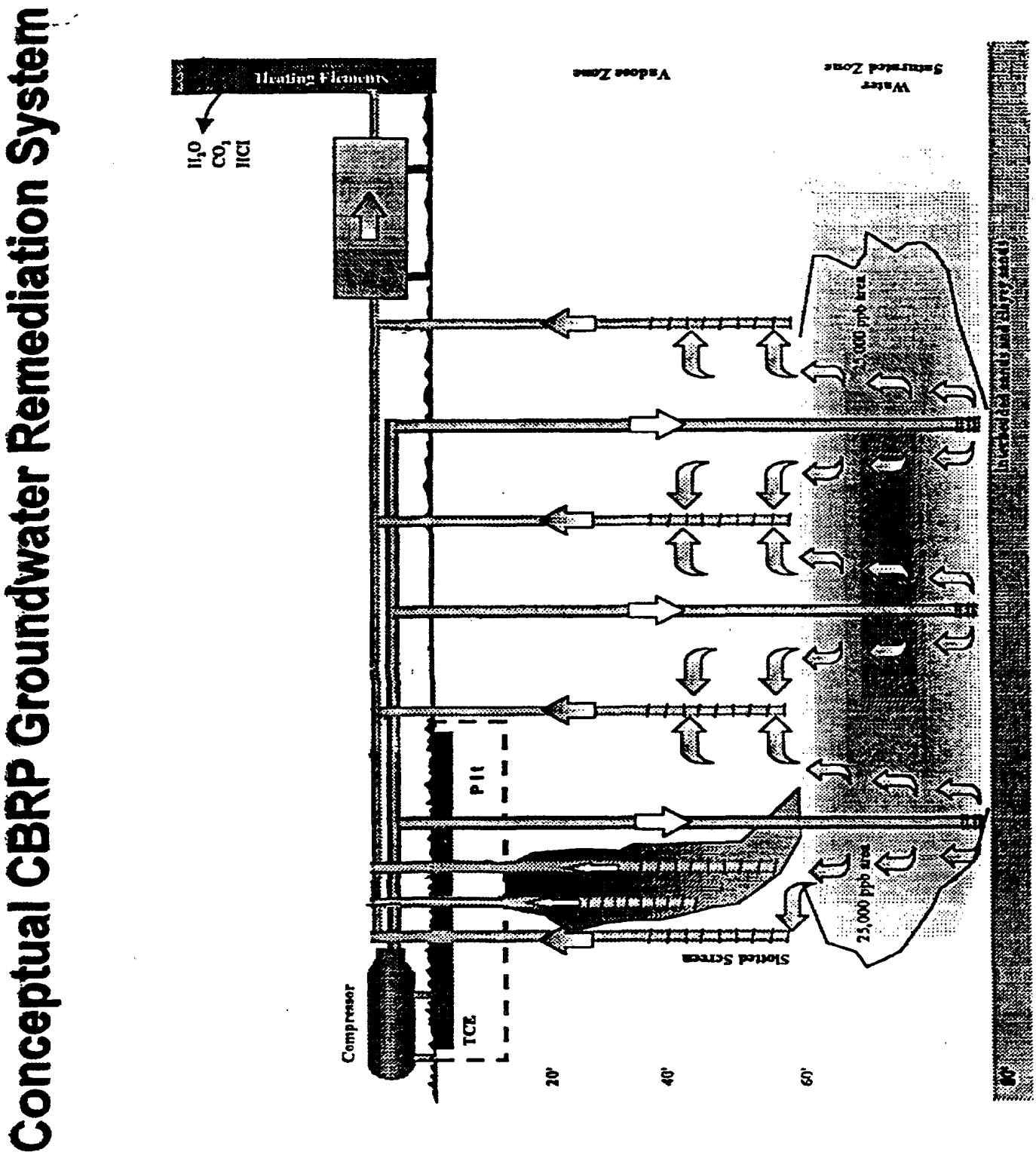
Alternative GW-2 would be protective of human health and the environment. Over time, as the VOCs decay and concentrations lessen through dispersion, the risk to human health and the environment would decrease. However, as a stand-alone alternative, biodegradation, volatilization, and dispersion would potentially not decrease contaminant levels to acceptable levels in a reasonable amount of time.

Alternative GW-2 would require no construction of groundwater monitoring wells other than the installation of the six "point of compliance" wells. No specialized equipment or technical specialists would be required for installation, and laboratories are readily available to perform the required analyses. The remedy could be implemented immediately. Costs associated with Alternative GW-2 include labor and materials to install the six monitoring wells and conduct the required groundwater monitoring and associated administrative controls. Although this alternative would be performed indefinitely, the costs are estimated for 30 years. A 5-year remedy review is required. The estimated cost associated with the alternative is $406,600.

Alternative GW-3: In-Situ Air Sparging (with Soil Vapor Extraction)

In-Situ, Air Sparging (with Soil Vapor Extraction), conceptually depicted in Figure 8, would involve operation of an air sparging system that would inject air into the bottom of the contaminated groundwater plume. The contaminants would then pass into the injected air, as it moves upward through the plume and, in turn, would flow into the relatively dry soil (vadose zone) above the water table. These volatilized groundwater VOCs would be extracted via vacuum wells by a soil vapor extraction (SVE) system as they rise into the vadose zone. Additionally, VOCs residing in the vadose zone (see Figure 8) would also be extracted via these same vacuum wells. The extracted soil vapors would be processed through a liquid-phase separator to remove condensate. The offgas would then either be mated or released into the atmosphere in accordance with release requirements.

Figure 8. Conceptual CBRP Groundwater Remediation System



Institutional controls would involve the installation and maintenance of lone-term monitoring systems for groundwater to monitor the rate of attenuation of organic contamination at the site. Monitoring would be similar to that described for Alternative GW-2, except that soil vapor monitoring would be conducted as part of the SVE system operation.

Alternative GW-3 would be protective of human health and the environment by removing VOCs from the shallow groundwater. Theestimate for this alternative assumes a 5-year period of operation of the in-Situ Air Sparging/Soil Vapor Extraction (AS/SVE) system. Installation would involve straightforward construction processes readily implementable in a relatively short time frame. Construction would involve the use of available materials from commercial vendors and the use of conventional equipment. In-situ AS!SVE has been commonly used at other hazardous and mixed waste sites.

Installation of the AS/SVE system is targeted to remove high concentrations of TCE that could be in a free phase, in the upper water table. The AS/SVE system will prevent rapid migration from the upper water table to the lower table and will be consistent with the IRAOs. The use of AS/SVE to volatilize and extract the VOCs; in the upper water table will not result in significant releases of tritium to the environment or radiological hazards to workers because the tritium activities are very low. The relatively high activities of tritium associated with the CRSB are principally sidegradient of the CBRP and will not effect remedial operations.

Costs associated with Alternative GW-3 include labor and materials to install the extraction wells and injection points, blowers, and an offgas control system. Also included is the cost for the operation and maintenance of the AS/SVE system for a 5-year operation and maintenance period. The estimated cost associated with the alternative is $2,000,000. A more thorough discussion of this alternative with respect to the interim action is provided in Section IX.

Alternative GW-4: In-Situ Methane Biodegradation with (Soil Vapor Extraction)

Alternative GW4 would involve operation of a bioremediation/SVE system and the installation of associated wells in the Pit Area. Alternative GW-4 would be similar to Alternative GW-3 in that it would involve installing air sparging points and SVE wells. The primary difference between the alternatives is that GW-4 would introduce a methane and oxygen (air) mixture into the ground to enhance methanotrophic biological degradation of the

ch1orinated solvents by co-metabolism. This enhanced biodegradation would accelerate rernediation over natural attenuation and AS/SVE by themselves.

Institutional controls would involve the installation and maintenance of long-term monitoring systems for groundwater to monitor the rate of attenuation of organic contamination at the site. Monitoring would be similar to that described for Alternative GW-2, except that soil vapor monitoring would be conducted as part of the SVE system operation.

Alternative GW-4 would protect human health by substantially reducing the volume of contaminants in groundwater by degrading and removing the VOCs. In-Situ Methane Biodegradation/SVE would involve straightforward construction processes readily implementable in a relatively short time frame. Construction would involve the use of available materials from commercial vendors and the use of conventional equipment (e.g. drill rigs). The alternative may not be well suited for an interim action. Specifically, In-Situ Methane Biodegradation with SVE may not be effective on the free phase TCF, which is thought to be present in the upper water table. In addition, the time required for biodegradation of the solvents is likely to be long (10 years) for an interim action. Costs associated with Alternative GW-4 include labor and materials to install the extraction and injection wells, blowers, and an offgas, control system. Also included in the cost for methane biodegradation/SVE system is a 5year operation and maintenance period. The estimated cost associated with the alternative is $2,500.000.

Alternative: Ex-Situ Air Stripping

Alternative GW-5 would include a groundwater extraction system designed to capture VOC contaminated groundwater between the pit and Fourmile Branch. Once extracted, the groundwater would be treated onsite using air stripping followedb) granular activated carbon adsorption, if needed, as a polishing step. Once treated, the residual groundwater would be discharged directly to local surface water.

Alternative GW-5 would be protective of human health and the environment with respect to VOCS, and would reduce the volume of VOCs in groundwater. If Alternative GW-5 is employed, its groundwater extraction would create a significant cone of depression (i.e., lower the water table around each pumping wen), which would eventually cause migration of tritiumbearing groundwater from the CRSB plume. Alternative GW-5 would essentially cause mixing of VOCs and tritium in the upper water table. The operation of the air stripper would

result in significant atmospheric releases of tritium to the environment and potentially pose unnecessary health risks to workers. Estimated present worth costs associated with Alternative GW-5 is $1,200,000.

II SUMMARY OF COMPARATIVE ANALYSIS OF THE INTERIM ALTERNATIVES

The previous section detailed the five alternatives for soils and five alternatives for groundwater. In the IAPP (WSRC 1998a), each of these remedial alternatives was evaluated using nine criteria established by the NCP. The criteria were derived from the statutory requfivnents of CERCLA Section 121. The NCP (40 CFR & 300.430 (e) (9) sets forth nine evaluation criteria that provide the basis for evaluating alternatives and selecting a remedy. The criteria are as follows:

- overall protection of human health and the environment
- compliance with ARARs
- long-term effectiveness and permanence
- reduction of toxicity, mobility, or volume through treatment
- short-term effectiveness
- implementability
- cost
- state acceptance
- community acceptance

In selecting the preferred alternative, the above criteria are used to evaluate the alternatives developed. Seven of the criteria are used to evaluate all the altematives based on human health and environmental protection, cost, and feasibility issues. Comparative evaluations of all the remedial action alternatives against these seven criteria are detailed in the IAPP and briefly summarized in the Comparative Alternative Analysis section below. The preferred alternatives are further evaluated in the subsequent state acceptance and community acceptance sections below.

Comparative Alternative Analysis

Alternative GW-3 would be protective of human health and the environment by removing VOCs from the shallow groundwater. The removal of contamination would significantly reduce the risk from groundwater ingestion and contact to future residents and workers. Alternative GW-3 involves active treatment commonly used at other hazardous and mixed waste sites to volatilize the contaminants and remove them from the groundwater. Installation, operation, and maintenance of the AS/SVE system could be readily implemented within a short time period. Installation, operation, and maintenance of the system would present minor risk to the remedial worker, which would be mitigated through the use of proper protective equipment and adherence to approved health and safety procedures.

Alternative GW-3 is selected as the preferred alternative over Alternative GW-2 because in Alternative GW-2 it is uncertain that groundwater concentrations would decrease below MCLs before reaching a point of exposure. Alternative GW-3 is selected over Alternative GW-4 because it is less expensive with comparable results. Further, Alternative GW-4 was not selected because "hot spot" concentrations of TCE in the groundwater beneath the Pit Area are presently at levels that would likely poison the biological degradation process. Alternative GW-5 was not selected because it would likely cause mixing of VOCs and the relatively high activities of tritium sidegradient of the unit.

Pursuant to the EPA IROD guidance (EPA 1989) and checklists, the alternative selection focused upon the key ARARs listed below which apply to the limited scope of the interim action. The alternative selection also considered final action ARARs to ensure the interim action would be compatible.

- Fugitive Particulate Emissions (40 CFR 50.6 and SC R61-62.6, Section III)
- SC Toxic Air Pollutant regulations (SC R61-62.1, Section II, paragraph 3)
- SC Well Construction regulations (SC R61-71)

State Acceptance

Per EPA guidance on presumptive response strategies for groundwater (EPA 1996), groundwater response actions should be implemented in a phased approach with provisions for monitoring and evaluating their performance. Consistent with this guidance, an interim action is documented herein to remove high concentrations of TCE from a known source of VOC contamination.

State of South Carolina and EPA concurrence with the proposed interim action, detailed in Section IX, has been received. Both alternatives are effective in protecting human health, are readily implementable, and are reasonably priced for the benefit received.

Community Acceptance

Community acceptance of the preferred alternative is assessed by giving the public an opportunity to comment on the IAPP. The public was notified of a public comment period through mailings of the *SRS Environmental Bulletin,* the *Aiken Standard,* the *Allendale Citizen Leader,* the *Barnwell People Sentinel, The State,* and *Augusta Chronicle* newspapers, and through announcements on local radio stations. In addition, the IAPP was presented to the SRS Citizen Advisory Board in an open public meeting (May 6, 1998) during the public comment period. Public comments concerning the proposed remedy are addressed in the Responsiveness Summary of this IROD.

IX. THE SELECTED INTERIM REMEDY

Based on the risks identified in Section VI, the CBRP Pit Area soil poses a significant risk to human health. Significant carcinogenic risks to the potential future worker or resident are driven by exposure from the Pit Area soils contaminated with organic chemicals and shallow groundwater contaminated with VOCs. Significant potential for contamination of groundwater exists from leaching of VOCs caused by rainwater infiltration.

Based on the CERCLA evaluation criteria, the preferred alternatives that successfully address the IRAQs to prevent or mitigate these hazards are Alternative S-3, Native Soil Cover, for Pit Area soils and Alternative GW-3, In-Situ Air Sparging with SVE, for unit groundwater. Capital and O&M costs are listed in Table 2. The selected remedial alternatives are consistent with EPA guidance and the NCP for sites that have relatively large volumes of waste with low levels of contamination. They effectively represent the integration of IRAQs and risk management principles.

Native Soil Cover

The preferred alternative for Pit Area soil, Alternative S-3, consists of placing a layer of clean soil over the entire surface area of the CBRP. This additional layer of soil will act as a barrier to prevent soil exposure to future human and ecological receptors and will also reduce precipitation infiltration to minimize the further migration of TCE from the CBRP soils to the groundwater. Therefore, this alternative satisfies the remedial action objectives and reduces the risk to humans and the environment.

The soil cover is consistent with present and future land use expectations, because the CBRP is located in an area that has been recommended for industrial use by the SRS Citizens Advisory Board, and it is so designated by DOE. In addition, the *Savannah River Site Future Use Report Stakeholder Recommendations for SRS Land and Facilities* (DOE 1996) includes the recommendation that "residential uses of SRS land should be prohibited." Existing SRS institutional controls would prevent exposure to the industrial worker by limiting activities in the vicinity of the CBRP if the recommendations are upheld. However, in the event the property was ever transferred to nonfederal ownership, land use restrictions and notifications would be filed as part of the final ROD.

In conclusion, Alternative S-3 is selected as the preferred soil alternative because it is the least expensive alternative that satisfies the IRAQs with comparable protection of human health, the ecosystem, and the groundwater. Alternative S-3 is easily and quickly implementable because commercial, experienced resources are readily available. The hazards to the workers are slight. Positive health and safety practices would minimize inhalation of fugitive dust and standard industrial accidents.

AS/SVE

The selected groundwater remedy, In-Situ Air Sparging (with Soil Vapor Extraction), conceptually depicted in Figure 8, would involve operation of an air sparging system that would inject air into the bottom of the contaminated groundwater plume. The contaminants would then pass into the injected air, as it moves upward through the plume and, in turn, would flow into the unsaturated soil (vadose zone) above the water table. These volatilized groundwater VOCs would be extracted via vacuum wells by a soil vapor extraction (SVE) system as they rise into the vadose zone. Additionally, VOCs residing in the vadose zone (see Figure 8) would also be extracted via these same vacuum wells. The extracted soil vapors would be processed through a liquid-phase

separator to remove condensate. The offgas would then either be treated or released into the atmosphere in accordance with release requirements.

Installation of the AS/SVE system is targeted to remove high concentrations of TCE in the upper water table that could be in a free phase. The AS/SVE system, will prevent rapid migration from the upper water table to the lower water table will be consistent with the IRAOs.

As discussed in Section VII, the primary difference between this alternative (GW-3) and biodegradation (GW-4) is the injection of methane along with air. As the design and capital costs are relatively low, the proposed Alternative GW-3 will be designed, where cost effective, to allow the addition of methane or other nutrients as an injection option.

Simultaneous institutional controls would involve the installation and maintenance of long-term monitoring systems for groundwater, surface water, and biota to monitor the rate of attenuation of organic contamination at the site. Monitoring would continue for an indefinite period until sampling indicated remediation is successful in reducing groundwater contaminant levels below ARARs. Existing SRS access controls will be used to restrict the public and limit utilization of the site to industrial workers.

The preferred alternative (GW-3: air sparging in conjunction with SVE) offers the following advantages:

- Air sparging induces volatilization of VOCs in the groundwater and also provides oxygen to the groundwater, which is necessary for biodegradation and

- The injection points in the saturated zone could be used to introduce reagents that would assist in the degradation of the solvent plume;

- SVE increases the volatility of the VOCs in the vadose zone and also ventilates the vadose zone to facilitate removal of volatilized VOCs.

A groundwater concentration of 11,000 ug/L is typically thought to be required to suspect a high probability for the presence or freephase TCE. Figure 6 illustrates the area adjacent to the CBRP thought to have the highest potential for free phase TCE in the upper water table (i.e., 25,000 ug/L contour). This IROD proposes treatment of the 25,000 and 20,000 ug/L areas adjacent to the pit illustrated in the current contaminant contours depicted in

Figure 6. As shown in Figure 9, sparging and extraction cells will be concentrated within the 25,000 ug/L TCE zone, with fewer cells in the 20,000 to 25,000 ug/L interval. The total AS design flow rate is 300 cfm. To ensure complete recovery of the sparged air, the total SVE design flow rate is slightly greater at 500 cfm. Catalytic oxidation would be used for control of the SVE offgas because it is more cost-effective than carbon adsorption.

Per EPA guidance on presumptive response strategies for groundwater (EPA 1996), groundwater response actions should be implemented in a phased approach with provisions for monitoring and evaluating their performance. In accordance with the phased approach provisions in this guidance, this interim action is documented herein to allow the treatment system design to be evaluated and optimized. The goal of the interim system will be to treat the area in the vicinity of the pit within the 25,000 ug/L VOC isoconcentration contour to reduce concentrations and stabilize the migration of TCE within the 25,000 ug/L VOC contour. The criteria used to calibrate and evaluate the remedial action will include, at a minimum, the following monitoring: groundwater VOC concentrations within and adjacent to the treatment zone, AS radius of influence and SVE VOC air emissions rates.

Proposed monitoring well locations from the Corrective Measures Implementation/Remedial Design/Remedial Design Report/Remedial Action Work Plan (CMI/RD/RDR/RAWP) Rev. 0 (WSRC-RP-98-4058) are illustrated in Figure 10. Associated geologic, hydrogeologic, and hydraulic features are provided as Figure 11. The information depicted in Figure 11 is described in the Phase II RFI/RI Work Plan (WSRC 1998b).

Performance of the interim action will be assessed continuously. If it is determined during annual performance reviews that the interim action is not effective, a decision will be made, in consultation with EPA and SCDHEC, on whether to continue, modify, expand or discontinue this interim action. System modifications may include

- number, location and configuration of the cells may be changed to improve the performance of the system;
- positive and negative air flow rates, temperatures, and pressures may be modified to improve performance; and after the higher concentration areas targeted by this interim action become remediated to concentrations amenable to bioremediation, nutrients may be added to the air sparging system to enhance biodegradation.
- Air injection may be utilized in the vadose zone extraction points to promote VOC volatilization and create pathway for extraction.

Figure 9. CBRP AS/SVE Well locations and the Upper Water Table TCE Contours (µg/L)

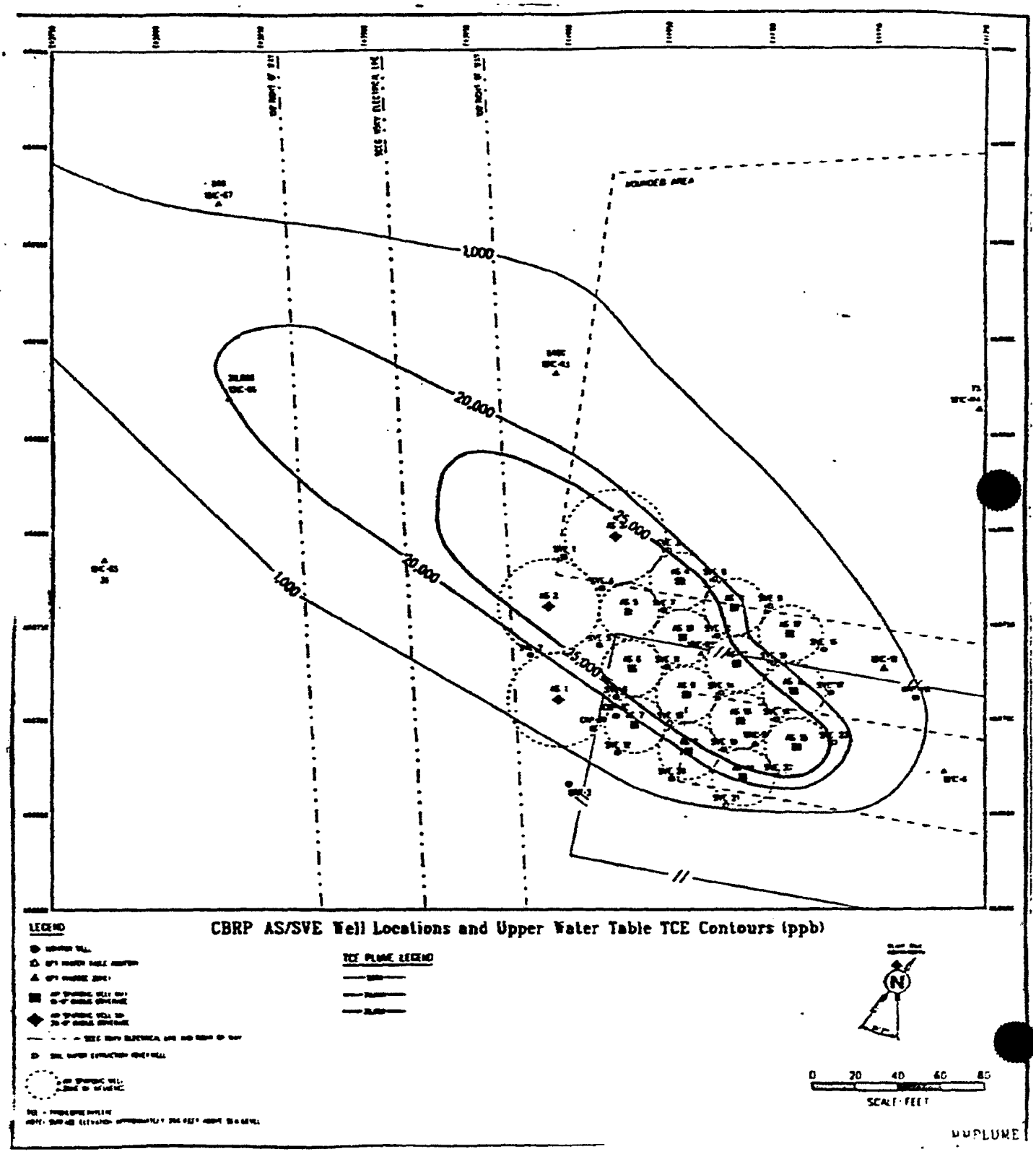
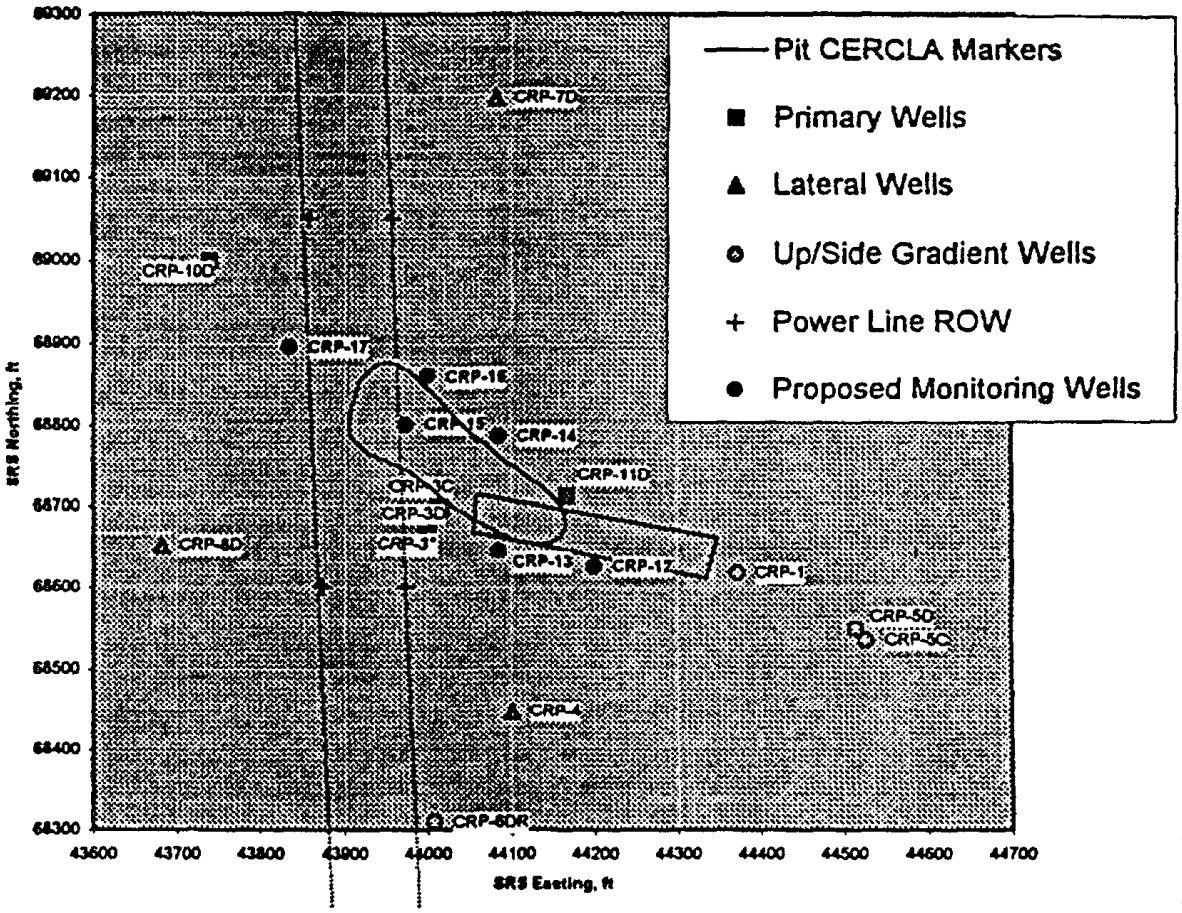


Figure 10. CBRP Site Map Illustrating locations of Current and Proposed Monitoring Wells with Respect to the 25,000 ug/L Contour and SVE/AS Treatment Zone



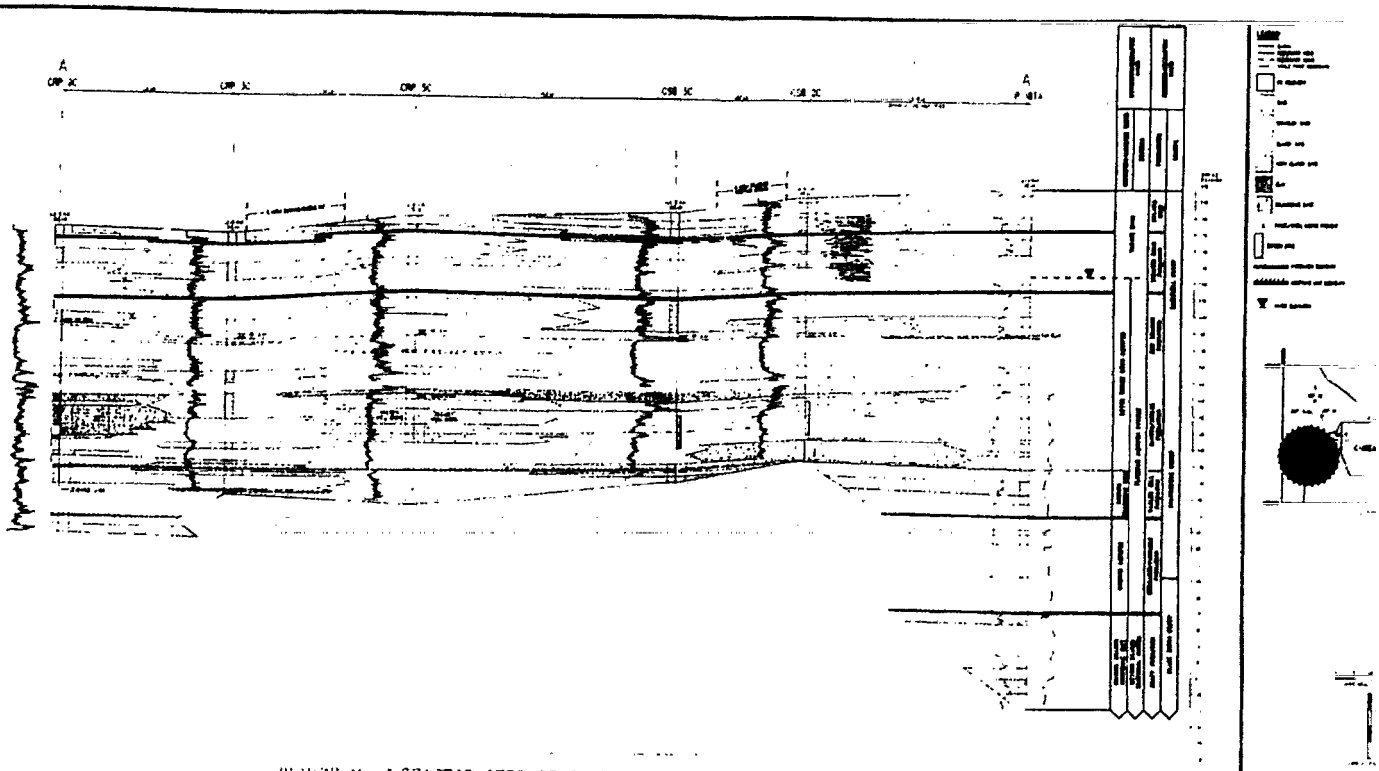


FIGURE 11 C-REACTOR SEEPAGE BASIN CROSS-SECTION A A

Pages 4

The AS/SVE flow rates; monitoring criteria; system performance modifications; and soil cover specifications provided in section V.B will be finalized with the approval of SCDHEC and EPA via the Corrective Measures Implementation/Remedial Design/Remedial Design Report/Remedial Action Work Plan (CMI/RD/RDR/RAWP) scheduled for December 22, 1998.

X. STATUTORY DETERMINATIONS

This interim action is protective of human health, and the environment and will reduce the principal threats posed by the CBRP. Relative to its overall effectiveness with respect to the nine selection criteria established by the NCP, the selected alternatives are cost effective. This interim action will not identify final remedial goals; but the selected interim alternatives are consistent with the interim remedial action objectives and any final action. Pursuant to the EPA IROD guidance (EPA 1989) and checklists, the alternative selection focused upon the key ARARs listed below which apply to the limited scope of the interim action. The alternative selection also considered final action ARARs to ensure the interim action and any final action is compatible. The final action will comply with Federal and State applicable or relevant and appropriate requirements. Although this interim action is not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action does utilize treatment and thus is a furtherance of that statutory mandate.

Because this action does not constitute the final remedy for the CBRP, the statutory preference of remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, although partially addressed in this remedy, will be addressed by the final response action. Subsequent actions are planned to fully address the threats posed by the conditions at the CBRP. This interim action is not designed or expected to be a final action for the groundwater, but the selected remedy represents the best balance of tradeoffs among alternatives with respect of pertinent criteria, given the limited scope of the action. The soil cover will likely be acceptable for the final action for soils at the unit. The native soil cover will address low level threat wastes (i.e., low concentration dioxin contamination in the Pit Area soil and organic contamination in the deep soil). In-Situ Air Sparging with Soil Vapor Extraction will address principal threat wastes (i.e., highly concentrated TCE in the aquifer sediments immediately adjacent to the pit in the upper zone of the water table aquifer) and VOC vadose zone contamination.

- Fugitive Particulate Emissions (40 CFR 50.6 and SC R61-62.6, Section III)
- SC Toxic Air Pollutant regulations (SC R61-62.1, Section II, paragraph 3)
- SC Well Construction regulations (SC R61-71)

SCHWMR R.61-79.124 and Section 117(a) of CERCLA, as amended, require advertisement of the draft permit modification and the proposed plan, respectively. Because this is an interim remedial action, a permit modification is not required to be included with this IROD. A final permit modification will include the final selection of remedial alternatives under RCRA, will be sought for the entire CBRP OU with the final SB/PP and will include the necessary public involvement and regulatory approvals. This IROD also satisfies the RCRA requirements for an Interim Measures Work Plan.

XI. EXPLANATION OF SIGNIFICANT CHANGES

The IAPP provided forinvolvement with the community through a document review process and a public comment period from April 17, 1998 through May 16, 1998. The IAPP was presented to the SRS Citizens Advisory Board in an open public meeting which was advertised and held on May 6, 1998. Comments received during the 30-day public comment period and the May 6, 1998 public meeting are addressed in Appendix A of this IROD. No significant changes to the selected remedy resulted from public comments.

XII. RESPONSIVENESS SUMMARY

Comments received during the public comment period are discussed in the Responsiveness Summary (see Appendix A) of this IROD.

XIII. POST-IROD DOCUMENT SCHEDULE

An integrated interim and final action implementation schedule is illustrated in Figure 12. A signed IROD is scheduled for September 30, 1998. The interim CMI/RD/RDR/RAWP was submitted on June 19,1998. Construction of the interim action is scheduled to begin by January 22, 1999. A performance evaluation of the interim action will be prepared and submitted to EPA and SCDHEC by October 27, 2000.

Figure 12. Integrated Interim and Final Action Implementation Schedule

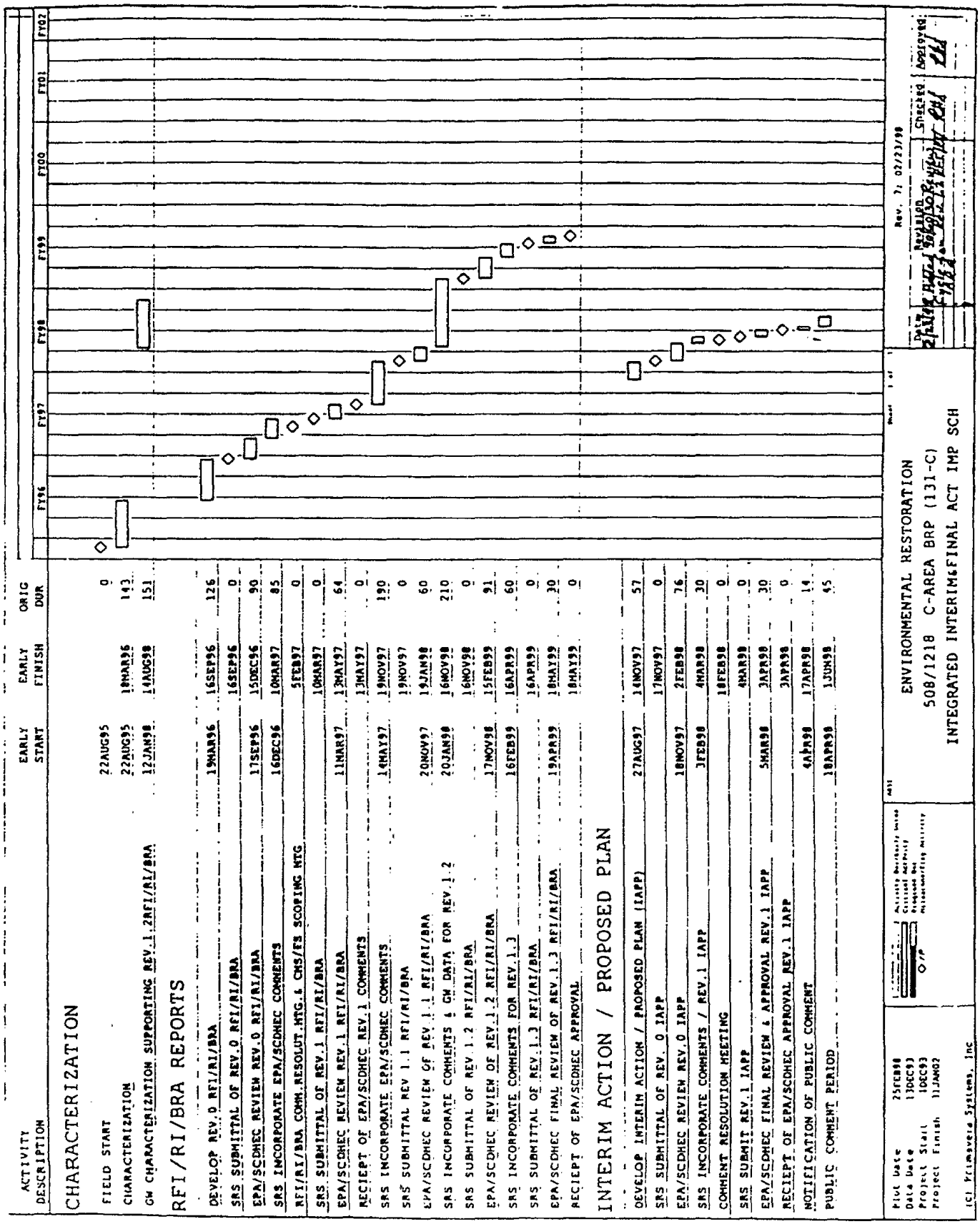


Figure 12. Integrated Interim and Final Action Implementation Schedule

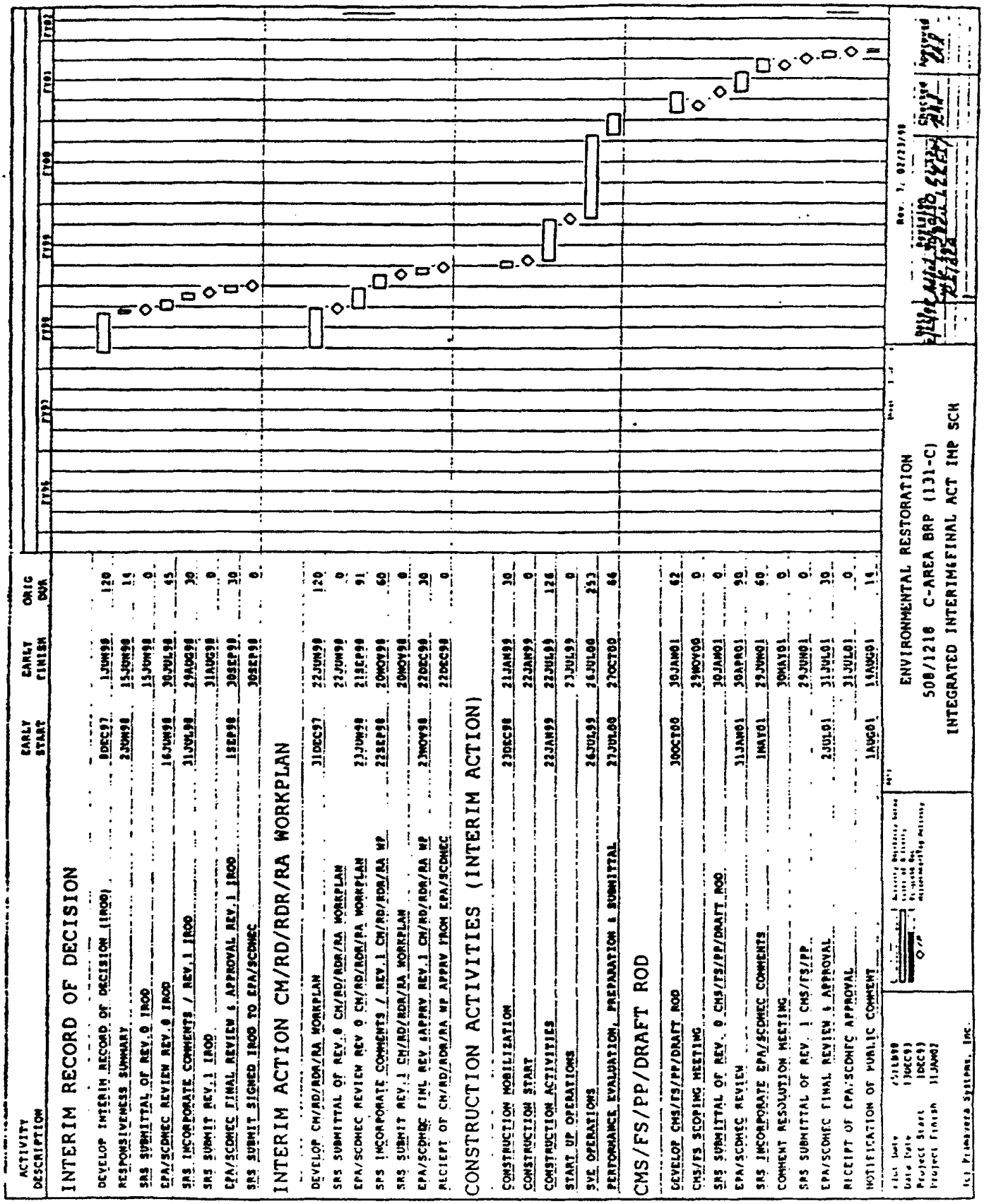
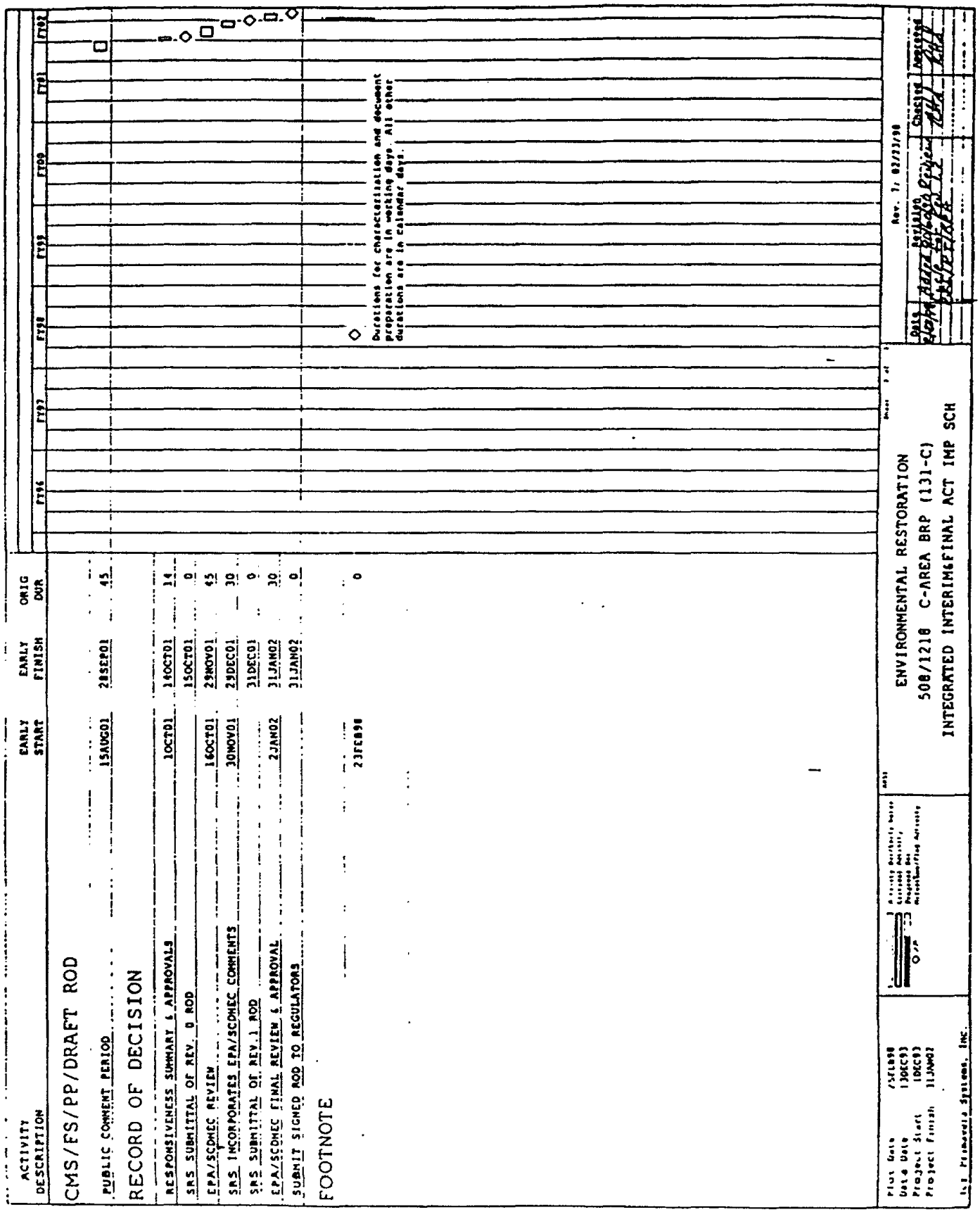


Figure 12. Integrated Interim and Final Action Implementation Schedule



Concurrent with the above interim action, a final action is scheduled. A detailed alternative screening process will be conducted for the final action in the CMS/FS. The CMS/FS will be scoped after the nature and extent of the plume is known and a performance evaluation has been completed on the Interim Action. A SB/PP will be submitted at the same time as the CMS/FS on January 30, 2001. Upon approval of the SB/PP, the public comment period will start and the final ROD will be submitted within 14 days after the completion of the public comment period.

XIV. REFERENCES

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APPENDIX A

RESPONSIVENESS SUMMARY

The 30-day public comment period for the CBRP IAPP began on April 17, 1998 and ended on May 16, 1998. The IAPP was also presented to the Citizens Advisory Board during the public comment period on May 6, 1998 at an open public meeting.

Comments from the Citizens Advisory Board Meeting

The following comments were taken from the May 6, 1998 Citizens Advisory Board meeting transcript. The following comments are paraphrased from the public meeting transcript during the presentation of the proposed remedy for this waste unit.

DOE presented the proposed Interim Action for the C-Area Burning/Rubble Pits. This presentation was requested by the Subcommittee in order to determine if the Subcommittee would pursue a motion. After the presentation, a suggestion was made for the use of horizontal wells; however, it was determined that because of the close proximity to the water table and the relatively small size of the hotspot, the horizontal well approach to remediating the site was not economically viable. A suggestion for the use of the Plug-in ROD approach to remediating the site was made. This suggestion was discussed but it was determined to not be consistent with the timing of this interim action. There was discussion on whether the Plug-in-ROD approach would be acceptable for other burning rubble pits, and it was decided that it could be useful if they were similar in nature and extent of contamination. Therefore, it appears the path forward will be that proposed in the presentation, which for soils is the use of a native soil cover and for the groundwater, In-Situ Air Sparging/SVE. In conclusion, the interim action objectives revolve around controlling solvent migration in the soils beneath the pit and the groundwater."

Comments from the audience at the Citizens Advisory Board Meeting (as recorded by SRS.)

Comment 1: Is tritium mixed within the VOC plume?

Response 1: Yes, but at low activities. Additional information was provided within the IAPP (WSRC 1998a) Section IV. A, page 6.

Comment 2: How much VOC is expected to be recovered and how long will it take?

Response 2: Recovery rates were not modeled, but one purpose of IAPP is to determine actual recovery rates to evaluate AS/SVE as a final remedial alternative.

Comment 3: Why is SRS concerned about tritium mixing with the VOC plume which would result from alternative GW-5?

Response 3: The operation of alternative GW-5's air stripper would result in significant tritium releases which would potentially pose unnecessary health risks to workers.

Comment 4: Why didn't we choose to dig up the contamination?

Response 4: Alternative S-5 considered digging up the top 4 feet, but at $785,400 versus the selected native soil cover (S-5) at $194,800, S-5 was prohibitively expensive. In addition, removal of the contaminated vadose zone soils is not a viable alternative because the depth of the excavation would have to be in excess of 60 feet and when safe slopes are considered the volume of soils ultimately removed would be very large.

Comment 5: Are operations and maintenance costs included in the estimates and for what period?

Response 5: They are included for the planned 5-year operations period.

Comment 6: Why are we doing an interim action?

Response 6: Per EPA guidance, on presumptive response strategies for groundwater (EPA, 1996), groundwater response actions should be implemented in a phased approach with provisions for monitoring and evaluating their performance. Consistent with this guidance, this interim action is proposed to remove high concentrations of TCE from a known source of VOC contamination which will assist in limiting the spread of contamination from the pit area to the down-gradient areas.

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SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 05/20/1999
Operable Unit: 57
ROD ID: EPA/541/R-99/053

Media: Air, Soil

Contaminant: Metals, Radioactive

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The Savannah River Site (SRS) occupies approximately 310 square miles of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. SRS is a secured U.S. government facility with no permanent residents. SRS is located approximately 25 miles southeast of Augusta, Georgia and 20 miles south of Aiken, South Carolina.

SRS is owned by the Department of Energy (DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided nuclear materials for the space program and for medical, industrial, and research efforts. Chemical and radioactive wastes are by-products of nuclear material production processes. The entire SRS facility was placed on the National Priorities List (NPL) in December 1989.

Operable Unit (OU1):

The M-Area Hazardous Waste Management Facility (HWMF) is a source-specific operable unit within the A/M Area Fundamental Study Area. The M-Area HWMF includes an unlined surface impoundment (settling basin), a portion of an inactive process sewer line, drainage and seepage areas, and a Carolina bay known as Lost Lake. The nearest plant boundary is approximately 5800 feet northwest of the M-Area HWMF.

The M-Area settling basin was constructed in 1958 to settle out metals discharged from M-Area manufacturing operations. The basin dimensions were approximately 330 feet by 280 feet by 17 feet with a volumetric capacity of approximately eight million gallons. Overflow from the settling basin was directed to a natural seepage area and ultimately to Lost Lake. In July 1985, a permitted wastewater treatment facility was placed in operation and discharges to the settling basin were discontinued.

A Record of Decision (ROD) addressing OU1 was completed in June 1992.

OU2:

The Metallurgical Laboratory HWMF is a source-specific operable unit within the A/M Area fundamental Study Area. The Metallurgical Laboratory HWMF includes an abandoned portion of a process sewer line, a seepage basin, a drainage outfall, and a Carolina bay. The nearest plant boundary is located approximately three-fourths of a mile to the northwest of this operable unit.

The Metallurgical Laboratory was used for corrosion testing on stainless steels and nickel-based alloys. This testing required degreasing and cleaning metal parts, etching sample identification information on the parts, and photographing the samples. No radioactive materials were known to have been discharged to the HWMF. During periods of heavy rainfall, wastewater and surface water overflowed a drainage outfall at the Metallurgical Laboratory Basin into the adjacent Carolina Bay. A RCRA closure plan for the basin and sewer line portions of the Metallurgical Laboratory HWMF was submitted and approved in June 1991. The intent of the closure plan is to ensure the basin and sewer line portions of the Metallurgical Laboratory HWMF will be closed in a manner that controls, minimizes, or eliminates post-closure migration of hazardous constituents and decomposition products to the vadose zone, groundwater, surface waters, or atmosphere.

A ROD addressing OU2 was completed in June 1992.

OU3:

The A/M Area, located in the northwest portion of SRS, contains nuclear fuel fabrication buildings, office buildings, and research areas. The A/M Area groundwater is a media-specific operable unit

within the A/M Area Fundamental Study Area. As a result of past waste disposal practices, the groundwater beneath A/M Area has been contaminated with organic solvents, primarily trichloroethylene (TCE) and tetrachloroethylene (perchloroethylene; PCE). Total plume size beneath the A/M Area, as currently defined, is approximately 1200 acres. The contamination in the A/M Area groundwater and the overlying unsaturated zone appears to be associated with releases from the following A/M Area source units: the A-014 Outfall, the M-Area Settling Basin/Lost Lake (M-Area HWMF), and the M-Area HWMF Process Sewer, and the 321-M Solvent Storage Area.

From 1952 to 1981, an estimated 13 million pounds of chlorinated solvents were used in the A/M Area to degrease fuel and target tubes used in SRS reactors. An estimated 50 to 90 percent of the solvents evaporated during degreasing operations. The remaining solvents were discharged as waste to the process sewer system. Additionally, significant quantities of chlorinated solvents were inadvertently spilled during handling and storage.

A ROD addressing OU3 was completed in June 1992.

OU4:

The Gunsite 720 Rubble Pit is located within SRS and is approximately 305 meters (100 feet) west of South Carolina Highway 125, 168 meters (550 feet) north of SRS Road A-2, and 2.5 kilometers (1.5 miles) from the nearest SRS boundary.

During the period from 1955 to 1960, to defend the SRS in the event of an air attack, the U.S. Army established onsite anti-aircraft artillery gun emplacements at several locations near the perimeter of SRS. The Gunsite 720 was one of those emplacements. In the early 1980s, while work was being performed in the area, nine empty, partially buried drums, labeled "duPont Freon 11" were found at the gunsite. The drums were excavated in July 1987, and placed on a pallet at the gunsite. The drums were excavated in July 1987, and placed on a pallet at the gunsite. The area around the drums was screened during excavation and the liquid (rainwater) that collected in the excavated drums was sampled prior to disposal. No evidence of hazardous substances was found. In October, 1989, the drums were removed from the unit.

A ROD addressing OU4 was completed in March 1997.

OU5:

The Gunsite 113 Access Road Unit is located in the northeast corner of SRS, adjacent to the access road leading to Gunsite 113, and is approximately 91.5 meters (300 feet) east of where SRS Road 8 crosses the SRS facility boundary.

The area appears to have been used as a surface disposal area for

spoil dirt and/or road construction debris. There is no documentation or record of any hazardous substance management, disposal, or any other type of waste disposal at this unit. There is no evidence that any recent disposal activities have occurred in this area or that disposal activities were more widespread. Also, there is no evidence of any burning or excavation at this waste unit.
A ROD addressing OU5 was completed in March 1997.

OU6:
The F-Area HWMF (basins F-1, F-2, and F-3) operated from 1955 until November 1988. During that time, the facility received waste effluents from F-Area chemical separation facilities processes such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads. The three basins had a combined maximum operating capacity of 20.5 million gallons of wastewater.
These basins were closed by dewatering, physically and chemically stabilizing the remaining sludges and placing a protective multi-layer cover system over them to reduce rainwater contact with basin bottoms.
Closure of the F-Area HWMF was begun in 1989 and completed in January 1991. The F-Area HWMF was certified closed in February 1991. Closure activities specifically included removal of standing water remaining in the basin; stabilization of the basin sludge with a layer of granite, limestone and blast furnace slag; construction of a low permeability cap over the basin; and restoration of the area.
A ROD addressing OU6 was completed in September 1993.

OU7:
The H-Area HWMF is a source specific operable unit within the H-Area Fundamental Study Area. The H-Area HWMF consists of three unlined, earthen surface impoundments located in the center of SRS, southwest of Road E and north of road 4 approximately 6 miles from the nearest site boundary.
The H-Area HWMF operated from 1955 until November 1988. The original H-Area HWMF consisted of basins H-1, H-2, and H-3 and operated from 1955 to 1962. In 1962 H-3 was replaced by H-4. At the time of closure, the H-Area HWMF had a combined maximum operating capacity of 26.5 million gallons of wastewater. The H-Area HWMF received waste effluents from H-Area chemical separation facilities processes such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads.
The four basins were closed by dewatering, physically and chemically stabilizing the remaining sludges and placing a protective multi-layer cover system over them to reduce rainwater contact with

basin bottoms.

OU8:
The F-Area HWMF is a source specific operable unit within the F-Area Fundamental Study Area. The F-Area HWMF is located in the center of SRS, Southwest of Road E and North of Road 4 approximately 16 miles from the nearest plant boundary. The F-Area HWMF consisted of three unlined earthen basins that had a combined maximum operating capacity of 20.5 million gallons of waste water during operation. It received waste effluents from F-Area chemical separations facilities such as the nitric acid recovery unit, waste storage system evaporator overheads, and general purpose evaporator overheads. Significant amounts of nitrates and caustics were received.
A ROD addressing OU8 was completed in April 1995.

OU9:
The H-Area HWMF consists of a series of three hydraulically connected unlined basins (H-1, H-2, and H-4). Basin H-4 was built in 1962 to replace basin H-3. Wastewater flow to the basins was terminated on November 7, 1988 in accordance with the requirements of RCRA. The H-Area HWMF received waste effluents from H-Area chemical separations facilities such as nitric acid recovery unit, waste storage system evaporator overheads, and general purpose overheads. The waste stream contained hazardous constituents and low levels of radionuclides.
A ROD addressing OU9 was completed in April 1995.

OU10:
The Fire Department Hose Training Facility (FDHTF) is located approximately 200 meters (700 feet) northeast of the intersection of Roads C and 6 and approximately six meters (20 feet) west and downgradient of a heat exchanger storage pad. The FDHTF is a source control and groundwater operable unit. The FDHTF was built between 1975 and March 1979 and operated by the SRS Fire Department between 1979 and 1982 to train personnel in fighting waste oil fires. Training exercises typically included pouring burnable oil into the unit, igniting the oil, and then having the fire department extinguish the fire with water from fire hydrants located adjacent to the unit. No known hazardous wastes were placed in the unit.
The SRS Fire Department discontinued use of the FDHTF and recommended the facility for cleanup and closure in March 1982. Available documentation indicates cleanup activities occurred on November 21, 1982 during which 14 loads of oil-contaminated soil were excavated from an area approximately 6 by 6 by 1 meter and

transported to the sanitary landfill. However, the date of this cleanup activity could not be verified.
A ROD addressing OU10 was completed in August 1998.

OU11:
The Central Shops Burning/Rubble Pit (631-6G) (BRP6G)is located in the Central Shops Area near the center of the SRS. It operated from 1951 through 1955 for the disposal and burning of waste materials. The unit consisted of a shallow unlined excavation, approximately 3m (10 feet) deep. Materials believed to be disposed of in the pit included waste oils, rags, paper, cardboard, plastics, degreasers, wood, rubber, and drummed organic solvents. These materials were periodically burned in the pit, usually on a monthly basis. The volume of waste disposed of at BRP6G was not recorded.
A ROD addressing OU11 was completed in May 1997.

OU12:
The M-Area West unit is located west of the M-Area Production Facility on a dirt road approximately 1.8 kilometers north of Silverton Road. There are no structures of any type located at or near M-Area West. The only nearby man-made feature is a dirt access road located about 30 to 40 feet west of the waste areas.
The unit consists of two small areas. Several drums and other small innocuous debris were found on the land surface adjacent to a dirt road approximately 1 kilometer west of the M-Area production facility. The total waste at the unit consisted of six empty 55-gallon drums, four 1-gallon cans and a 1-gallon glass jar. The cans and the jar were originally contained in one of the larger drums. With the exception of a crushed drum and small amounts of metal debris, all other materials were removed from the site in 1992.
There is no documented information available regarding past hazardous or non-hazardous waste disposal activities at M-Area West. Markings on the drums found at the unit suggest that they once contained oil and solvents, and that they are approximately 37 years old. There is no evidence that any recent disposal activity has occurred or that the disposal activity was more widespread. Also, there is no evidence of any burning or excavation at this waste unit.
A ROD addressing OU12 was completed in September 1995.

OU13:
The Silverton Road Waste Unit (SRWU) is located in the northwestern part of SRS in Aiken County, approximately 1.5 miles southwest of A/M Area. The SRWU was first used before construction of the SRS. Municipal, agricultural, and commercial trash, rubbish, garbage, debris, and refuse probably constituted the waste stream until the early 1950s. After procurement by the federal

government, the SRWU land continued to be used as an open dump for disposal of metal shavings, 55-gallon drums, cardboard drums, tires, lumber, etc. No records of waste disposal activities were kept. In 1974, the disposal of waste at the SRWU ceased, and the area was bulldozed, graded, covered with soil, and planted with grasses.
A ROD addressing OU13 was completed in March 1997.

OU14:
The F-Area Burning /Rubble Pits (FBRP) comprise a source unit located within the SRS, approximately 3000 feet west of F-Area and 1100 feet north of SRS Road C. Between 1951 and 1973, SRS used Pits 231-F and 231-1F to burn a variety of wastes which were considered non-hazardous at that time. Some of these waste materials (degreasers and solvents) are now considered to be hazardous based on ingestion or possible dermal contact. Waste was usually burned on a monthly basis. The chemical composition and volumes of the disposed waste are unknown, but waste materials burned included paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents.
A ROD addressing OU14 was completed in March 1997.

OU15:
The D-Area Burning/Rubble Pits (DBRP) are located in the western part of the SRS in Barnwell County, approximately 2600 feet west of D Area and 1.6 miles west of State Highway. Between 1951 and 1973, burning pits were used at SRS to burn a variety of hazardous and non-hazardous waste. The chemical composition and volumes of the disposed waste are unknown. Combustible materials, which were burned monthly, included paper, plastics, wood, rubber, rags, cardboard, oil, degreasers, and spent organic solvents. No known or suspected radioactive materials were allowed in the burning pits. Burning of waste in the SRS pits was discontinued by October 1973. A layer of soil was then placed over the residue in the pits and they were subsequently used as rubble pits.
A ROD addressing OU15 was completed in March 1997.

OU16:
The Old F-Area Seepage Basin (OFASB) is located within the SRS, approximately 600 feet north of F Area and one mile east of Road C and is located in Aiken County. The Savannah River and associated swamps are located approximately six miles west of the basin. The OFASB is designated as Building Number 904-49G and covers a total area of 1.3 acres.
Between November 1954 and mid-May 1955, 9 to 14 million gallons of wastewater were discharged to the basin which served as an unlined seepage basin for the purpose of reducing radioactive

substance concentrations. Wastewater included overhead condensates from evaporators, laundry washwaters, non-reactor cooling water from F and H Areas, and possibly other chemicals.
A ROD addressing OU16 was completed in May 1997.

OU17:
The L-Area Oil and Chemical Basin (LAOCB) and L-Area Acid Caustic Basin (LAACB) are located south of L-Area in an area of low to moderate relief. They are situated on the southern flank of a hill approximately 300 feet south of the L-Area perimeter fence and 1,250 feet north of L Lake.
The LAOCB was designed and constructed as an unlined seepage basin in 1961 for the purpose of disposing of small volumes of wastes that were not appropriate for discharge to local streams, regular seepage basins, or the 200-Area waste management system. The exact quantity of waste water discharged to the LAOCB basin is not documented. Liquid wastes consisting of small volumes of slightly radioactive oil and chemical wastewater were sent to the LAOCB from throughout SRS, but came primarily from the reactor areas. Wastes were transported to the drainage pad in tank trucks, metal drums, skid tanks, and other containers. The Hot Shop (Building 717-G) discharged decontaminated wastewater containing radionuclides, detergents, and spent degreasing solvents through the pipeline to the basin.
A ROD addressing OU17 was completed in March 1997.

OU18:
The Burma Road Rubble Pit (BRRP) is located approximately one-half mile southwest of F-Area Separations Facility and one-tenth mile southwest of C Road. The BRRP is between Upper Three Runs Creek and Four Mile Creek.
The BRRP consists of two unlined earthen pits dug into surficial soil and filled with various waste materials. A small circular area of disturbed soil was detected adjacent to these pits and is considered to have been used as a source of backfill for the pits. It has been determined that the BRRP source control OU does not contribute contamination to the area groundwater or surrounding soils.
A ROD describing OU18 was completed in August 1998.

OU20:
The K-Area Bingham Pump Outage Pit (KBPOP) is situated in the Tobacco Road formation which extends from ground surface to a depth of 95 feet below ground surface. Between 1957 and 1958, miscellaneous construction debris generated by major modifications and repairs to the primary and secondary reactor cooling water systems was buried in the KBPOP. There were no pumps buried and

no liquid waste was disposed of in the KBPOP.
A ROD addressing OU20 was completed in March 1998.

OU23:
The F-Area Retention Basin (FRB) is located outside and south of the F-Area perimeter fence, approximately 1035 meters (3397 feet) from Fourmile Branch. The FRB, with an area of 0.6 acres, was designed and operated as an unlined, temporary container for potentially contaminated cooling water from the F-Area Canyon Facility and stormwater drainage from the F-Area Tank Farm. Cooling water from the Canyon Facility generally had low levels of radioactivity, while water from the Tank Farm is believed to have had only trace quantities of nonradionuclide chemicals. The quantities of water released to the retention basin and the level of various constituents contained within the water are unknown.
A ROD addressing OU23 was completed in September 1998.

OU27:
The D-Area Oil Seepage Basin is located on the Ellenton Plain, the highest of three terraces between the Savannah River to the west and the Aiken Plateau to the east. Construction of the D-Area Oil Seepage Basin trenches began in 1952. Employee interviews indicated the basin was used in the disposal of waste oil originating from D-Area Powerhouse operations to dispose of nonburnable waste and for the routine burning of office and cafeteria waste. Unknown amounts and types of waste were disposed into the basin. Records of the contents of the disposed drums do not exist. To date, there is no evidence to indicate the presence of radionuclides in the drums. Furthermore, employee interviews have indicated that no radionuclides were disposed within the trenches. In 1975, the D-Area Oil Seepage Basin was removed from service and backfilled with soil. Approximately one foot of standing liquid, plus an unknown number of 55-gallon drums possibly containing waste oil, remained in the basin when it was backfilled. The basin remains inactive and is covered with natural vegetation, including bushes and grasses, and is surrounded by trees.
RODs addressing OU27 were completed in March 1995 and August 1998.

OU29:
The TNX Area is a pilot scale test facility for the SRTC. The pilot scale facilities are used to provide technical support to various SRS production areas. From 1953 to August 1988, wastewater generated by research performed in the TNX Area was disposed of in seepage basins. In August 1988, wastewater was rerouted to the TNX Effluent Treatment Facility.

A ROD addressing OU29 was completed in November 1994.

OU32:
The Burial Ground Complex (BGC) is an area which occupies approximately 195 acres in the central part of SRS between F and H Separation Areas, on a nearly flat divide between Upper Three Runs Creek to the north and Four Mile Creek to the south.
The BGC includes the Old Radioactive Waste Burial Ground (ORWBG) and other OUs such as the Mixed Waste Management Facility (MWMF), the Low Level Radioactive Waste Disposal Facility (LLRWDF), Solvent Tanks S1-S22 (located in the ORWBG and currently being characterized), Solvent Tanks S23-S30, and Solvent Tank S32.
The ORWBG comprises a disposal area for solid radioactive waste produced at the SRS, as well as shipments from other U.S. DOE and Department of Defense facilities. The ORWBG has contributed to localizedshallow aquifer groundwater contamination. The plume of groundwater contamination from the ORWBG seeps into the old F-Area effluent stream which flows into Four Mile Creek which in turn flows into the Savannah River. Other RCRA/CERCLA units within the BGC are undergoing characterization and investigation to determine the impacts to the environment.
The ORWBG began receiving waste in 1952 and was filled in 1972. Examples of materials disposed of at the Old Radioactive Waste Burial Ground (ORWBG) include the incidental waste from laboratory and production operations, contaminated equipment, lead, spent deionizer resins, spent lithium-aluminum targets, irradiated process oil from pumps in the tritium facilities and reactor areas, mercury from gas pumps in tritium facilities, cadmium, scintillation fluid, and shipments from off-site.
A ROD addressing OU32 was completed in June 1996.

OU33:
The mixed waste management facility (MWMF) operated from 1969 until March 11, 1986. During that time, this facility, which comprises approximately 58 acres, received low-level radioactive waste materials produced at SRS. Some of these materials are classified as mixed waste containing both hazardous and radioactive components under the RCRA. These trenches were closed by precompacting and placing a protective multi-layer cover system over them to reduce rainwater contact with trench bottoms.
RCRA preventive actions at the MWMF were conducted pursuant to the requirements of RCRA. In 1985 a RCRA Closure Plan was submitted, and closure of the MWMF was begun in 1988 and completed in December 1990. The MWMF was certified closed in 1991. Closure activities specifically included precompaction,

construction of a low permeability cap over the trenches, and restoration of the area.
A ROD addressing OU33 was completed in September 1994.

OU34:
The Tank 105-C HWMF was installed in 1961 as part of an off-line heat exchanger repair program and was used as a temporary holding tank for liquid solution. Sumps from the heat exchanger cleaning area drained into Tank 105-C. Oil in the tank was probably attributable to oil leaks into these sumps. The reacted or spent oxalic acid solution that resulted from the rinsing process was pumped into an above ground neutralization tank in the stack area of the reactor building.
In October 1990, a RCRA Closure Plan was submitted to the SCDHEC. SRS received approval of the closure plan on January 16, 1991, with no revision required. Closure activities specifically included the neutralization of waste to a pH of less than 12.5, removal of as much waste as reasonably possible, and shipment of removed waste to an onsite storage/disposal facility. Any remaining waste and the tank void were stabilized with concrete.
A ROD addressing OU34 was completed in September 1994.

OU35:
Par Pond is a 2640-acre man-made reservoir located northeast of P Area and east of R Area in the eastern portion of SRS. The southern shore of the reservoir lies approximately 1.5 miles from the eastern SRS boundary. The southern shore of the reservoir lies approximately 200 feet north of Road B. Par Pond discharges through controlled releases into Lower Three Runs Creek, which in turn discharges into the Savannah River. The length of Lower Three Runs Creek from the outfall of Par Pond to the Savannah River is approximately 20 miles.
Par Pond was built to augment the cooling water requirements of both P and R Reactors. During the 1950s, an effluent pathway was constructed from R Reactor to Par Pond. The pathway consisted of the R Canal and Pond B. Releases in the form of process leaks, purges, and makeup cooling water have contaminated Par Pond with cesium-137 and other radioactive and non-radioactive contaminants. Mercury has been detected in fish from the Savannah River and SRS waterbodies since the analyses began in 1971, with comparable concentrations measured in onsite and offsite fish.
A ROD describing OU35 was completed in February 1995.

OU41:
OU41 contains the P-Area CP R/O Basin (P-CRPB). The P-CRPB is located approximately 330 feet southeast of the limited area fence

surrounding P Area in northwestern Barnwell County.
A ROD addressing OU41 was completed in September 1998.

OU42:
OU42 contains the C-Area CP R/O Basin (C-CRPB). The C-CPRB is located approximately 700 feet southeast of the limited area fence surrounding C Area in northwestern Barnwell County.
A ROD addressing OU42 was completed in September 1998.

OU45:
The Grace Road Site is located approximately 1.3 kilometers south of B-Area and about 244 meters east of the intersection of Grace Road and SRS Road 2. It consists of numerous drums and cans, concrete slabs, brick foundations, and miscellaneous debris. The unit also contained numerous drums and cans varying in size from ? gallon cans to 55-gallon drums and various car parts. Most of the debris was on the surface or partially buried in scattered locations across the unit. Markings on a few of the smaller drums and cans indicated that they once contained oil and grease. There is no evidence that any recent disposal activity has occurred or that the disposal activity was more widespread. Also, there is no evidence of any burning or excavation at this waste unit.
Between February and May 1992, all the debris, drums and concrete slabs were removed from the Grace Road Site. The items removed were either used at soil erosion control areas or were disposed of in the sanitary landfill. No records of any type of waste management activity have been found for the Grace Road Site.
A ROD addressing OU45 was completed in March 1997.

OU51:
The Motor Shops Seepage Basin (716-A) (MSSB) is located in A Area south of the railroad tracks near the automotive shop in Aiken County. A small drainage feature runs through the area approximately 91 meters (300 feet) to the east of the MSSB.
The MSSB was constructed and placed in service in 1977 to receive liquid waste from the 716-A Motor Shops oil/water separator. The MSSB was designed and constructed as an unlined seepage basin. The wastewater flowed into the basin from the northwest through two influent pipes from the Motor Shop and seeped naturally into the soil beneath the basin. Effluent discharges from the Motor Shops included wastewater with trace amounts of engine oil, grease, kerosene, ethylene glycol, and soapy water.
A ROD addressing OU51 was completed in June 1998.

OU52:
The K-Area CP R/O Basin (K-CPRB). The K-CPRB is located

approximately 500 feet west of the limited area fence surrounding K Area in northwestern Barnwell County.
A ROD addressing OU52 was completed in September 1998.

OU54:
The F-Area CP R/O Basin (F-CPRB) is located approximately 50 feet southeast of the limited area fence surrounding F Area in southwestern Aiken County.
A ROD addressing OU54 was completed in September 1998.

Remedy: If there is no current or potential threat to human health and the environment and no action is warranted, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121 requirements are not triggered. This means that there is no need to evaluate other alternatives or the "No Further Action" remedy against the nine criteria specified under CERCLA. Because no final contaminants migration constituents of concern (COCs), ecological final COCs, or human health final COCs were identified, any residual soil contamination at the unit does not pose a future site risk to groundwater, a current or future risk to ecological receptors, or a current or future risk to human health. Under "No Further Action," no treatment will be performed, no institutional controls or engineering controls will be implemented, and no cost will be associated with the remedy.

Estimated Capital Cost: Not Provided
Estimated Annual O&M Costs: Not Provided
Estimated Present Worth Costs: Not Provided
Other Costs: Not Provided

Text: Full-text ROD document follows on next page.

PB99-964011
EPA541-R99-053
1999

EPA Superfund
Record of Decision:

Savannah River Site (USDOE)
Ford Building Waste Unit (643-11G) OU 57
Aiken, SC
5/20/1999

United States Department of Energy

Savannah River Site

Record of Decision

for the

Ford Building Waste Unit (643-11 G)

Operable Unit (U)

WSRC-RP-98-4066
Revision 1
April 1999

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

Prepared for the U.S. Department of Energy under Contract No. DE-AC09-96-SR18500

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Prepared for
U.S. Department of Energy
and
Westinghouse Savannah River Company
Aiken, South Carolina

RECORD OF DECISION
FOR THE FORD BUILDING WASTE UNIT (643-11G)
OPERABLE UNIT (U)

WSRC-RP-98-4066
Revision 1
April 1999

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
For the
U. S. Department of Energy Under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

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Department of Energy
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P.O. Box A
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SEP 14 1999

Mr. K. A. Collinsworth, Manager
Federal Facility Agreement Section
Division of Site Assessment and Remediation
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

Mr. J. L. Crane
SRS Remedial Project Manager
Waste Management Division
United States Environmental Protection Agency, Region IV
61 Forsyth Street, SW
Atlanta, GA 30303

Dear Mr. Collinsworth and Mr. Crane:

SUBJECT: Submittal of the Signed Copy of the Record of Decision for the Ford Building Waste Unit (643-11G) Operable Unit (WSRC-RP-98-4066, Revision.1, Final)

Please find enclosed the signed copy of the Record of Decision (ROD) for the Ford Building

Waste Unit Operable Unit for your records.

Questions from you or your staff may be directed to me at (803) 725-7032.

Sincerely,

Brian T. Hennessey
SRS Remedial Project Manager
Environmental Restoration Division

BTH/JLK:lp
OD-99-337
Enclosure
1 Record of Decision for the Ford Building Waste Unit (643-11G) Operable Unit WSRC-RP-98-4/66.Revision.1.Final

c: A. B. Gould, US DOE-ECD, 703-A SEP 14 1999
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Administrative Record File, 730-2B, Room 1000*
*w/enclosure

DECLARATION

Site Name and Location

Ford Building Waste Unit (643-11G)
Savannah River Site
Aiken, South Carolina

The Ford Building Waste Unit (643-11G) (FBWU) Operable Unit is listed as a Resource Conservation and Recovery Act (RCRA)3004(u) Solid Waste Management Unit/ Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS).

Statement of Basis and Purpose

This decision document presents the selected remedial for the FBWU, in Aiken, South Carolina, which was chosen in accordance with CERCLA, as amended by SARA, and, to the extent practical, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this specific RCRA/CERCLA site.

The state of South Carolina concurs with the selected remedy.

Description of the Selected Remedy

The selected remedy for FBWU is "No Further Action". The Baseline Risk Assessment (BRA) considered current, future industrial and future residential land use scenarios. Based on these scenarios, the BRA concluded that there were no final constituents of concern (COCs) (i.e., no contaminant migration constituents of concern [CM COCs], human health COCs, or ecological (COCs). Therefore, no further action is required to clean up the FBWU to acceptable levels.

Declaration Statement

A time-critical removal action was implemented in early 1997. This removal action focused

on removing secondary sources consisting of surface and subsurface soils that contained levels of cesium-137 above the time-critical action cleanup goal of 0.35 pCi/g. The cleanup goal was set to the unit-specific two times (2X) average background.

Based on the FBWU RCRA Facility Investigation/Remedial Investigation (RFI/RI) Report and the BRA, no further action is necessary at the FBWU to ensure the protection of human health and the environment. Since the FBWU poses no risk to human health and the environment, and no further action is needed, the CERCLA Section 121 requirements are not applicable. The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is meant to be a permanent solution, and final action, for the FBWU operable unit.

Section 300.430(f)(ii) of the National Oil and Hazardous Substances Pollution Contingency Plan requires that a Five-Year Review of the Record of Decision (ROD) be performed if hazardous substances, pollutants, or contaminants remain at the unit. The US EPA, SCDHEC, and US DOE have determined that a Five-Year Review of the ROD for the FBWU operable unit will not be performed. The remedial action for this unit ("No Further Action") results in no hazardous substances, pollutants, or contaminants remaining in the soils of the FBWU operable unit.

4/12/99

Date

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DECISION SUMMARY
FOR THE FORD BUILDING WASTE UNIT (643-11G)
OPERABLE UNIT (U)

WSRC-RP-98-4066
Revision 1
April 1999

Savannah River Site
Aiken, South Carolina

Prepared by:

Westinghouse Savannah River Company
For the
U. S. Department of Energy under Contract DE-AC09-96SR 18500
Savannah River Operations Office
Aiken, South Carolina

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ACRONYMS

2X	two times
ARARs	Applicable, or Relevant and Appropriate Requirements
bls	below land surface
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CM COCS	Contaminant Migration Constituents of Concern
COCs	Constituents of Concern
COPCs	Constituents of Potential Concern
ELCR	Excess Lifetime Cancer Risk
FBWU	Ford Building Waste Unit (643-11G)
FFA	Federal Facility Agreement
FIP	FFA Implementation Plan
ft.	feet
HI	Hazard Index
HQ	Hazard Quotient
km	Kilometer
m	Meter
mi.	Mile
pCi/g	Picocurie/gram
RAOs	Remedial Action Objectives
RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RGOs	Remedial Goal Options
RI	Remedial Investigation
ROD	Record of Decision
SCA	Soil Contamination Area
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulations
sq.	Square
SRS	Savannah River Site
TCHI	Total Cumulative Hazard Index
TCL	Target Compound List
TCR	Total Cumulative Risk
TICs	Tentatively Identified Compounds
TMR	Total Medium Risk
URMA	Underground Radioactive Materials Area
USCs	Unit-Specific Constituents
US DOE	U.S. Department of Energy
US EPA	U.S. Environmental Protection Agency
WSRC	Westinghouse Savannah River Company

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I. SITE NAME, LOCATION, AND DESCRIPTION

Savannah River Site (SRS) occupies approximately 800 sq. km (310 sq. mi.) of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. SRS is a secured U.S. Government facility with no permanent residents. SRS is located approximately 40 km. (25 mi.) southeast of Augusta, Georgia, and 32 kilometers (20 miles) south of Aiken, South Carolina.

SRS is owned by the U.S. Department of Energy (US DOE). Management and operating services are provided by Westinghouse Savannah River Company (WSRC). SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense.

The Ford Building Waste Unit (643-11G) (FBWU) is located near the center of the SRS (Figure 1). A photograph of the unit is provided as Figure 2. The FBWU now consists of a rectangular area measuring 9.1 to 10.4 m (30 to 34 ft) wide by 53.0 m (174 ft) long. Prior to a time-critical removal action in 1997, approximately one-half of the FBWU was marked with yellow chains and signs delineating an Underground Radioactive Materials Area (URMA). Additionally, the FBWU contained a Soil Contamination Area (SCA) of approximately 1 x 1 m (3 x 3 ft).

The FBWU is a source control and groundwater operable unit in the Fourmile Branch watershed (Figure 3). The Federal Facility Agreement (FFA) lists FBWU as a Resource Conservation and Recovery Act (RCRA)/Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) unit, requiring evaluation using an investigation/assessment process that integrates and combines the RCRA Facility Investigation (RFI) process with the CERCLA Remedial Investigation (RI) to determine the actual or potential impact to human health and the environment.

The FBWU is located in the industrial buffer zone of N Area (Central Shops) and will remain industrial use in the future, in accordance with SRS Citizen Advisory Board Recommendation #2. The unit is not located within an area expected for future Heavy Industrial (Nuclear Use) activity. Figure 4 (i.e., Figure 3-3 of FIP) is an enlarged section of the CAB Recommendation #2 map.

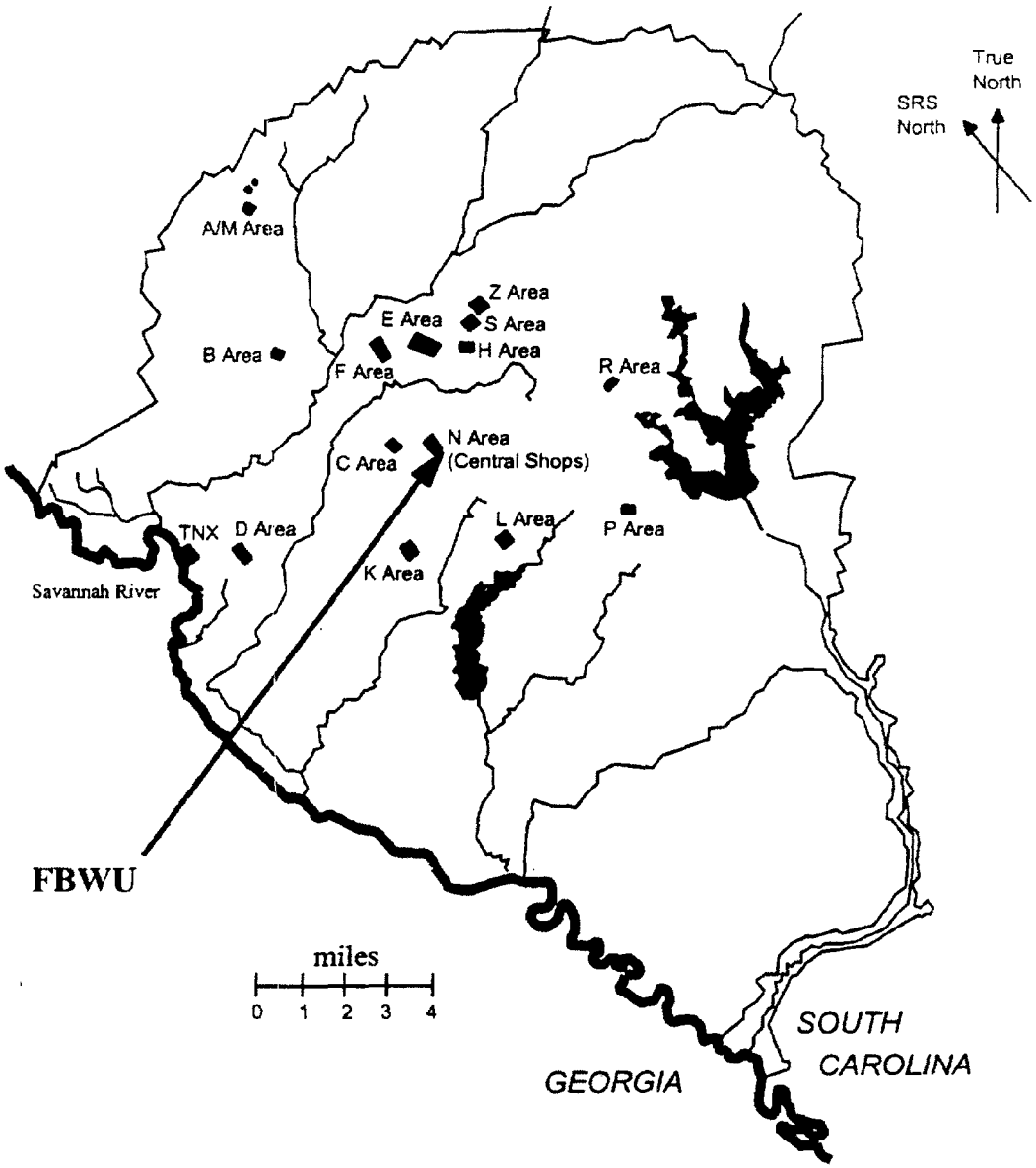

Figure 1. Location of FBWU at the SRS

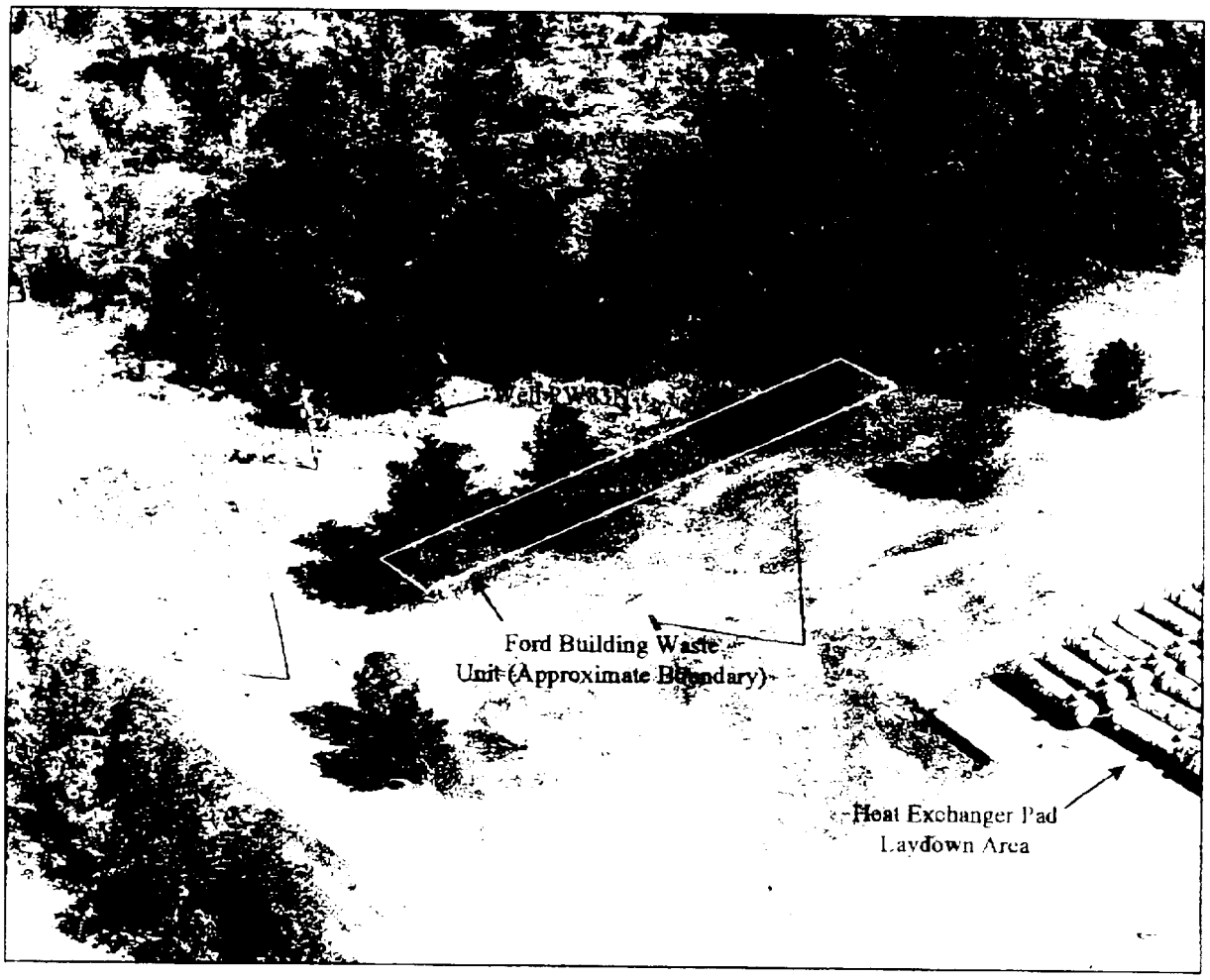

Figure 2. Oblique Aerial Photograph of the FBWU Area (April 1996)

Photograph was taken prior to the 1997 time-critical removal action; the unit is currently grass-covered with two mature pine trees remaining near the northwest corner of the unit (lower left side of the unit on the photograph).

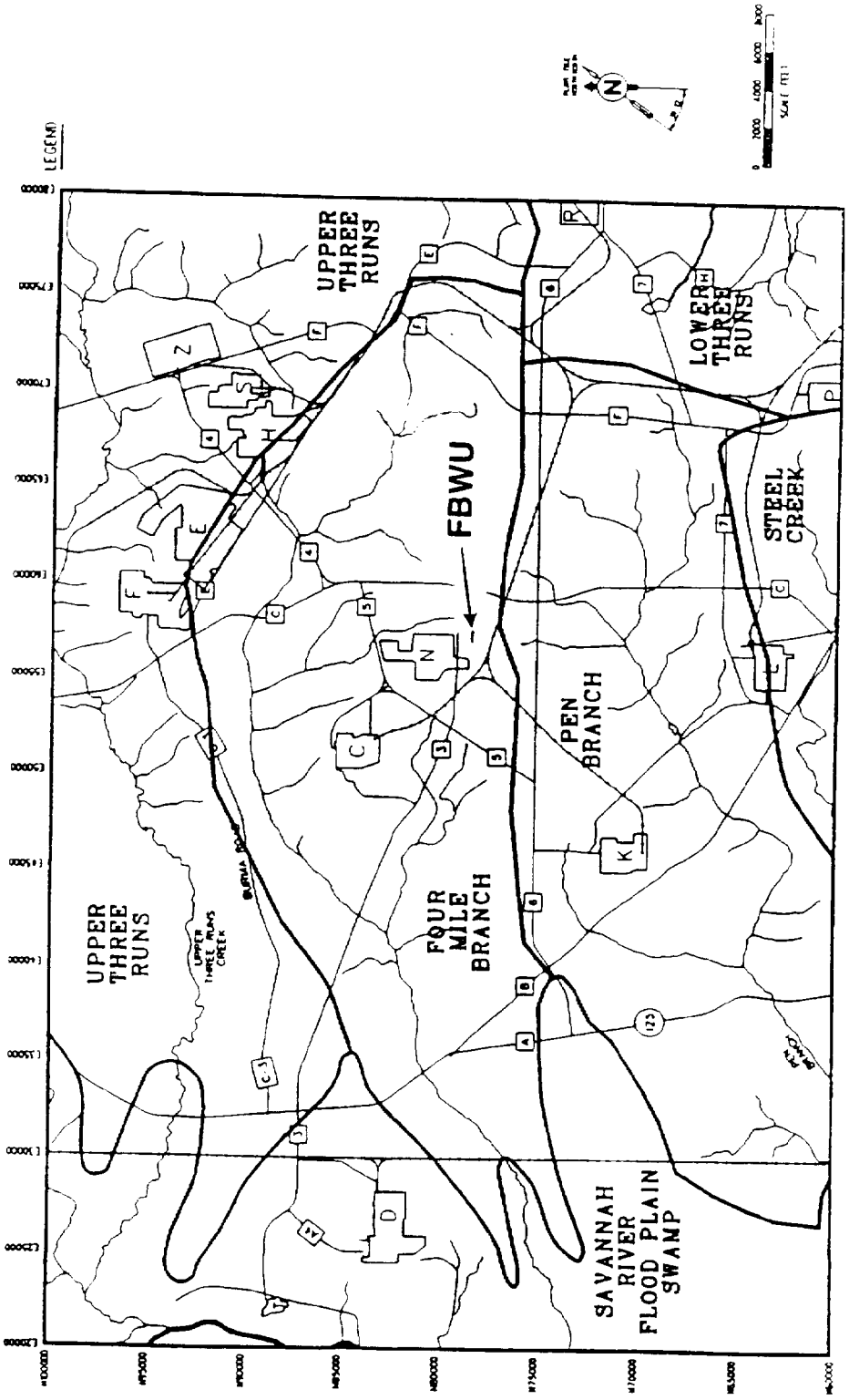

Figure 3. Location of FBWU in the Fourmile Branch Watershed

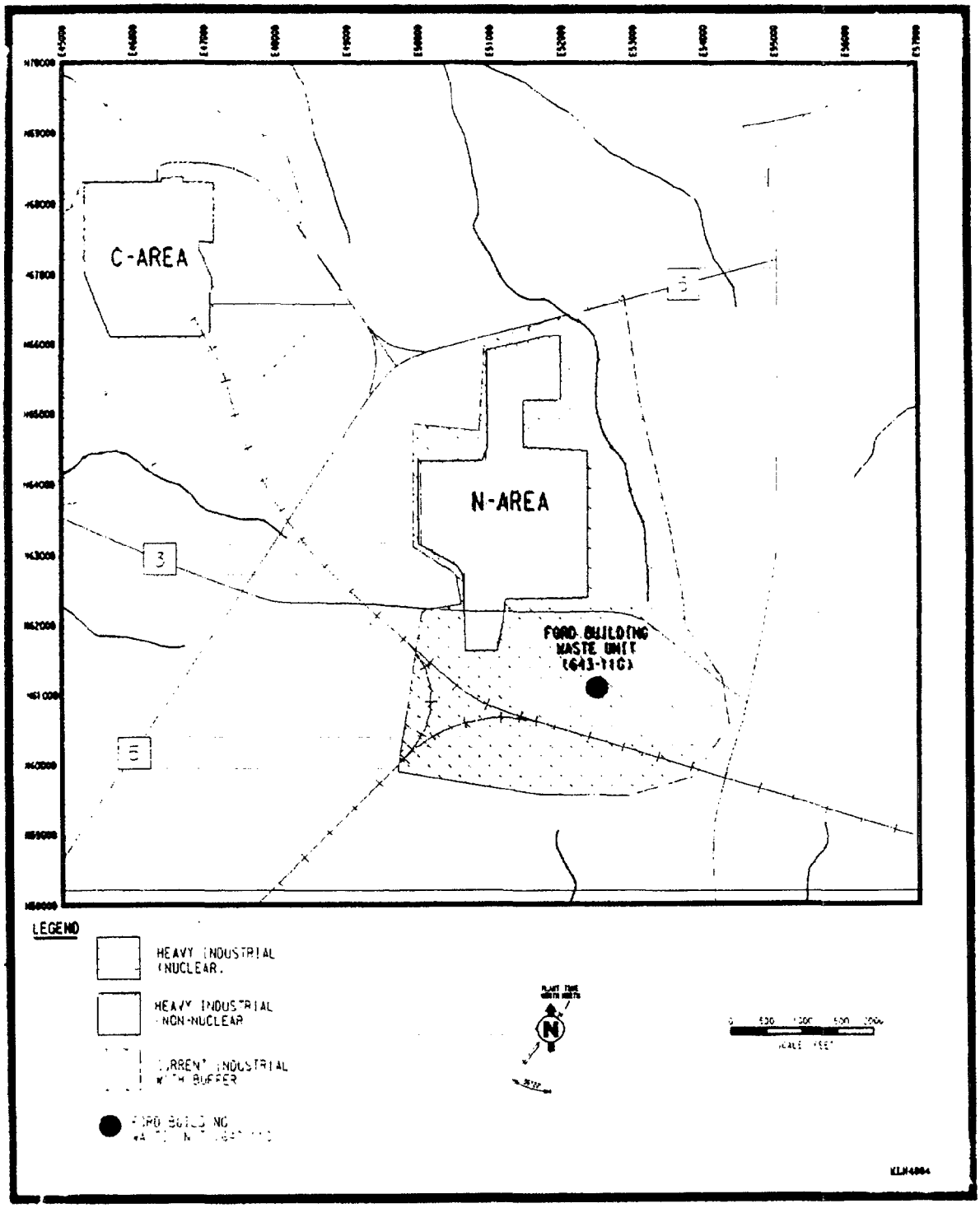

Figure 4. Central Shops Enlarged Figure 3-3 from the FIP

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

Operable Unit History

Operations with regulated radioactive equipment probably occurred at the FBWU (WSRC, 1998a). The nearby Ford Building was used for the reconfiguration and repair of reactor heat exchangers and other process equipment that had been decontaminated prior to receipt at the facility. There are no records of waste disposal for the FBWU. However, in the past, objects identified on the surface of the waste unit included shoe covers, step-off pads, coveralls, and rubber gloves. These are typical wastes from work performed in radiological controlled areas. In addition, a sign typically used to designate a radiologically controlled area marked the site. This sign, personal protective clothing, and contamination control equipment indicate that regulated work was performed at this location. All surface debris was removed from the unit in an undocumented removal sometime prior to 1992.

Cesium-137 was produced at SRS in tremendous quantities and is a ubiquitous SRS contaminant with a relatively long half-life (about 30 years). It is reasonable to conclude that the radiological work performed at this location resulted in releases of cesium-137 to the soil.

Low levels of radioactivity were detected at the FBWU in 1988 while grounds maintenance work was being performed. A subsequent radiation survey, conducted in 1990, also detected low levels of radioactivity (1 millirem per hour). As a result of these findings, the area was posted as a Soil Contamination Area (SCA) to protect site workers from inadvertent exposure. Additionally, a larger area was designated as an Underground Radioactive Materials Area (URMA) to indicate the possibility of buried material. However, subsequent Ground Penetrating Radar survey results, soil sampling results and a time-critical removal action demonstrated that there was no buried waste at the unit.

Based on pre-Work Plan analytical data, cesium-137 was detected at elevated levels in the surface and subsurface soils (Figure 5). A time-critical removal action was implemented in early 1997 to address these secondary sources of contamination. The time-critical removal action focused on removing secondary sources consisting of surface and subsurface soils that contained levels of cesium-137 above the time-critical removal action cleanup goal of 0.35 pCi/g. The cleanup goal was set to the unit-specific two times (2X) average background.

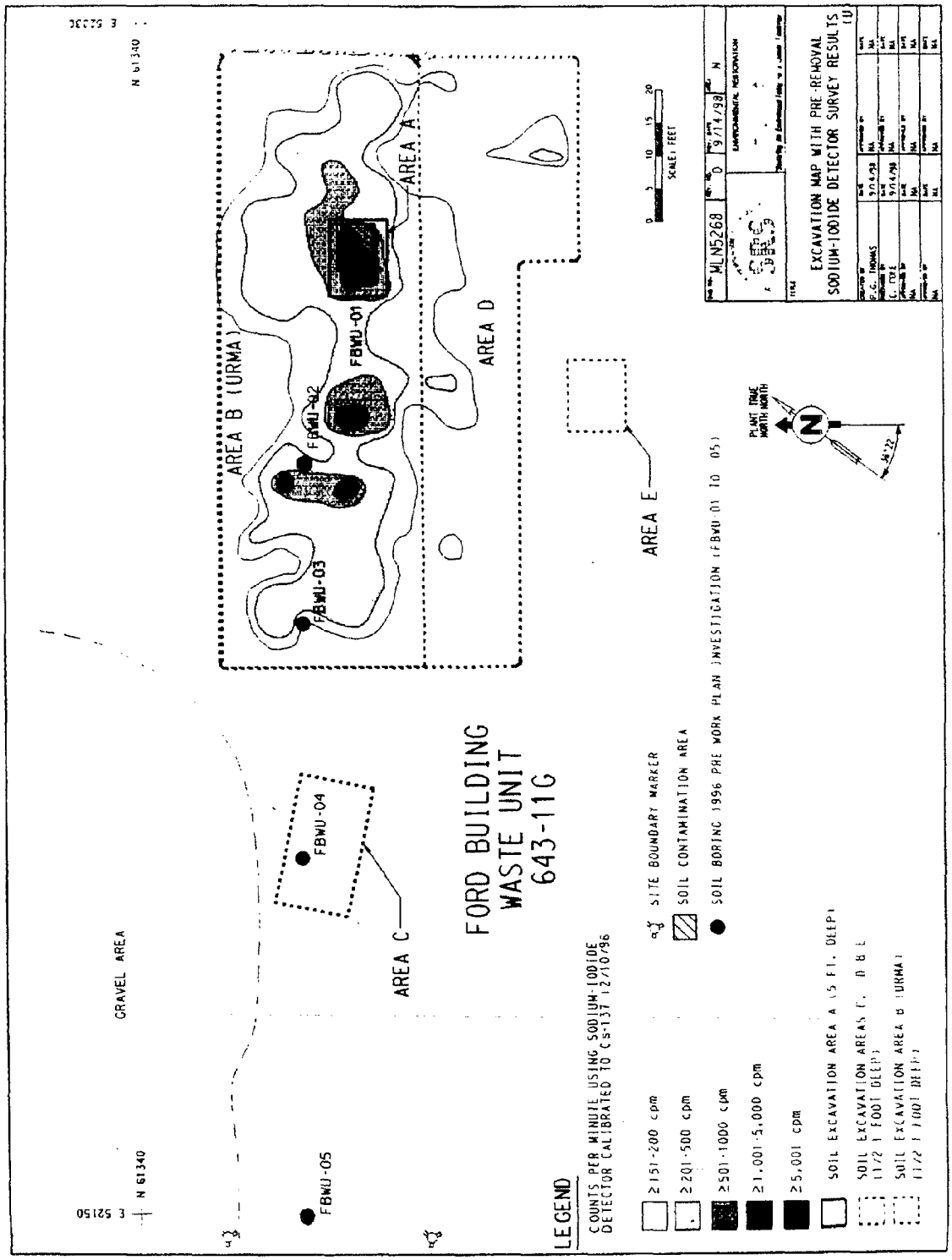

Figure 5. Excavation Map with Pre-Removal Cesium-Iodide Detector Survey Results

concentration using established protocols at the time. The goal of the time-critical removal action was to remove contaminated soil so that the concentrations and risks associated with cesium-137 in the remaining unit soils would be from those of background. The time-critical removal action was guided by analytical results of soil samples collected during the removal action and field surveys with a sodium-iodide detector calibrated for cesium-137. The following areas, depicted in Figure 5, were removed:

- The SCA and the area around boring FBWU-01 were excavated to a depth of approximately 1.5 m (5 ft) (Area A)
- The URMA was excavated to a depth of approximately 0.3 m (1 ft) (Area B)
- An area measuring approximately 3 x 6 m (10 x 20 ft.) west of the URMA around the site of soil boring FBWU-04 was excavated to a depth of approximately 0.15 m (0.5 ft) (Area C)
- An area of soil at the south perimeter of the URMA measuring 7.5 x 27 m (25 x 90 ft) was excavated to a depth of 0.15 to 0.3 m (0.5 to 1 ft) (Area D)
- An area of soil south of the URMA measuring 2.4 x 3.0 m (8 x 10 ft) was excavated to a depth of 0.15 to 0.3 m (0.5 to 1ft) (Area E)

A total of 96.3 m^3 (126 yd^3) of soil was removed. The waste was placed in skid pans and dispositioned to engineered trenches at the SRS Low Level Radioactive Waste Disposal Facility in E Area. The SRS radiological control organization removed the SCA postings and associated barricades after the time-critical removal action.

SRS Compliance History

Waste materials handled at SRS are regulated and managed under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities have required federal operating or post-closure permits under RCRA. SRS received a hazardous

waste permit from the South Carolina Department of Health and Environmental Control (SCDHEC); the permit was most recently renewed on September 5, 1995. Part V of the permit mandates that SRS establish and implement an RFI program to fulfill the requirements specified in Section 3004(u) of the federal permit.

On December 21, 1989, SRS was included on the National Priorities List. The inclusion created a need to integrate the established RFI program with CERCLA requirements to provide for a focused environmental program. In accordancewith Section 120 of CERCLA, US DOE has negotiated an FFA (FFA, 1993) with U.S. Environmental Protection Agency (US EPA) and SCDHEC to coordinate remedial activities at SRS into one comprehensive strategy to fulfill these dual regulatory requirements.

Operable Unit Compliance History

As previously stated, the FBWU is listed in the FFA as a RCRA/CERCLA unit requiring further evaluation to determine the actual or potential impact to human health and the environment. Because pre-Work Plan data indicated the need for a time-critical removal action, an RFI/RI Work Plan was not submitted and a Field Start date was omitted. A Removal Site Evaluation Report (WSRC, 1997) was submitted in September 1996, and the time-critical removal action was performed from January 8 to June 2, 1997. Results of the time-critical removal action were presented in the RFI/RI with Baseline Risk Assessment (BRA) (WSRC, 1998a). The RFI/RI/BRA was submitted in accordance with the FFA and the approved implementation schedule, and was approved by US EPA and SCDHEC in June 1998. By agreement between US EPA, SCDHEC, and US DOE, a "No Further Action" Statement of Basis/Proposed Plan was developed without the need for a Corrective Measures Study/Feasibility Study. The Statement of Basis/Proposed Plan was submitted in accordance with the FFA and the approved implementation schedule and was approved by the US EPA and SCDHEC in October 1998.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Both RCRA and CERCLA require that the public be given an opportunity to review and comment on the draft permit modification and proposed remedial remedy. Public

participation requirements are listed in South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial remedy for addressing the FBWU soils and groundwater. The Administrative Record File must be established at or near the facility at issue. The *SRS Public Involvement Plan* (US DOE, 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of a remedial solution. The *SRS Public Involvement Plan* addresses the requirements of RCRA. CERCLA, and the National Environmental Policy Act. SCHWMR R.61-79.124 and Section 117(a) of CERCLA, as amended, required the advertisement of the draft permit modification and notice of any proposed remedial action and provide the public an opportunity to participate in the selection of the remedial action. The *Statement of Basis/Proposed Plan for the Ford Building Waste Unit (643-11G)* (WSRC, 1998b), which is part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the FBWU.

The FFA Administrative Record File, which contains the information pertaining to the selection of the response action, is available at the US EPA office and at the following locations:

U.S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Asa H. Gordon Library
Savannah State University
Tompkins Road
Savannah, Georgia 31404
(912) 356-2183

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia. South Carolina 29208
(803) 777-4866

Reese Library
Augusta State University
2500 Walton Way
Augusta, Georgia 309 10
(706) 737-1744

The public was notified of the public comment period through the *SRS Environmental Bulletin*, a newsletter sent to approximately 3,500 citizens in South Carolina and Georgia, through notices in the *Aiken Standard*, the *Allendale Citizen Leader*, the *Augusta Chronicle*, the *Barnwell People-Sentinel*, and *The State* newspapers. The public comment period was also announced on local radio stations.

The 45-day public comment period for the Statement of Basis/Proposed Plan and the draft RCRA permit modification began on November 15, 1998, and ended on January 1, 1999. No comments were received during the public comment period.

IV. SCOPE AND ROLE OF OPERABLE UNIT WITHIN THE SITE STRATEGY

The overall strategy for addressing the FBWU was to (1) characterize the waste unit by delineating the nature and extent of contamination and identifying the media of concern (perform the RFI/RI); (2) perform a time-critical removal action; (3) perform a BRA to evaluate media of concern, constituents of concern (COCs), exposure pathways, and characterize potential risks; and (4) evaluate and perform a final action to remediate, as needed, the identified media of concern.

The FBWU is a source control and groundwater operable unit in the Fourmile Branch watershed. There are no ditches, drainage areas, or surface waters associated with the unit. An unnamed tributary of Fourmile Branch is located approximately 396 m (1,300 ft) to the north-northeast of the FBWU.

The SRS has recently concluded a surface and subsurface soil investigation at the FBWU. The unit was initially evaluated with another waste site, but based upon preliminary

characterization results. SCDHEC and US EPA concurred with US DOE's proposal to separate the operable unit into two operable units (i.e., the FBWU and the Fire Department Hose Training Facility). SCDHEC and US EPA also agreed that the investigation at the FBWU adequately characterized contamination within that unit and along potential migration pathways. This Record of Decision (ROD) will propose a final remedial action for the FBWU operable unit.

V. SITE CHARACTERISTICS

Media Assessment

The soil sampling activities conducted at the FBWU and background locations (Figures 6 and 7) provided data on the types and extent of constituents present. These data were supplemented by soil gas surveys conducted in 1986 and 1992 and field surveys with a sodium-iodide detector conducted in 1997. The primary source of contamination at the FBWU was miscellaneous radiological materials (removed prior to 1992). Secondary sources of contamination were surface and subsurface soils (removed by the time-critical removal action in 1997).

A conceptual site model was prepared which shows the potential human health and ecological receptors and exposure pathways to assist in determining what samples were needed during characterization. This conceptual site model is shown in Figure 8.

Pre-Work Plan sampling in 1996 consisted of five borings in the FBWU (FBWU-01 through -05) (Figure 7) and five background borings (FBFDBG-01 through -05) (Figure 6). Five depth intervals were sampled in each of these borings (0 to 0.3, 0.3 to 1.2, 1.2 to 2.1, 2.1 to 3.1, and 3.1 to either 4.0 or 4.3 m [0 to 1, 1 to 4, 4 to 7, 7 to 10, and 10 to either 13 or 14 ft] below land surface [bls]). Each sample was analyzed for a comprehensive suite of constituents including Target Analyte List inorganics with cyanide, Target Compound List (TCL) volatile organic compounds with tentatively identified compounds (TICs), TCL semivolatile organic compounds with TICs, pesticides, polychlorinated biphenyls, and radionuclides. Gamma speciation was performed on all pre-Work Plan samples; alpha and

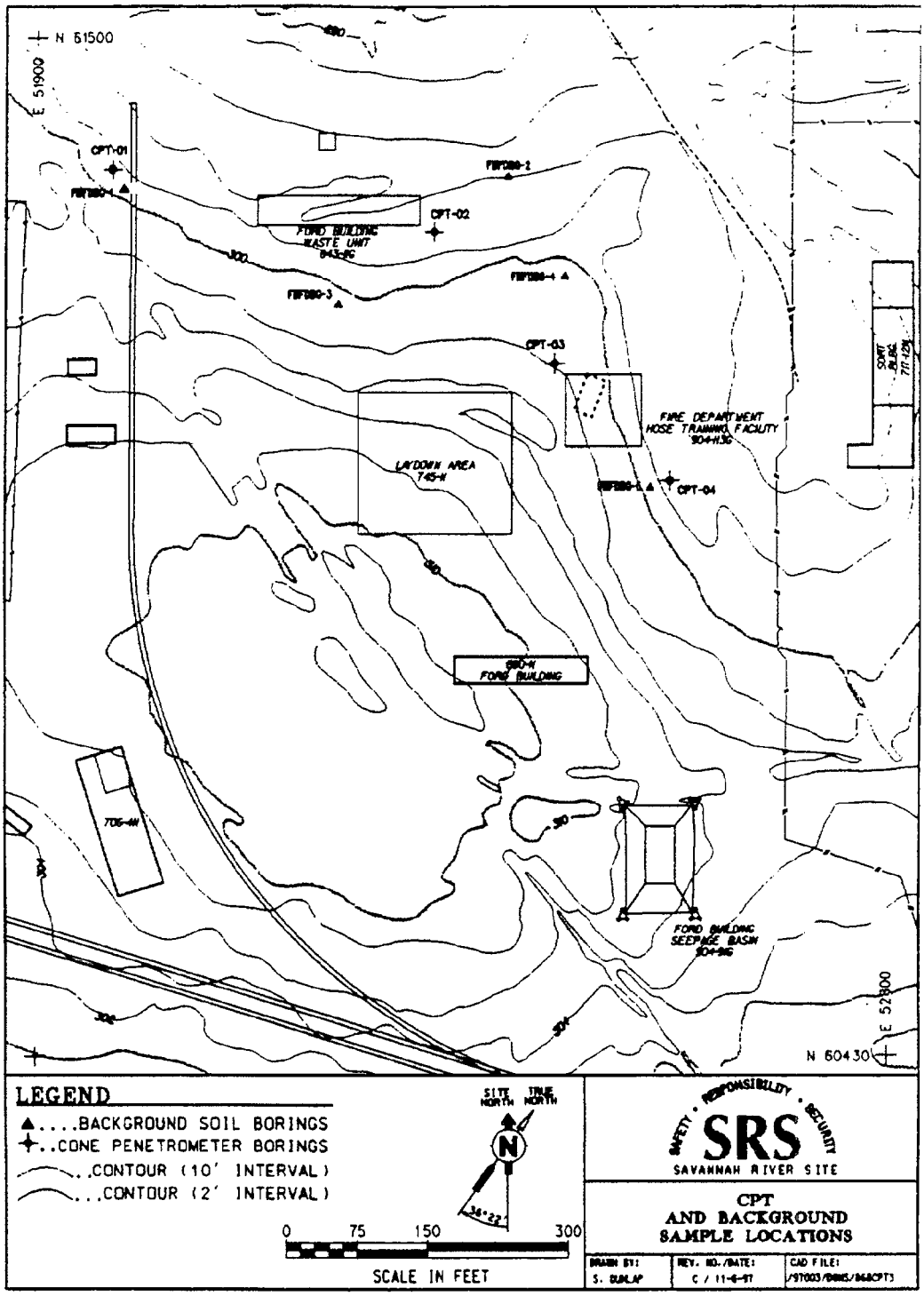

Figure 6. Location of Background Soil Borings

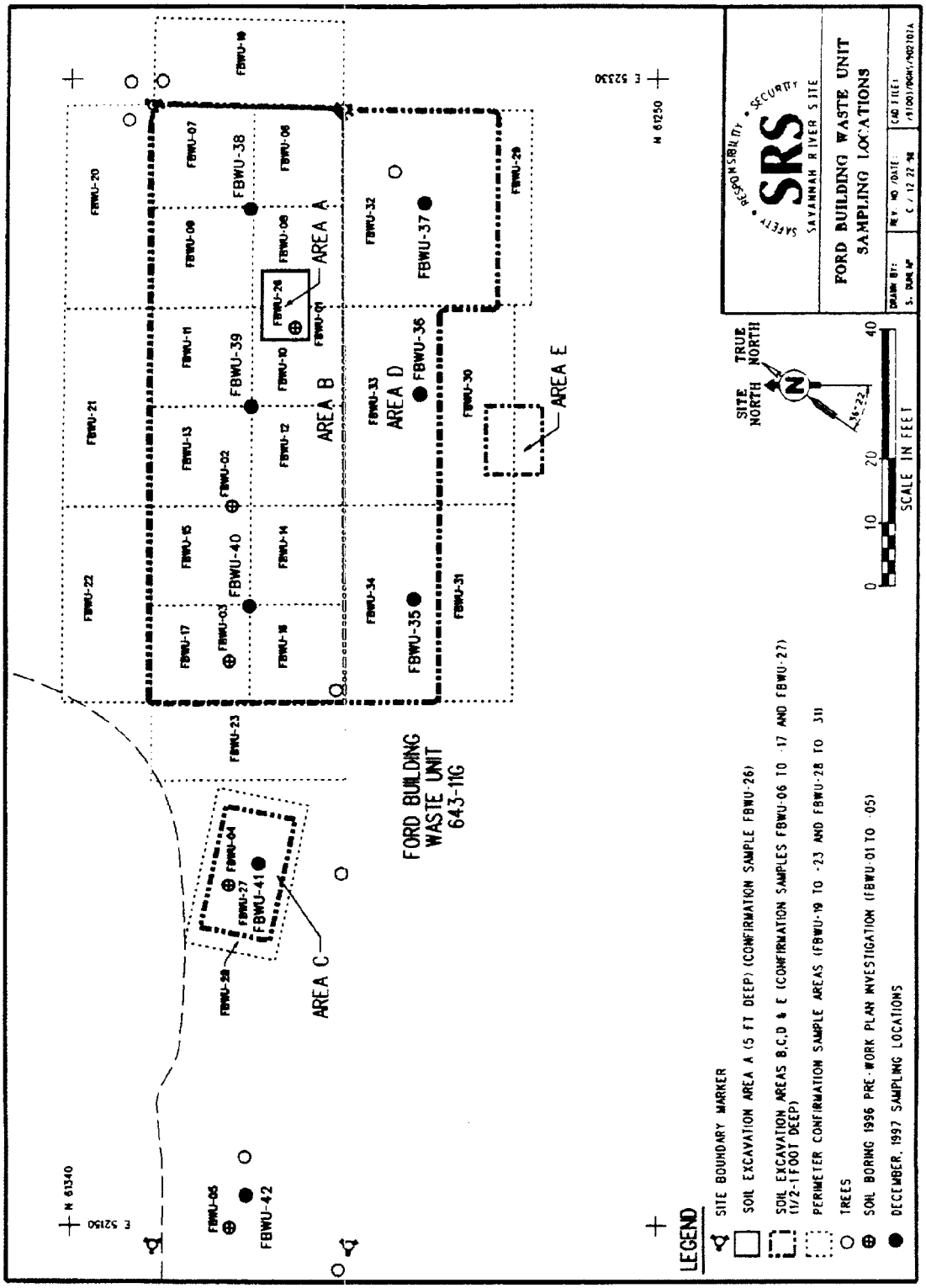

Figure 7. FBWU Sampling Locations

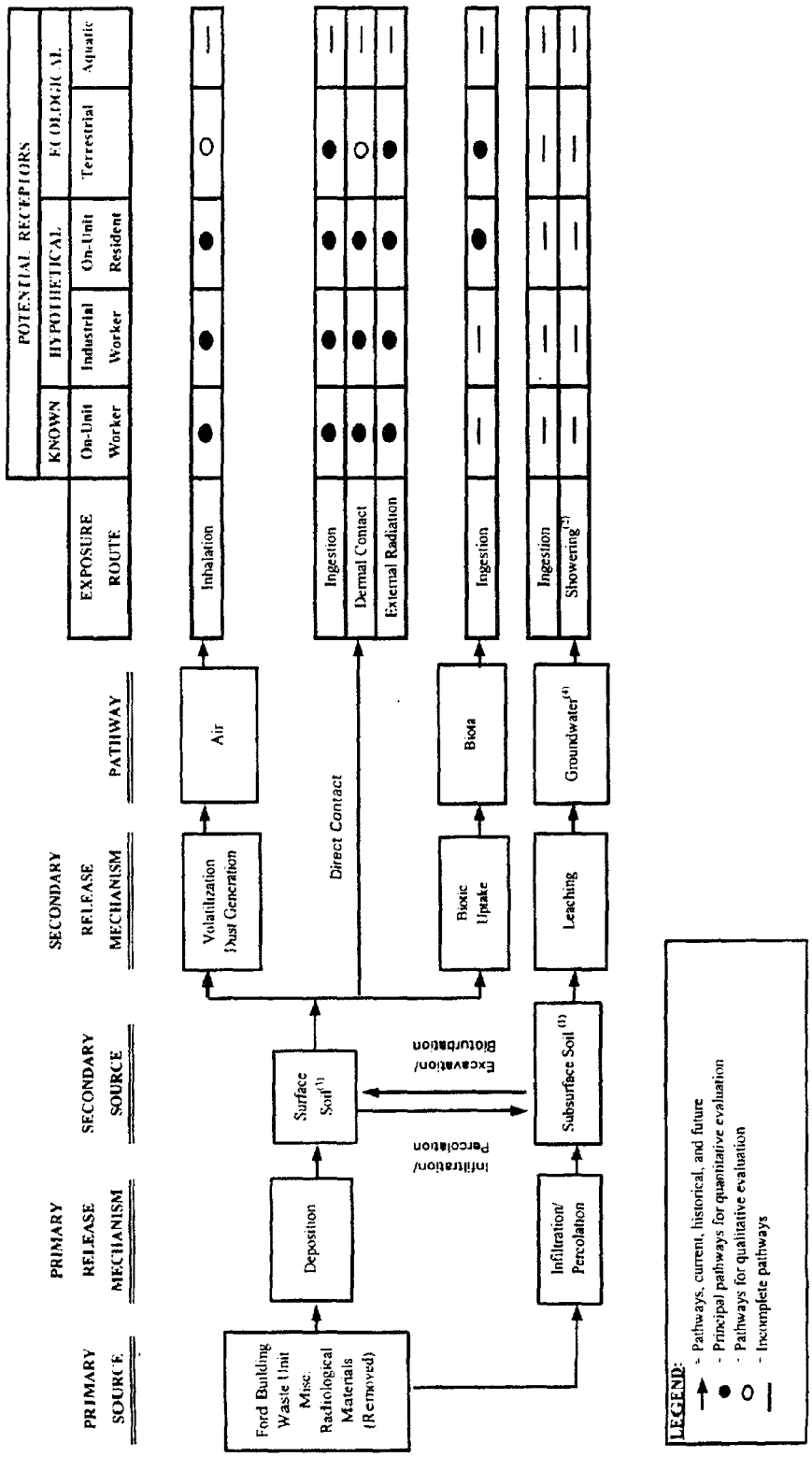

Figure 8. Conceptual Site Model for the FBWU

beta speciation was performed on selected samples. Alpha speciation included americum-241, radium-226, uranium-234. uranium-235. uranium-238. plutonium-238. plutonium-239, plutonium-240, plutonium-242. plutonium-244, thorium-228, thorium-230, and thorium-232; beta speciation included iodine-129, carbon-14, technetium-99, strontium-90, promethium-147, and radium-228. The sampling program was designed to establish the presence or absence of hazardous and/or radiological substances at the FBWU. The maximum detected concentration for each constituent was compared to 2X the average background concentration to identify unit-specific constituents (USCs). Based on the analytical data, cesium-137 was targeted for remediation. Using protocols established at the time, a 2X average background concentration of 0.35 pCi/g for cesium-137 was used as the time-critical removal action cleanup goal (WSRC, 1998a).

Composite confirmatory soil samples were collected during the time-critical removal action to guide soil removal. Samples were collected from the floors of the excavations as well as from unexcavated areas around the lip of each excavation (perimeter samples) (Figure 7). These samples were composite samples of five individual soil aliquots collected in each sampling area. The composite soil samples were split into two sets. One set was screened onsite by WSRC for cesium-137 to facilitate decision making during the time-critical removal action. If the cesium-137 concentration in any sample exceeded the time-critical removal action cleanup goal, additional soil was removed from that area and the area was sampled and screened again. If the onsite screening indicated the cesium-137 concentration was below the time-critical removal action cleanup goal, the excavation stopped and the remaining split sample set was sent to an US EPA-approved laboratory for analysis and verification(WSRC, 1998a). The time-critical removal action was considered complete when the cesium-137 concentrations,as determined by the US EPA-approved laboratory did not exceed the time-critical removal action cleanup goal of 0.35 pCi/g. Figure 7 shows the locations of 26 of the 29 composite confirmatory sample locations. The other three samples were collected from Area D and were removed by subsequent excavation (Figure 7). Contaminated soil and exhumed tree roots were the only materials removed under the time-critical removal action. The waste was placed in skid pans and dispositioned to engineered trenches at the SRS Low Level Radioactive Waste Disposal Facility in E Area

(WSRC, 1998a). The SRS radiological control organization removed the SCA postings and associated barricades within the unit and declared the unit unrestricted.

After the time-critical removal action, 16 discrete, location-specific surface soil (0 to 0.3 m [0 to 1 ft] bls) and subsurface soil (0.3 to 1.2 m [1 to 4 ft] bls) samples were collected in December 1997 and analyzed for cesium-137 (borings FBWU-35 to -42). Cesium-137 was detected in six of the eight surface soil samples. The detected concentrations ranged from a minimum of 0.07 pCi/g (location FBWU-35) to a maximum of 0.22 pCi/g (location FBWU-37) with an average surface soil concentration of 0.095 pCi/g. No point sources of cesium-137 contamination were apparent. Cesium- 137 was below method detection limits in all subsurface samples.

Due to the small areal extent of the unit (<464 m^2 [<5,000 ft^2]), the surface and near surface location of the contamination (<3 m [<10 ft] bls), the distance from contamination to the water table (13.7 to 16.8 m [45 to 55 ft] bls), the high percentage of clays in the top 9.1 m (30 ft) of soil, and the affinity for cesium-137 to bind to clays, the FBWU was not considered a likely source of groundwater contamination. Consequently, the investigation of groundwater was not part of the pre-Work Plan characterization. However, a fate and transport analyses were performed as part of the RFI/RI/BRA evaluation.

Fate and transport analyses conducted for USCs identified at the FBWU revealed selenium and potassium-40 exceed the unit-specific soil screening levels. The predicted maximum concentration in groundwater for both exceeded the corresponding groundwater Applicable, or Relevant and Appropriate Requirements (ARARs), consequently, selenium and potassium-40 were retained as preliminary contaminant migration constituents of concern (CM COCs). Both preliminary CM COCs were eliminated in the uncertainty analysis, and no final CM COCs were retained at the FBWU.

VI. SUMMARY OF SITE RISKS

As a component of the remedial investigation process, a BRA was prepared for the FBWU. The BRA consists of human health and ecological risk assessments. Summary information for the human health and ecological risk assessments follows.

The environmental data used in the risk assessments, including the sample intervals, sample locations, and sample identification numbers, can be found in *RCRA Facility Investigation/Remedial Investigation Report with Baseline Risk Assessment for the Ford Building Waste Unit (643-11G)* (WSRC, 1998a).

Human Health Risk Assessment

The human health risk assessment characterizes both the potential risk from exposure to carcinogenic substances and adverse health effects from noncarcinogens to human receptors exposed to unit-related constituents under current and future land use conditions (Figures 9 and 10). The risks listed in this section were derived from the BRA (WSRC, 1998a) which used the data obtained from the RFI/RI characterization.

The BRA designates the constituents of potential concern (COPCs) based on a conservative screen against background concentrations and the relative potential of the chemicals to cause toxic or carcinogenic effects. Constituents soil concentrations that produce a threshold risk less than the risk-based concentration levels are screened from further analysis. Threshold risk is defined as constituent concentrations that exceed either a cancer risk of $1E10^{-6}$ or a hazard quotient (HQ) of 0.1. At the FBWU, identified COPCs included cesium-137 and beryllium.

Three land use assumptions were made to describe the human receptors that may be exposed to these constituents. Potential receptors are expected to differ for the current and future land use scenarios. The possible receptor under the current land use scenario includes the known on-unit worker. The possible receptors under the future land use scenario include the on-unit industrial worker and the on-unit resident (adult and child).

Carcinogenic risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of pathway-specific exposure to cancer-causing contaminants. The risk to an individual resulting from exposure to non-radioactive chemical carcinogens is expressed as the increased probability of cancer occurring over the course of a 70-year lifetime. Cancer risks are related to the US EPA target risk range of one in ten thousand ($1E\ 10^{-4}$) to one in one million ($1E\ 10^{6}$) for incremental cancer risk at National Priorities List sites. Risk levels greater than $IE\ 10^{6}$ require a risk management decision

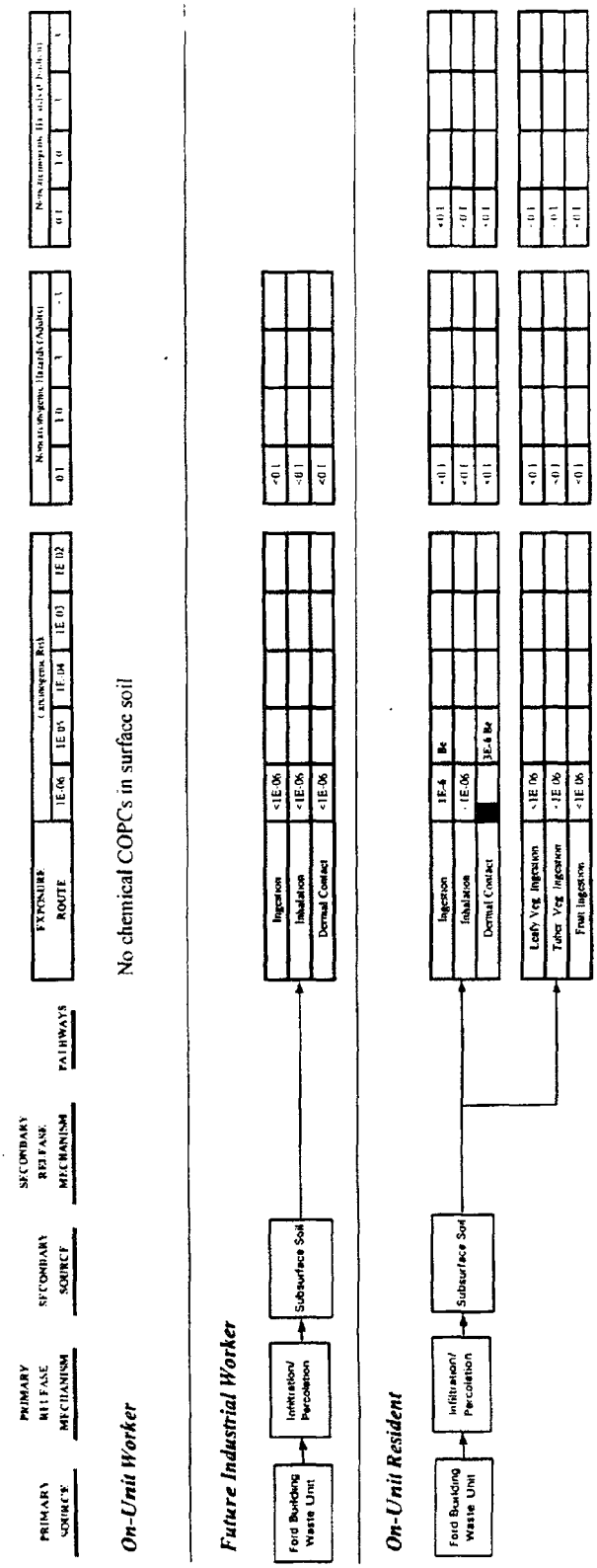

Figure 9. Summary of Chemical Risks and Hazards Across Pathways

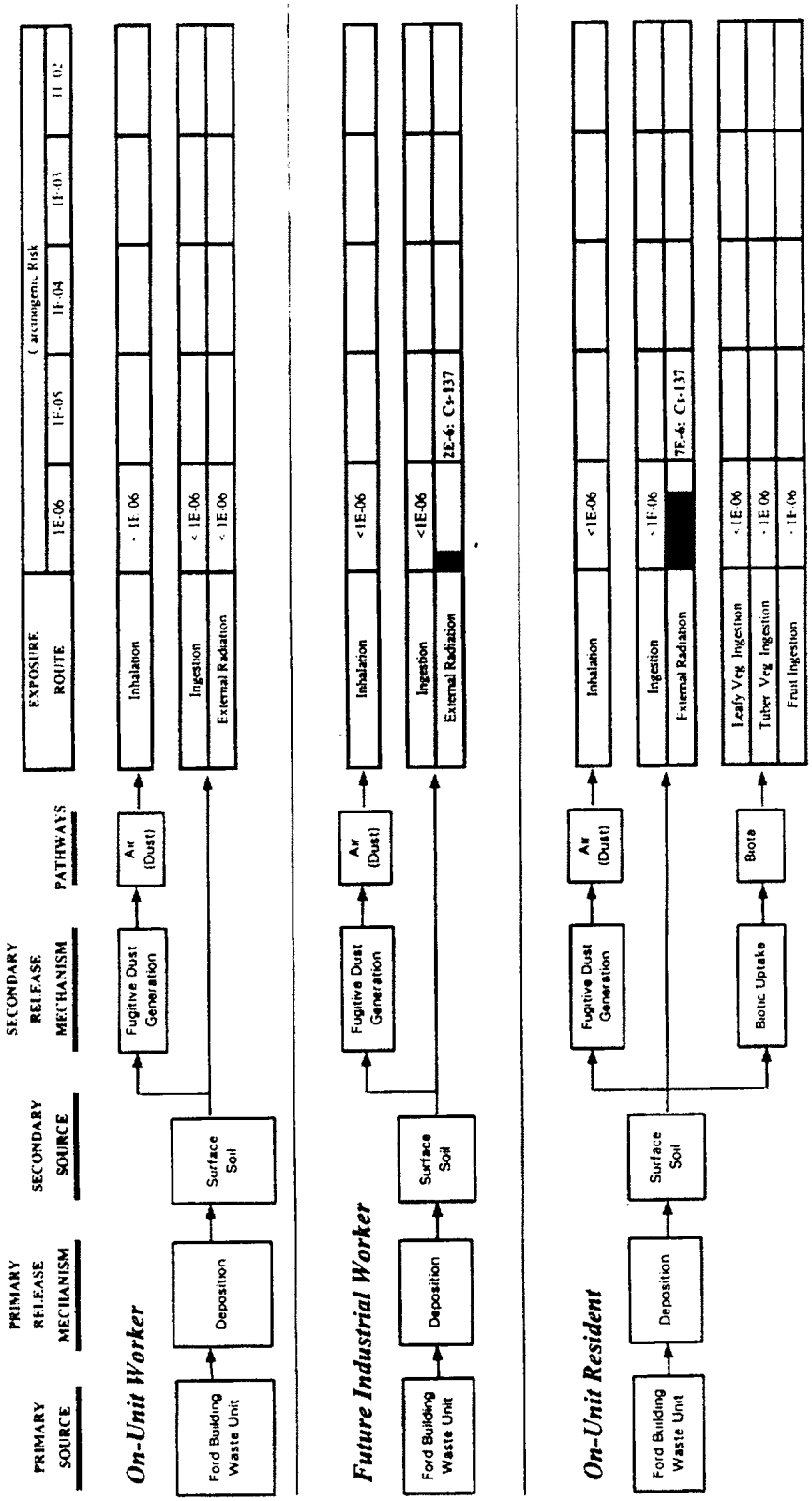

Figure 10. Summary of Radiological Risks Across Pathways

where specific actions to reduce risk may be considered, while cancer risk levels below 1 x 10^{-6} are considered to be insignificant.

Non-carcinogeniceffects are also evaluated to identify a level at which there may be concern for potential non-carcinogenic health effects. The HQ, which is the ratio of the exposure dose to the reference dose, is calculated for each contaminant. HQs are summed for each exposure pathway to determine the specific hazard index (HI) for each exposure scenario. If the HI exceeds unity (1.0), the potential exists that adverse health effects might occur.

The following sections discuss the excess lifetime cancer risk (ELCR) and combined HI values that were determined in the BRA for current workers, future industrial workers, and the future residential child/adult. A summary of the human health risks for the various land use scenarios is provided in the following sections, Figures 9 and 10, and Tables 1 through 3.

Current Worker

The current worker was evaluated for the 0 to 0.3 m (0 to 1 ft) bls soil interval only. There are no chemical COPCs in the surface soil at the FBWU. Therefore, chemical carcinogenic risks and chemical noncarcinogenic hazards were not calculated for the known on-unit worker (Figure 9). Under the current land use scenario, radiological risks from cesium-137 are characterized for ingestion, external radiation exposure, and inhalation exposure to surface soil (Figure 10). The total medium risk TMR) for the known on-unit worker based on the summation of exposure routes is 6E 10^{-9}. All of the estimated risks are less than 1E 10^{-6}, indicating that radiological risk is insignificant at the unit under current conditions.

Future Industrial Worker

The industrial worker was evaluated for the 0 to 0.3 m (0 to 1 ft) bls and 0 to 1.2 m (0 to 4 ft) bls soil intervals. Carcinogenic risks and noncarcinogenic hazards associated with beryllium were calculated for the hypothetical on-unit industrial worker from exposure to redistributed subsurface soil and air (Figure 9). Radiological risks associated with cesium-137 were calculated for the hypothetical on-unit industrial worker exposed to cesium-137 in surface soils and air (Figure 10).

Table 1. Risk Characterization Summary: Current Land Use Scenario – Surface Soil

Medium	Exposure Route	Chemicals				Radionuclides
		Noncancer HI		Cancer Risk		Cancer Risk
		On-Unit Worker		On-Unit Worker		On-Unit Worker
Soil	Ingestion	0E+00	B	0E+00	B	1E-11
	Dermal/External	0E+00	B	0E+00	B	6E-09
	Inhalation	0E+00	B	0E+00	B	5E-16
	Subtotal	0E+00	B	0E+00	B	6E-09
Leafy Vegetables	Ingestion	NA		NA		NA
Tuberous Vegetables	Ingestion	NA		NA		NA
Fruits	Ingestion	NA		NA		NA
	Subtotal	NA		NA		NA
Chemical Exposures						
Combined Hazard Index:		0E+00	B			
Combined Cancer Risk:				0E+00	B	
Radiological Exposures						
Combined Cancer Risk						6E-09

NA - pathway not evaluated
OE + 00 - pathway evaluated but no risks could be calculated due to lack of US EPA-approved toxicity values
B - HI # 1 or ELCR # 10^{-6}
E - HI > 1 OR ELCR > 10^{6}

Table 2. Risk Characterization Summary: Future Land Use Scenarios – Surface Soil

Medium	Exposure Route	Chemicals										Radionuclides	
		Noncancer HI						Cancer Risk				Cancer Risk	
		Resident				Industrial				Industrial			
		Child		Adult		Worker		Resident		Worker		Resident	Worker
Soil	Ingestion	0E+00	B	0E+00	B	0E+00	B	0E+00	B	0E+00	B	9E-09	2E-09
	Dermal/External	0E+00	B	0E+00	B	0E+00	B	0E+00	B	0E+00	B	7E-06	2E-06
	Inhalation	0E+00	B	0E+00	B	0E+00	B	0E+00	B	0E+00	B	2E-13	1E-13
	Subtotal	0E+00	B	0E+00	B	0E+00	B	0E+00	B	0E+00	B	7E-06	2E-06
Leafy Vegetables	Ingestion	0E+00	B	0E+00	B	NA		0E+00	B	NA		4E-08	NA
Tuberous Vegetables	Ingestion	0E+00	B	0E+00	B	NA		0E+00	B	NA		8E-08	NA
Fruits	Ingestion	0E+00	B	0E+00	B	NA		0E+00	B	NA		8E-07	NA
	Subtotal	0E+00	B	0E+00	B	NA		0E+00	B	NA		1E-06	NA
Chemical Exposures													
Combined Hazard Index:		0E+00	B	0E+00	B	0E+00	B						
Combined Cancer Risk:								0E+00	B	0E+00	B		
Radiological Exposures													
Combined Cancer Risk												8E-06	2E-06

NA - pathway not evaluated
0E+00 - pathway evaluated but no risks could be calculated due to lack of US EPA-approved toxicity values
B - HI # 1 or ELCR # 10^{-6}
E - HI > 1 or ELCR > 10^{-6}

Table 3. Risk Characterization Summary: Future Land Use Scenarios – Subsurface Soil

Medium	Exposure Route	Chemicals										Radionuclides	
		Noncancer HI						Cancer Risk				Cancer Risk	
		Resident				Industrial				Industrial			
		Child		Adult		Worker		Resident		Worker		Resident	Worker
Soil	Ingestion	5E-04	B	5E-05	B	2E-05	B	1E-06	B	1E-07	B	0E+00	0E+00
	Dermal/External	4E-04	B	3E-04	B	1E-04	B	3E-06	B	9E-07	B	0E+00	0E+00
	Inhalation	0E+00	B	0E+00	B	0E+00	B	6E-11	B	2E-11	B	0E+00	0E+00
	Subtotal	9E-04	B	3E-04	B	1E-04	B	4E-04	B	1E-06	B	0E+00	0E+00
Leafy Vegetables	Ingestion	4E-05	B	3E-05	B	NA		3E-07	B	NA		0E+00	NA
Tuberous Vegetables	Ingestion	3E-05	B	2E-05	B	NA		2E-07	B	NA		0E+00	NA
Fruits	Ingestion	8E-05	B	5E-05	B	NA		5E-07	B	NA		0E+00	NA
	Subtotal	2E-04	B	9E-05	B	NA		1E-06	B	NA		0E+00	NA
Chemical Exposures													
Combined Hazard Index:		1E-03	B	4E-04	B	1E-04	B						
Combined Cancer Risk:								5E-06	B	1E-06	B		
Radiological Exposures													
Combined Cancer Risk												0E+00	0E+00

NA - pathway not evaluated
0E+00 - pathway evaluated but no risks could be calculated due to lack of US EPA-approved toxicity values
B - HI # 1 or ELCR # 10^{-6}
E - HI > 1 or ELCR > 10^{-6}

Carcinogenic Risk: For subsurface soil, the TMR for the hypothetical on-unit industrial worker based on the summation of exposure routes is 1E 10^{-6}. All of the estimated risks by pathway are less than 1E 10^{-6} (ingestion of soil = 1E 10^{-7}, dermal contact with soil = 9E 10^{-7}, and inhalation of particulate from soil = 2E 10^{-11}). Under future conditions, chemical risk for the industrial worker is insignificant at the unit.

Noncarcinogenic Hazard: For subsurface soil, the total cumulative hazard index (TCHI) for the hypothetical on-unit industrial worker based on the summation of exposure routes is 1E 10^{-1}. The HIs for all pathways are well below 1. All of the estimated hazards by pathway are well below 1. Under future conditions, chemical hazard for the industrial worker is insignificant at the unit.

Radiological Risk: For surface soil, the TMR for the hypothetical on-unit industrial worker based on the summation of exposure routes is 2E 10^{-6}. Radiological risks were estimated for three soil exposure routes: ingestion of soil (2E 10^{-9}); direct, external radiation exposure from soil (2E 10^{-6}); inhalation of particulate from soil (1E 10^{-13}). Cesium-137 is a preliminary COC for the external radiation exposure pathway.

Residential Adult/Child

The residential scenario was evaluated at the 0 to 0.3 m (0 to 1 ft) bls and the 0 to 1.2 m (0 to 4 ft) bls soil intervals. Under the future land use scenario, carcinogenic risks and noncarcinogenic hazards associated with beryllium were calculated for the hypothetical on-unit resident (adult and child) from exposure to redistributed subsurface soils, air, and homegrown produce (Figure 9). Radiological risks associated with cesium-137 were calculated for the hypothetical on-unit resident from exposure to surface soils, air, and homegrown produce (Figure 10).

Carcinogenic Risk: For subsurface soil, the total cumulative risk (TCR) for the hypothetical on-unit resident based on the summation of exposure routes and media is 5E 10^{-6} (soil TMR = 4E 10^{-6}, produce TMR = 1E 10^{-6}) . Estimated risks equal or exceed 1E 10^{-6} for both soil and produce pathways. Chemical risks were estimated for three soil exposure routes: ingestion of soil (1E 10^{-6}) , dermal contact with soil (3E 10^{-6}) , and inhalation of particulate from soil

(6E 10^{-11}). Chemical risks were estimated for three produce exposure routes: ingestion of leafy vegetables (3E 10^{-7}), ingestion of tuberous vegetables (2E 10^{-7}), and ingestion of fruits (5E 10^{-7}). Beryllium is a preliminary COC for the dermal contact and ingestion pathways.

Noncarcinogenic Hazard: Based on the summation of exposure routes and media. the TCHIs for the hypothetical on-unit resident child and adult are 1E 10^{-3} and 4E 10^{-4}, respectively. The HIs for all pathways are well below 1, indicating that chemical hazard for the hypothetical on-unit resident is insignificant.

Radiological Risk: For surface soil, the TCR for the hypothetical on-unit resident based on the summation of exposure routes and media is 8E 10^{-6} (soil TMR = 7E 10^{-6}, produce TMR = 1E 10^{-6}). Radiological risks were estimated for three soil exposure routes: ingestion of soil (9E 10^{-9}); direct, external radiation exposure from soil (7E 10^{-6}); inhalation of particulate from soil (2E 10^{-13}) . Radiological risks were estimated for three produce exposure routes: ingestion of leafy vegetables (4E 10^{-8}), ingestion of tuberous vegetables (8E 10^{-8}), and ingestion of fruits (8E 10^{-7}). Cesium-137 is a carcinogenic preliminary COC for the external radiation pathway.

Ecological Risk Assessment

The ecological BRA for the FBWU evaluated the likelihood of harmful effects to ecological receptors from exposure to contaminants in soil. Ecological receptors serve as assessment endpoints for the risk to plant and animal populations and ecosystems at FBWU.

COPCs are those constituents whose maximum measured concentrations exceeded a toxicity screening value for ecological receptors and 2X the background mean concentration. No ecological COPCs were identified from among constituents detected at FBWU. Therefore, all exposure pathways are incomplete and the calculation of ecological HQs for current and future exposure of ecological receptors was not required. Consequently, no preliminary COCs were carried forward into the uncertainty analysis and no ecological final COCs were retained.

Uncertainty

Preliminary CM COCs identified by the fate and transport analyses and preliminary COCs identified during the risk assessment are evaluated through an uncertainty analysis to determine final COCs. Remedial goal options (RGOs), which become the basis of and the focus for remediation are developed for the list of final COCs.

Fate and transport analyses identified selenium and potassium-40 as preliminary CM COCs. The human health risk assessment identified no preliminary COCs for surface soil under the current land use. Under future industrial land use, cesium-137 was identified as a preliminary COC for surface soil. Under future residential land use, cesium-137 was identified as a preliminary COC for surface soil, and beryllium was identified as a preliminary COC for subsurface soil.

Following the uncertainty analysis, no constituents were retained as final COCs and no RGOs were developed. Key uncertainties for each preliminary COC are summarized below.

Potassium-40 was not retained as a final CM COC for the following reasons:

- At the FBWU, potassium-40 concentrations range from 0.83 pCi/g to 3.51 pCi/g. The observed range in background values is virtually identical, 0.76 pCi/g to 3.5 pCi/g. There does not appear to be a difference between the observed unit and background values and, using present protocols, both unit and background data sets fail the background screen.

- Potassium-40 is a naturally occurring radionuclide present in soils at the SRS. There is no process history of potassium-40 use associated with FBWU and no reason to postulate that it would be associated with the regulated activities that are suspected to have occurred there.

- Potassium-40 was detected in all of the unit samples analyzed. The values that exceed the 2X background screen are greater than 1.2 m (4 ft) deep and are probably associated with natural soil profile development. They are not near the surface where the primary source for this unit was located.

Selenium was not retained as a final CM COC for the following reasons:

- At the FBWU. selenium concentrations range from 1.5 mg/kg to 3.4 mg/kg. The observed range in background values is similar, 0.416 mg/kg to 2.9 mg/kg. The unit and background values are similar and, using present protocols, both data sets fail the background screen.

- The laboratory results for selenium are highly questionable. The laboratory method used to identify selenium (inductively coupled plasma) often results in false positives from spectral interference when elevated levels of iron are present in the sample. Review of the unit data found that in all cases where selenium values exceed the background levels, elevated iron concentrations are present in the same sample. The selenium values are therefore viewed as false positives.

- Selenium is a naturally occurring metal. There is no process history of selenium use associated with FBWU and no reason to postulate that it would be associated with the regulated activities that are suspected to have occurred there.

- Selenium was detected in only 5 of 20 samples. The detections are at depth, not near the surface where the primary source for this unit was located. The associated high iron values are probably associated with natural soil profile development.

Beryllium was not retained as a final COC for the following reasons:

- Within the subsurface soils, beryllium concentrations range from 0.09 mg/kg to 0.21 mg/kg. The observed range in background values is comparable, 0.04 mg/kg to 0.20 mg/kg. The 2X average background screening value is 0.15 mg/kg and the RBC screening value is also 0.15 mg/kg. The observed unit and background values are indistinguishable, and using present protocols, both unit and background data sets fail the background and RBC screens.

- Beryllium is a naturally occurring metal present in soils at the SRS. There is no process history of beryllium use associated with FBWU, and no reason to postulate that it would be associated with the regulated activities that are suspected to have occurred there.

- Beryllium is a preliminary COC in subsurface soils at the FBWU for the hypothetical future resident scenario only. The cancer risk associated with this preliminary COC is 4E 10^{-6}. Background risk associated with beryllium for the future resident yields a similar value (2E 10^{-6}).

Cesium-137 was not retained as a final COC for the following reasons:

- Only 1 of the 8 surface soil samples from the discrete, post-removal sampling event in December 1997 slightly exceeded the 2X average background value for cesium-137 i.e., 0.22 pCi/g unit vs. 0.19 pCi/g background). Cesium-137 was not detected in subsurface soils.

- The single cesium-137 value that exceeded 2X background is located on the perimeter of the waste unit and represents backfill from the Central Shops Borrow Pits.

- Cesium-137 background values for surface soil at the Central Shops Burning Rubble Pits, which are adjacent to the Borrow Pit, ranged from 0.101 – 0.338 pCi/g. The maximum unit value of 0.22 pCi/g for cesium-137 is within this range.

- Cesium-137 background values from 16 waste sites at SRS were reviewed. As reported in the Preliminary Background Soils Study Report (US DOE, 1996), the 2X average background value for cesium-137 in surface soils is 0.213 pCi/g with a maximum background value of 0.57 pCi/g. The 90th percentile for the SRS background surface soils is 0.258 pCi/g for cesium-137. Thus, 1 out of 10 background samples would be expected to be greater than 0.258 pCi/g. The maximum FBWU unit value of 0.22 pCi/g out of 8 samples is consistent with the observed background.

- A statistical review of the unit dataset from the 8 discrete post-removal samples and the background dataset indicates that the mean concentrations of cesium-137 are not statistically different (i.e., mean background concentration is 0.094 pCi/g and mean unit concentration is 0.099 pCi/g).

- The risk from the FBWU and the unit background are similar. Both the FBWU unit risk and the unit background risk for the Industrial Worker is 2E 10^{-6} for external exposure to

surface soil. Residential risk for external exposure to unit surface soil is 7E 10^{-6} and 5E 10^{-6} for exposure to unit background surface soil.

Because no final COCs were identified, no RGOs were developed for the FBWU.

VII. CONCLUSIONS

Fate and transport analyses identified two preliminary CM COCs (potassium-40 and selenium). No human health preliminary COCs were identified under current land use assumptions. Preliminary COCs were identified for the hypothetical industrial worker (cesium-137) and hypothetical on-unit resident (cesium-137 and beryllium). Due to the elimination of both preliminary CM COCs and both human health preliminary COCs through the uncertainty analysis process, no final COCs were retained. Because no final CM COCs, ecological final COCs, or human health final COCs were identified, any residual soil contamination at the unit does not pose a future risk to groundwater, a current or future risk to ecological receptors, or a current or future risk to human health.

Site-Specific Considerations

Site-specific considerations, based on the conclusions of the BRA and RFI/RI, which suggest no potential for significant risk include:

1) All surface debris was removed from the unit sometime prior to 1992, and no primary sources of contamination remain.

2) The concentrations of constituents in the soil after the time-critical removal action are indistinguishable from the background data.

3) Fate and transport analyses indicate that the unit does not represent a current or future risk to groundwater.

4) The BRA did not identify any final COCs after the uncertainty analysis; therefore, any residual soil contamination at the unit does not pose a current or future risk to human health.

Remedial Action Objectives

Remedial action objectives (RAOs) specify USCs, media of concern, potential exposure pathways, and remediation goals. Remediation goals are developed based upon ARARs or RBCs. After the uncertainty analysis, the BRA determined that there are no unit-specific contaminants. Therefore, there are no RAOs. "No Further Action" will be protective of human health and the environment.

Description of "No Further Action" Decision

According to the US EPA guidance document *Guidance on Preparing Superfund Decision Documents* (US EPA, 1989), if there is no current or potential threat to human health or the environment and no action is warranted, the CERCLA Section 121 requirements are not triggered. This means that there is no need to evaluate other alternatives or the "No Further Action" remedy against the nine criteria specified under CERCLA.

Under "No Further Action", no treatment will be performed, no institutional controls or engineering controls will be implemented, and no cost will be associated with the remedy. Because no remedial action is being chosen in this ROD, the requirements of CERCLA Section 121 are not triggered and an ARARs analysis is not required.

Based on the RFI/RI/BRA, the FBWU poses no significant risk to human health and the environment. Therefore, "No Further Action" has been selected as the remedy that satisfies the CERCLA criteria. "No Further Action" is the final action for the FBWU operable unit. This solution is meant to be permanent and effective in both the short and long term and is applicable to all media evaluated (soil, groundwater, etc.). The "No Further Action" decision is the least cost option with no capital, operating, or monitoring costs, and is protective of human health and the environment.

This proposal is consistent with US EPA guidance and is an effective use of risk management principles. The Statement of Basis/Proposed Plan provided for involvement with the community through a document review process and a public comment period.

The selected remedy is protective of human health and the environment and complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action.

VIII. EXPLANATION OF SIGNIFICANT CHANGES

The Statement of Basis/Proposed Plan and draft permit modification provide for involvement with the community through a document review process and a public comment period. No comments were received during the public comment period; therefore, no changes were made based on public comments.

IX. RESPONSIVENESS SUMMARY

No comments on the Statement of Basis/Proposed Plan were received from the public during the public comment period. Therefore, a Responsiveness Summary was not prepared.

X. REFERENCES

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SAVANNAH RIVER SITE (USDOE)

Site Information:

Site Name: SAVANNAH RIVER SITE (USDOE)
Address: AIKEN, SC

EPA ID: SC1890008989
EPA Region: 04

Record of Decision (ROD):

ROD Date: 09/28/1999
Operable Unit: 55, 60, 65, 66
ROD ID: EPA/541/R-99/136

Text: Full-text ROD document follows on next page.

EPA 541-R99-136
1999

EPA Superfund
Record of Decision:

Savannah River Site (USDOE)
Ous 55, 60, 65, & 66
Aiken, SC
09/28/1999

United States Department of Energy
Savannah River Site

OU-65, 55, 60 & 66
Plug-In Record of Decision for In Situ Stabilization With a Low Permeability Soil Cover System for Radiological Contaminants in Soil (U)

WSRC-RP-98-4099

Revision 0

September 1999

Prepared By:
Westinghouse Savannah River Company
Savannah River Company
Aiken, SC 29808

Prepared for the U.S. Department of Energy under Contract No. DE-AC09-96-SR18500

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Plug-In Record of Decision for
In Situ Stabilization With a Low Permeability Soil Cover System for Radiological Contaminants in Soil (U)

WSRC-RP-98-4099
Revision 0
September 1999

Savannah River Site
Aiken, South Carolina
Prepared by:

Westinghouse Savannah River Company
for the
U. S. Department of Energy under Contract DE-AC09-96-SR 18500
Savannah River Operations Office
Aiken, South Carolina

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DECLARATION FOR THE RECORD OF DECISION

Unit Name and Location

Savannah River Site
EPA ID #SC18000008989
Aiken, South Carolina

This plug-in record of decision (ROD) is designed to present a common remedy for high risk radioactively contaminated operable units (OUs) at (SRS) with similarities in history of use, contaminants, risk, and location in current industrial use areas adjacent to existing nuclear facilities. This approach has been developed by United States Environmental Protection Agency (US EPA) and successfully implemented at other superfund sites and is referred to as the plug-in approach. This ROD specifies the conditions that a specific operable unit shall meet in order to plug-in to this ROD and thus use the common remedy for remediation. A unit specific plug-in decision document will be used to demonstrate that an individual operable unit meets the criteria of this Plug-In ROD. By using the plug-in approach, remediation can begin earlier with a considerable cost savings, through reduction in documentation.

Candidate OUs, listed as "rad contaminated" Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) units in Appendix C of the Federal Facility Agreement (FFA) for SRS, may use this ROD if conditions exist which meet the plug-in criteria established within this ROD. If a candidate OU is to be plugged-in, this ROD will be modified through the issuance of an explanation of significant difference (ESD). The ESD will be-issued for public comment.

For those OUs where the plug-in ROD does not address all media included in the OU (e.g., groundwater, surface water, etc.), the plug-in ROD is an interim ROD that provides a final remedy for the source and does not impact the ability to remediate all additional media.. A

final unit-specific ROD will be required for these OUs to complete remedial decision making, according to a schedule agreed upon by the United States Department of Energy (US DOE), US EPA, and South Carolina Department of Health and Environmental Concerns (SCDHEC) through the FFA. The plug-in ROD will be a final ROD for those OUs that only include the source term.

Statement of Basis and Purpose

This decision document presents the selected remedial alternative for applicable operable units that are located at SRS in Aiken, South Carolina. The selected alternative was developed in accordance with CERCLA, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision was made considering the previous RODs for Old F-Area Seepage Basin (OFASB) and L-Area Oil and Chemical Basin (LAOCB) and on the Administrative Record File for the candidate operable units. The plug-in approach allows radiologically contaminated waste units that exhibit the appropriate criteria identified within this ROD to utilize the selected remedy.

Assessment of the Site

Candidate OUs are contaminated with radionuclides from past operations at SRS. The basins typically were used to dispose of radioactive process purge waters from the reactor disassembly basins, separation basins, and other similar basins, typically designed to allow the water to seep into the ground. Actual or threatened releases of hazardous substances from these sites, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

Based on the similar characteristics between the OFASB, the LAOCB, and preliminary candidate operable units (e.g., open reactor seepage basins), it is evident that use of a common remedy is appropriate. In situ stabilization with a low permeability soil cover system was selected as the remedial action for the OFASB and the LAOCB, and is selected as the plug-in ROD remedy.

The remedy consists of the following five aspects:

1) ***Institutional controls*** will consist of near- and long-term actions. Those actions will be consistent with industrial land use and the SRS Land Use Control Assurance Plan. For the near term, signs and existing SRS access controls will be used to prevent disturbance of the soil cover system. In the long term, if the property is ever transferred to nonfederal ownership, the U.S. Government will take those actions necessary pursuant to Section 120(h) of CERCLA, which will likely include deed restrictions precluding residential use or excavation within the boundaries of the unit.

2) ***Consolidation*** of contaminated soil outside the basins exceeding PTSM criteria, leachability RGs,s or surficial exposure RGs will occur. The soils will be excavated and placed into the primary discharge basin. Consolidated PTSM soil will be stabilized with the rest of the soil in that basin.

3) ***A low permeability soil cover system*** will be provided over the in situ stabilized soil to reduce water infiltration and to provide shielding to potential receptors on the surface. For basins that contain non-PTSM soil, but may leach contaminants to groundwater, a low permeability soil cover system will be placed over the soil. The soil cover system will be designed with permeability low enough to prevent migration of contaminants to groundwater for 1000 years at concentrations that will exceed MCLs.

4) ***In situ stabilization*** through grouting will be used to address PTSM soil in the basins which poses a risk in excess of 1 x 10^{-3} for future industrial workers. Stabilization treatment for this principal threat material is selected to meet the CERCLA preference for treatment. Stabilization treatment will provide for greater long-term effectiveness in protecting groundwater, and will also serve to augment prevention of potential direct exposure to the principal threat source material by converting the waste into a form less susceptible to uptake by human intruders.

5) ***Grouting*** will be used to stabilize any potential contamination left inside the pipeline and prevent access by small animals.

In situ stabilization with a low permeability soil cover system is the final action for the source term for each operable unit. This action will meet the following remedial action objectives:

1) Prevent human exposure to highly contaminated basin soils (PTSM) by performing stabilization treatment to the extent practicable and filling the basins. Reduce risks to the future worker from surface soils (0 to 0.3 m [0 to 1 ft]) outside the basin by establishing RGs for COCs at concentrations equivalent to 1 x 10^{-6} for carcinogens and a hazard quotient of 1 for noncarcinogens or background (where background levels of COCs exceed 1 x 10^{-6}).

2) Prevent the release of COCs in soil to groundwater beneath the unit above maximum contaminant levels (MCLs) or risk-based concentrations (when MCLs are not available). The soil RGs are back calculated based on these values.

3) Protect the ecological receptors indigenous to the area by preventing or limiting contact with contaminated basin soils and pipelines, and preventing the plant and animals from bringing contaminants up towards the surface.

The following specific criteria must be met before an operable unit can be considered for the plug-in ROD remedy:

- presence of elevated levels of radionuclides as primary soil contaminants,
- location in a current industrial use area (with buffer) adjacent to an existing nuclear facility,
- presence of principal threat source materials (PTSM), and
- PTSM not in direct contact with surface water or groundwater.

A technical evaluation report for each candidate OU must demonstrate that the OU meets these criteria and show how the remedy will be applied at that unit. An ESD will be issued and made available for public comment. The ESD will administratively select the plug-in remedy for the OU.

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technology to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment to reduce toxicity, mobility, or volume as a principal element. The levels of radionuclides in the soil warrant a common remedy in which institutional controls is a required aspect of the remedy. In situ stabilization with a low permeability soil cover system is considered a short- and long-term permanent solution.

Section 300.430 (f)(4)(ii) of the National Oil and Hazardous Substances Pollution Contingency Plan requires that if hazardous substances, pollutants, or contaminants above levels that allow for unlimited use and unrestricted exposure remain in the waste operable unit, the action must be reviewed no less than every five years after its initiation. Because this remedy will result in hazardous substances remaining onsite above levels that allow for unlimited use and unrestricted exposure, the three parties (US DOE, SCDHEC, and US EPA)

have determined that a five-year review of any decision made to use the plug-in interim ROD will be performed to ensure continued protection of human health and the environment.

Data Certification Checklist

This ROD is unique in that it does not identify a specific OU for the given remedial action. Rather, it selects a preferred remedy for OUs that meet the criteria specified in the ROD. The ROD provides the following information:

- COCs and their concentrations required (PTSM soil) to use the remedy
- Risks represented by the COCs
- Cleanup levels established for the COCs and the basis for the levels
- Current and future land use assumptions
- Land use that will be available at an OU as a result of the selected remedy
- Preliminary estimated capital, operation and maintenance, and total present worth cost
- Decision factors that lead to selecting the remedy

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DECISION SUMMARY

Plug-In Record of Decision for
In Situ Stabilization With a Low Permeability Soil Cover System for Radiological Contaminants in Soil (U)

WSRC-RP-98-4099
Revision 0
September 1999

Savannah River Site
Aiken, South Carolina
Prepared by:

Westinghouse Savannah River Company
for the
U.S. Department of Energy under Contract DE-AC09-96-SR18500
Savannah River Operations Office
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LIST OF ACRONYMS AND ABBREVIATIONS

AOC	area of contamination
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
C	Celsius
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
Ci	curie
cm	centimeter
cm/s	centimeter/second
COC	constituent of concern
CRSB	C-Area Reactor Seepage Basin
CSM	conceptual site model
ESD	Explanation of Significant Difference
F	Fahrenheit
FFA	Federal Facility Agreement
FS	Feasibility Study
ft	foot
in	inch
km.	kilometer
km^2	square kilometers
KRSB	K-Area Reactor Seepage Basin
LAOCB	L-Area Oil and Chemical Basin
LRSB	L-Area Reactor Seepage Basin
LUCAP	Land Use Control Assurance Plan
LUCIP	Land Use Control Implementation Plan
m	meter
MCL	maximum contaminant level
µg/L	microgram per liter
mi	mile
mi^2	square miles
msl	mean sea level
mrem	milliroentgen
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NPL	National Priorities List
OFASB	Old F-Area Seepage Basin

OU	operable unit
pCi	picocuries
pCi/g	picocuries per gram
pCi/L	picocuries per liter
PP	proposed plan
PRSB	P-Area Reactor Seepage Basin
PTSM	principal threat source material
RAO	remedial action objective
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RD/RA	remedial design/remedial action
RFI	RCRA Facility Investigation
RG	remedial goal
RI	remedial investigation
ROD	record of decision
SCDHEC	South Carolina Department of Health and Environmental Control
SLRG	soil leachability remedial goal
SRS	Savannah River Site
TBC	to be considered
USDA	United States Department of Agriculture
US DOE	United States Department of Energy
US EPA	United State Environmental Protection Aaency
WSRC	Westinghouse Savannah River Company

1.0 INTRODUCTION

The Savannah River Site (SRS), owned by the United States Department of Energy (US DOE), has historically produced tritium, plutonium, and other special nuclear materials for national defense and the space program. Wastes generated as by products from these processes are found in all of the nuclear and industrialized areas across SRS. Numerous waste units have been identified in the SRS Federal Facility Agreement (FFA 1993) between US DOE, the United States Environmental Protection Agency (US EPA), and the South Carolina Department of Health and Environmental Control (SCDHEC) and designated for investigation. Many of these waste units have similar, histories, contaminants, and environmental settings.

This record of decision (ROD) identifies in situ stabilization with a low permeability soil cover system as the preferred response action for radioactively contaminated source units that meet the specific criteria defined in this ROD. The remedy includes the use of institutional controls and allows for consolidation when appropriate. This conclusion was reached based on review of SRS decision precedents (i.e., previous RODs) and the evaluation of a centralized waste disposal facility; which together support the use of a plug-in approach. The plug-in approach is described below and specific sections of this ROD provide the rationale and justification for its application. Because US DOE, US EPA, and SCDHEC have agreed to the application of a plug-in approach toward remedy selection, this ROD may also be used as the decision basis for any unit at SRS that exhibits the specific unit characteristics described in this ROD.

1.1 Plug-in Approach Concept

Consistent with US EPA's presumptive remedy policy (US EPA 1993), which focuses on maximizing the administrative efficiency of the Comprehensive Environmental Response, Compensation & Liability Act (CERCLA) by utilizing similarities between operable units (OUs) to streamline remedial planning and implementation, the US DOE has adopted the use of plug-in approaches to OU remediation where there are recurrent problems warranting similar response

The plug-in approach identifies a preferred remedial action and then defines a process that will be used to determine where that remedial action shall be applied. US EPA,US DOE, and the U.S. Air Force used have plug-in approaches to accelerate remedial actions. Examples applications of plug-in approaches are presented below.

Examples of Plug-in Approaches	
1.	Indian Bend Wash Superfund Site (*Operable Unit Feasibility Study for VOCs in Vadose Zone, Indian Bend Wash Superfund Site, South Area; Tempe, Arizona; June 1993)* (US EPA 1994)
2.	Hanford Site 100 Area *USDOE Hanford 100 Area, Operable Units 100-BC-1, 100-DR-1, and 100-HR-1, EPA/ROD/R10-95/126*;(September 1995) (US EPA 1995a)
3.	Air Force PREECA *(United States Air Force Presumptive remedy Engineering Evaluation/Cost Analysis (PREECA); U.S. Army Corps of Engineers Omaha District* (May 5, 1995) (USCOE 1995)

This plug-in approach is consistent with the US DOE "Accelerating Cleanup: Focus On 2006" plan, as the approach would allow SRS to take final actions early at higher risk waste units to address source contamination. As a program management tool, this approach will allow appropriate decisions to be reached more efficiently and effectively, Specifically, the plug-in approach provides the following benefits:

- Evaluation of risk is focused on determining the need for action;
- Screening and evaluation of remedial alternatives are optimized;

- Documentation is streamlined and the time from characterization to remedial decision shortened;
- Remedial action decisions are made efficiently and consistently;
- Application of a common remedy allows for efficiencies in the remedial design and action phases

The plug-in approach is also consistent with the "Principles of Environmental Restoration" advocated by US DOE, US EPA, and SCDHEC. Table 1 identifies how the plug-in approach adheres to these principles.

The plug-in approach varies from the standard CERCLA process due primarily to the fact that the remedial decision making is initiated by defining the conditions for which a proven response is applicable and then identifying units that meet those conditions. Conversely, the standard CERCLA process would start with defining characteristics for a waste unit in a remedial investigation and then determining an appropriate response for those characteristics through a feasibility study (see Figure 1). Table 2 shows how the plug-in approach meets various CERCLA requirements.

This ROD will be applied to any OU exhibiting conditions that meet the plug-in criteria. This ROD defines what these conditions are and describes a process for determining whether they exist in a specific OU. When the conditions at an OU have been determined to match these predefined conditions, the OU will "plug-in" to the remedial action described in this plug-in ROD through a separate OU technical evaluation and explanation of significant difference (ESD). This decision framework and associated criteria for remedy selection were developed based on specific knowledge of a group of operable units.

Table 1. How the Application of the Plug-in Approach Meets the ER Principles

ER Principles	Application to this Plug-in Approach
Building an effective project / core team is essential.	This plug-in approach to decision making has been developed from the onset with the involvement of US DOE, US EPA and SCDHEC. All parties have participated in the conceptualization and subsequent documentation of this innovative approach. Further the plug-in ROD provides the framework that will be used to maintain the core team relationship for all current and future decisions made pursuant to this ROD.
Clear, concise, and accurate problem identification and definition are critical.	This ROD defines the common problem to be addressed by the plug-in remedy. This common problem statement is formulated through the evaluation of the site conditions addressed in precedent decision documents (e.g., previous RODs) and based on the existing knowledge of the candidate operable units.
Uncertainties are inherent and will always need to be managed.	By establishing a comprehensive decision making framework, this ROD identifies the type and level of information needed to achieve remedial decision. This focuses site specific evaluations and minimizes the uncertainty associated with remedy selection. Further, this ROD provides the rationale for the specific remedy application based on the comparison of site specific characteristics to key decision-making criteria.
Early identification of likely response actions is possible, prudent, and necessary.	By considering previous decisions on similar waste sites, this plug-in approach capitalizes on site precedents to focus directly on a preferred response action. Additionally, by defining decision criteria for applying given remedial technologies, this ROD establishes the range of conditions for which the response action will be effective at future sites, if identified.

Table 2. CERCLA Requirements and how they re met in the Plug-in ROD

CERCLA Requirements	Plug-in ROD Compliance
SCOPING	
"In implementing this (scoping) section, the lead agency should consider the program goal, program management principles, and expectations contained in this rule. The investigative and analytical studies should be tailored to site circumstances so that the scope and detail of the analysis is appropriate to the complexity of site problems being addresses. During scoping, the lead and support agencies shall confer to identify the optimal set and sequence of actions necessary to address site problems..." [40 CFR 300.430(b)	The plug-in approach allows the program goal of remediating operable units that pose risk to human health and the environment as quickly and cost-effectively as possible to be met. Duplicative documentation is eliminated, data collection meets well-defined objectives, and the start of actual remediation is begun considerably earlier in the remediation process.
"Site management planning is a dynamic, ongoing, and informal strategic planning effort that generally starts as soon as sites are proposed for inclusion on the NPL and continues through the remedial design and remedial action phases, to selection from the NPL." [55 FR 8706]	The use of the plug-in approach allows remediation to begin approximately two years earlier than the normal RCRA/CERCLA process allows. In addition, cost savings are realized by the elimination of numerous duplicative standard documents for these similar units.
NEED FOR ACTION	
"The purpose of the remedial investigation (RI) is to collect data necessary to adequately characterize the site for the purpose of developing and evaluating effective remedial alternatives..." [40 CFR 300.430(d)(1)]	The plug-in approach has a bias toward treatment. The approach allows data collection sufficient to show that there is a need for treatment of the contaminated soils.
REMEDY IDENTIFICATION	
"The primary objective of the feasibility study (FS) is to ensure that appropriate remedial alternatives are developed and evaluated such that relevant information concerning the remedial action options can be presented to a decision-maker and an appropriate remedy selected." [40 CFR 300.430(e)(1)]	Potential remedies have been investigated in the LAOCB and OFASB RODs and in the Alternative Screening Report Radioactive Soils/Debris Consolidation Facility/Off Unit Disposal report. All have indicated that in situ stabilization with a low permeability soil cover system is the preferred remedy for radiologically contaminated waste units.
REMEDY SELECTION	
"Remedies selected shall reflect the scope and purpose of the actions being undertaken and how the action relates to long-term, comprehensive response at the site." [40 CFR 300.430(f)]	The common remedy will be protective of human health and the environment and provides the most cost-effective treatment available. The action will be a long-term comprehensive response action for the contaminated soils in the source area.
"To support the selection of a remedial action by documenting all facts, analyses of facts, and site-specific policy determinations considered in the course of carrying out activities in this section shall be documented, as appropriate, in a record of decision..." [40 CFR 300.430(f)(5)(i)]	The decision document used to plug-in specific units to this plug-in ROD will contain sufficient data to support the need for treatment as specified in the plug-in ROD. This plug-in ROD indicates the levels of constituents that pose unacceptable risk. The common remedy will be applied to reduce those risks to acceptable levels through treatment.
IMPLEMENTING THE REMEDY	
"The remedial design/remedial action (RD/RA) stage includes the development of the actual design of the selected remedy and implementation of the remedy through construction. A period of operation and maintenance may follow the RA activities." [40 CFR 300.430(a)]	The plug-in approach will allow streamlining in the design process based on the application of the remedy at multiple units. The period of operation and maintenance will be included in the RD/RA.

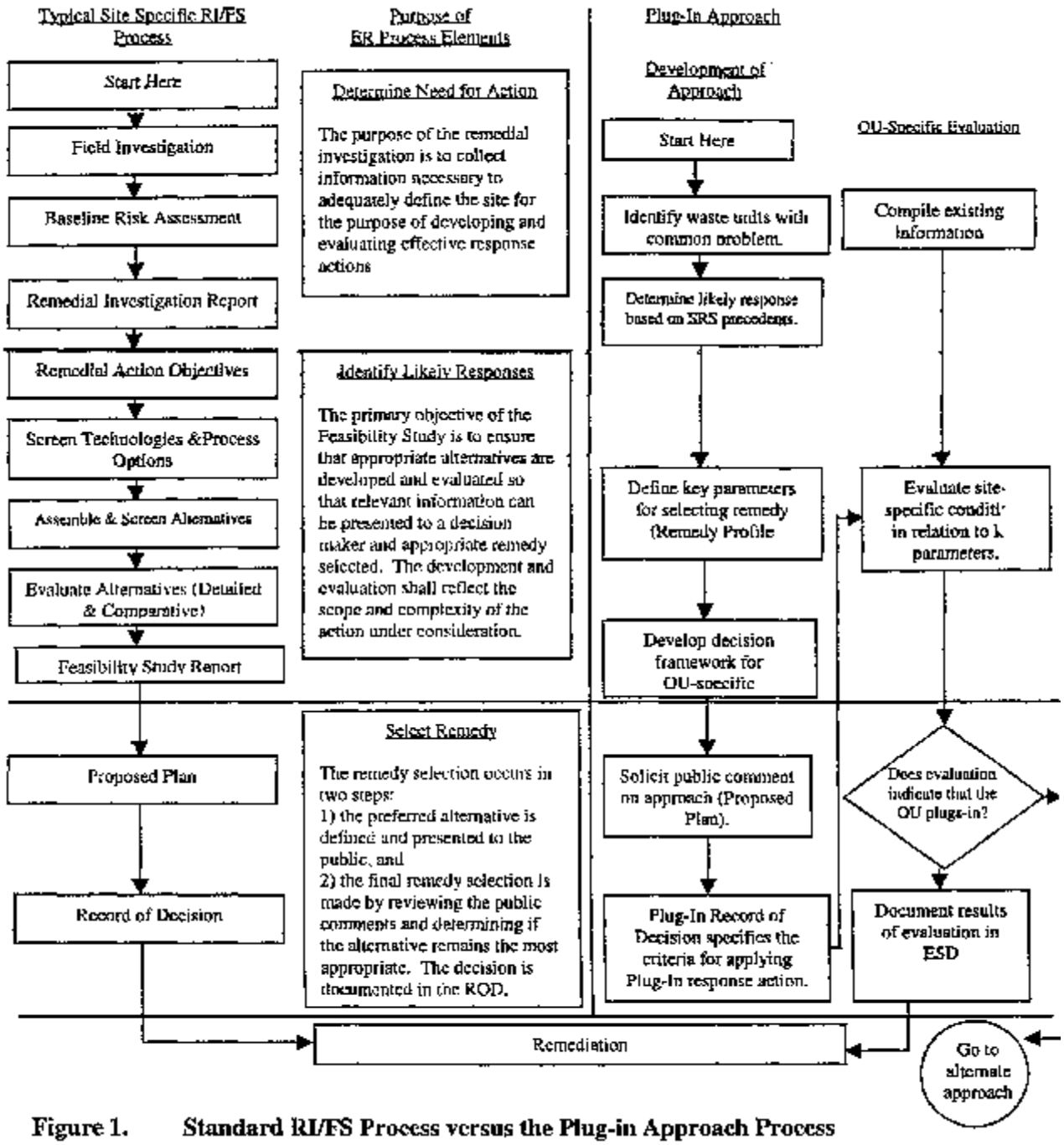

Figure 1. Standard RI/FS Process versus the Plug-in Approach Process

This plug-in ROD will describe the remedy and demonstrate that the preliminary candidate units are likely to meet the conditions that satisfy use of this remedy. To use the plug-in ROD for an OU, a technical evaluation report will be issued followed by an ESD.

The ESD will allow an opportunity for public comment before a decision is made as to whether an OU should use the plug-in ROD.

1.2 Plug-in Approach Components

The plug-in approach can be described by the following components, which will be detailed in the identified sections of the ROD:

Common Unit Characteristics: For the plug-in approach to be beneficial there must be the potential for similar unit problems to be encountered recurrently. Therefore, it must be established that common unit characteristics exist which warrant the identification of a common remedy. Next, a preferred response action is identified for a given set of unit conditions. The preferred response was selected by using the selected remedy and associated decision basis from two completed waste units as precedent for the identified candidate units. The common unit characteristics (e.g., physical conditions and contamination) to be addressed and the decision basis for the selected common remedy will be discussed in Section 5. This section also describes the remedial action objectives.

Common Remedy: The plug-in approach relies on up-front agreement of a preferred response action for a given set of unit conditions. The remedial action (in situ stabilization with a low permeability soil cover system), which has been determined

to be effective and preferred for the given set of unit characteristics, is presented in Section 6. This section also describes each aspect of the remedy, how the remedial action objectives will be met, applicable or relevant and appropriate requirements (ARAR), and the estimated cost of the remedy applied to the four units.

Plug-in Decision Framework: Because this ROD will be employed for at least four OU-specific decisions, it is necessary to establish the methodology for evaluating individual units. A decision-making framework is developed in Section 7 to provide a basis for determining if units plug-in to the common remedy identified in this ROD. Plug-in criteria are established to ensure that the candidate units match the conditions that the plug-in remedy has been designed to meet. By focusing early on the preferred response action and pre-determining the conditions that drive its selection and subsequent design and implementation, existing information and additional characterization needs can be more effectively identified to evaluate unit conditions.

Documentation of the Plug-in Decision: . The method of formally documenting that a unit is to be addressed by the plug-in remedy must be established. This will serve as the basis for future documentation and communication with regulators and the public, who will be given the opportunity to comment on the decision to plug specific units into the ROD. The unit-specific technical evaluation report and ESD are described in Section 7, with a template for the technical evaluation report provided in Appendix B.

1.3 Preliminary Candidate OUs

Listed below are the preliminary candidate OUs for this plug-in ROD, including the reactor seepage basins and separations retention basins. The F-Area and H-Area Retention Basins listed are currently active. Additional OUs may be considered for plugging in to this ROD in the future.

C-Area Reactor Seepage Basins (CRSB) (904-66G, -67G, -68G)

K-Area Reactor Seepage Basin (KRSB) (904-65G)

L-Area Reactor Seepage Basin (LRSB) (904-64G)

P-Area Reactor Seepage Basins (PRSB) (904-61G, -62G, -63G)

Warners Pond (685-23G)

F-Area Retention Basin (281-8F)

H-Area Retention Basins (281-1H, -2H, -8H)

2.0 SITE AND OPERABLE UNIT COMPLIANCE HISTORY

Waste materials handled at SRS are managed under the Resource, Concentration, and Recovery Act (RCRA), a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities have required federal operating or post-closure permits under RCRA. SRS received a hazardous waste permit from SCDHEC, which was most recently renewed on September 5, 1995. Part V of the permit mandates that SRS establish and implement a RCRA Facility Investigation (RFI) program to fulfill the requirements specified in Section 3004(u) of the federal permit. Units that managed hazardous waste after 1980 and had releases to the environment must be addressed under RCRA Corrective Action Programs.

In addition to RCRA compliance, on December 21, 1989, SRS was included on the National Priorities List (NPL). The inclusion created a need to integrate the established RFI program with CERCLA requirements to provide a focused environmental program. In accordance with Section 120 of CERCLA, US DOE has negotiated an FFA (FFA 1993) with US EPA and SCDHEC to coordinate remedial activities at SRS into one comprehensive strategy that fulfills these dual regulatory requirements.

Releases of radioactive contaminants at nonpermited waste units are subject only to CERCLA requirements. The preliminary candidate units did not receive any RCRA hazardous wastes and the contaminated soils do not meet the criteria for characteristic hazardous wastes, thus the candidate units are not subject to the permit requirements. Each of the preliminary candidate OUs presented in Section 1.3 are identified in the SRS FFA and as such must be investigated to determine if the OU contains unacceptable risks and if remedial actions are warranted. Sampling may be conducted for the OUs as part of an approved remedial investigation (RI) work plan or as part of a precharacterization work plan.

By separate Memorandum of Agreement (MOA), the US EPA, the SCDHEC, and the US DOE agreed to implement facility-wide, certain periodic site inspection, certification, and notification procedures set forth in a Land Use Control Assurance Plan (LUCAP), developed pursuant to the US EPA Region IV Land Use Controls (LUC) Policy. These procedures are designed to ensure the maintenance by US DOE-SRS personnel of any site-specific LUCs, set forth in a response action decision document, deemed necessary for future protection of human health and the environment. A fundamental premise underlying execution of that MOA was that through US DOE-SRS's substantial good-faith compliance with the procedures called for in the LUCAP, reasonable assurances would be provided to US EPA and SCDHEC as to the permanency of those remedies, which included the use of specific LUCs

Although the terms and conditions of the LUCAP MOA are not specifically incorporated or made enforceable herein by reference, it is understood and agreed upon by US DOE-SRS, US EPA, and SCDHEC that the contemplated permanence of the remedy reflected herein is in part dependent upon US DOE's substantial good-

faith compliance with the specific LUC maintenance commitments reflected therein. Should such compliance not occur or should the MOA be terminated, it is understood that the protectiveness of the remedy concurred in may be reconsidered and that additional measures may need to be taken to adequately ensure necessary future protection of human health and the environment.

3.0 SCOPE AND ROLE OF THE PLUG-IN ROD WITHIN THE SITE STRATEGY

OUs at SRS generally consist of both source unit (contaminated soils and/or pipelines) and potentially impacted media such as surface water, sediment, and groundwater. The source unit at these waste units accounts for a significant portion of the current risk to human health and the environment at the OU and may present a potential long-term threat to groundwater. Therefore, expedient and effective source unit control is key to this plug-in OU strategy and the overall site cleanup strategy. The preliminary candidate source units include the high-risk radioactively contaminated open reactor seepage basins. Groundwater and other potentially impacted media will be addressed under separate decisions.

A typical radioactive seepage basin area of contamination (AOC) may consist of several basins, associated pipelines, soil contaminated by leaking pipelines, and possibly adjacent surficial contamination. Figure 2 is a schematic diagram that shows the relationship between the reactor areas, the OUs within those areas, and the source unit AOC for a candidate OU. The remedy will address contamination in all these areas and identify opportunities to consolidate contaminated soils, thus minimizing the footprint of contamination and maximizing the efficiency of the remedial action.

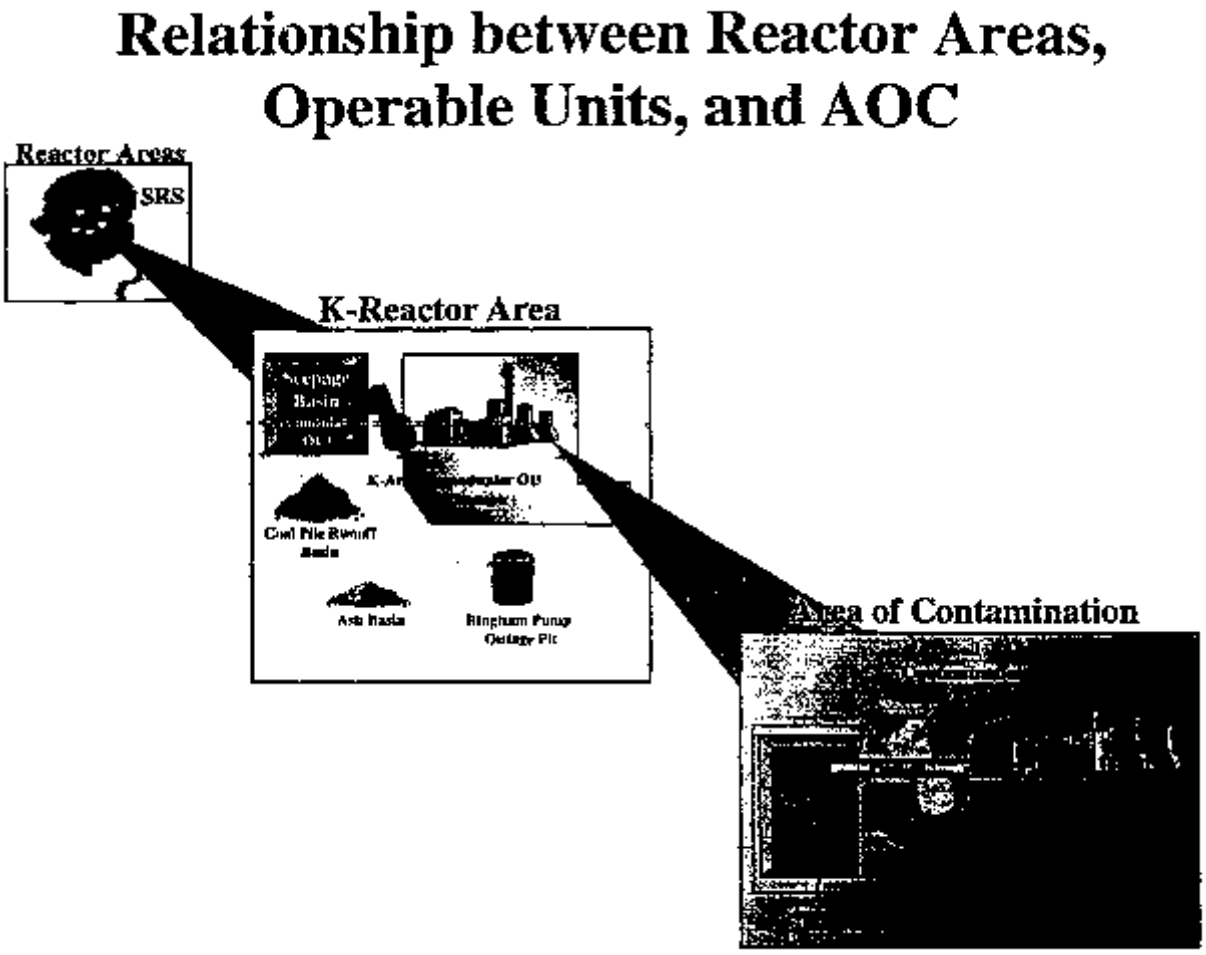

Figure 2. Relationship between Reactor Areas, Ous, and AOCs

The remedy, in situ stabilization with a low permeability soil cover system, is applicable to those radioactively contaminated waste units located within areas designated as current industrial use with buffer areas and are adjacent to existing nuclear facilities. The units will be maintained under institutional control for the long term. A Land Use Control Implementation Plan (LUCIP) for each OU will specify the area of institutional control for that specific unit. The remedy selected in this ROD is designed to significantly reduce the risk from the source unit to future workers and potential ecological receptors. It is also designed to prevent migration of soil contaminants to the groundwater.

Candidate OU's will be evaluated to verify that they plug into the plug-in ROD in accordance with their schedules as defined in the FFA. For those OUs where the plug-in ROD does not address all media (e.g., groundwater, surface water, etc.), the plug-in ROD is an interim ROD that provides a final remedy for the source unit and does not impact the ability to remediate all additional media. A final unit-specific ROD will be required for these OUs to complete remedial decision making, according to a schedule agreed upon by US DOE, US EPA, and SCDHEC through the FFA. The administrative status of each action will be clearly defined in the ESD prepared for each unit.

4.0 SAVANNAH RIVER SITE CHARACTERISTICS

SRS occupies approximately 777 square (km) (310 mi^2) of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina. SRS is a secured United States Government facility located approximately 40 km (25 mi) southeast of Augusta, Georgia, and 32 km (20 mi) south of Aiken, South Carolina. Figure 3 shows the locations of the four preliminary candidate units at SRS.

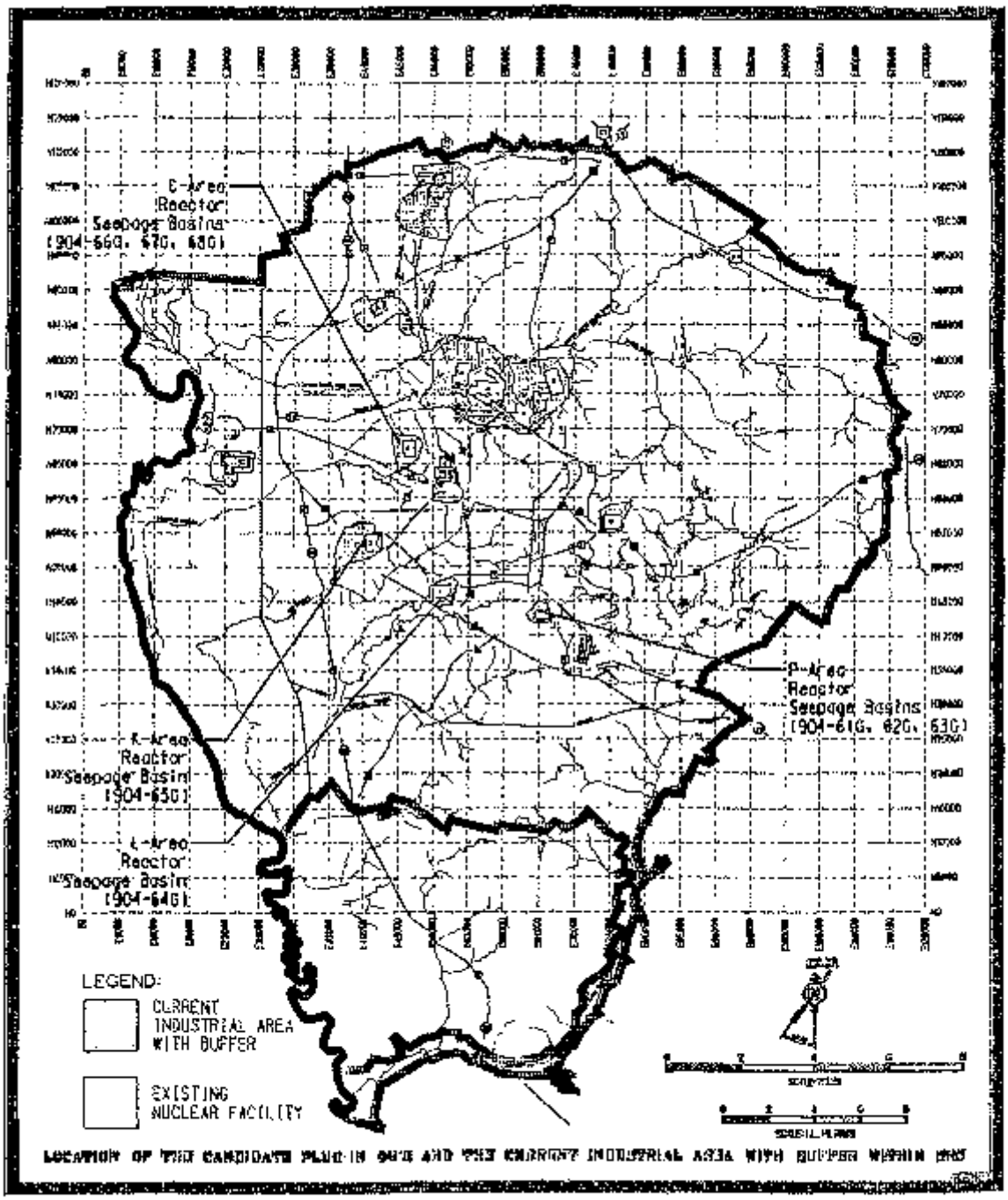

Figure 3. Map of SRS Showing the Location of the Candidate Plug-in OUs, Industrial Use Areas (with Buffer), and the Current Nuclear Facilities

SRS has historically produced tritium, plutonium, and other special nuclear materials for national defense. SRS has also provided nuclear materials for the space program and for medical, industrial, and research efforts. The nuclear material production processes required to support these efforts have resulted in chemical and radioactive wastes. These wastes have been treated, stored, and in some cases, disposed at SRS. This ROD addresses radioactively contaminated source units (soils and pipelines) impacted by the discharge of liquid process wastes contaminated with radionuclides. These past waste handling practices were consistently implemented at the reactor areas.

4.1 Demographics and Land Use

According to 1990 census data (Rand McNally 1992), the average population densities (people per square mile) for the surrounding South Carolina counties are 111 for Aiken County, 36 for Barnwell County, and 28 for Allendale County. The average population densities for the surrounding Georgia counties are 228 for Columbia County, 524 for Richmond County, 25 for Burke County, and 21 for Screven County. The 1990 population within an 80.5 km (50 mi) radius of SRS was 635,000 people. The estimated population for the area in the year 2000 is projected to be 852,000 (Rand McNally 1992).

Less than five percent of the land in the area surrounding SRS is devoted to urban and other development uses (WSRC 1993). Most of the urbanized development in the area has occurred in and around the cities of Augusta, Georgia, and Aiken, South Carolina. By the year 2000, a projected two percent increase in the development of urban land surrounding SRS is expected. Agriculture accounts for about 24 percent

of total land use; forests, wetlands, water bodies, and unclassified land, which is predominantly rural, account for about 70 percent.

Less than five percent of the total SRS land area is used by facilities engaged in the production of special nuclear materials. Reservoirs and ponds comprise approximately 13 km^2 (5 mi^2) of SRS. The remaining area, totaling greater than 777 km^2 (300 mi^2) is undeveloped.

The reasonably anticipated future land use for all of the areas that contain the potential plug-in candidate OUs considered in this ROD is industrial. These areas are located near nuclear industrial facilities (WSRC 1995) and are not expected to be released for unrestricted (residential) future land use due to anticipated future nuclear industrial missions at SRS and the significant costs that would be incurred to reduce risks to levels acceptable for unrestricted (residential) use. Figures 4 through 7 show the location of each of the candidate units per Citizens Advisory Board Recommendation #2 and as agreed upon in the FFA Implementation Plan (WSRC 1996a). They are within areas designated as current industrial (with buffer), and are located adjacent to existing nuclear industrial facilities. These areas were selected to remain as industrial areas in US DOE's future use project report (US DOE 1996a) and are within areas that the Citizens Advisory Board has recommended be retained as industrial future land use areas. Since these areas are designated as industrial, a future industrial worker is assumed as the future human receptor because of the conservative exposure assumptions as compared to a recreational user.

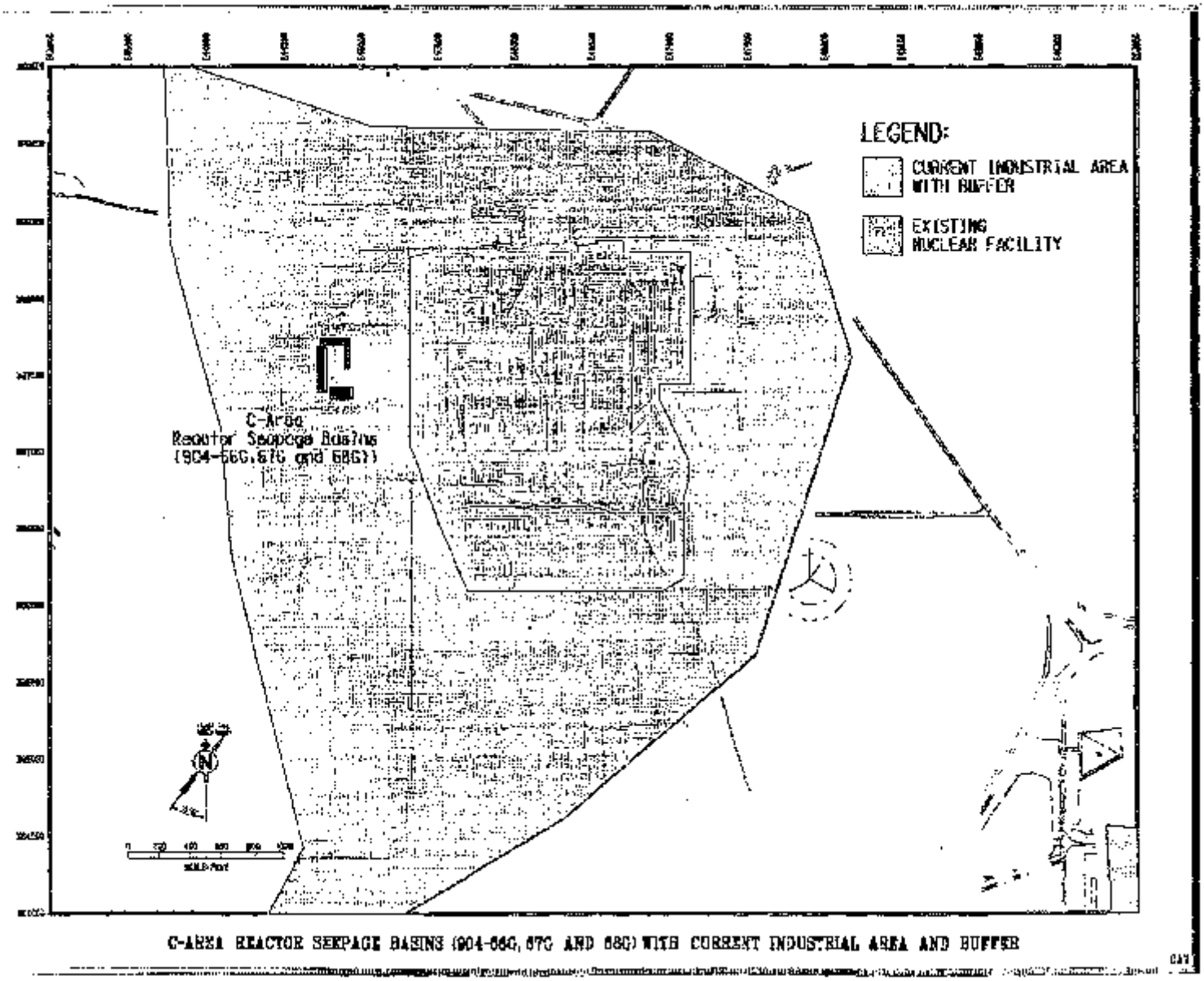

Figure 4. C-Aria Reactor Seepage Basins (904-66G, -67G, -68G)

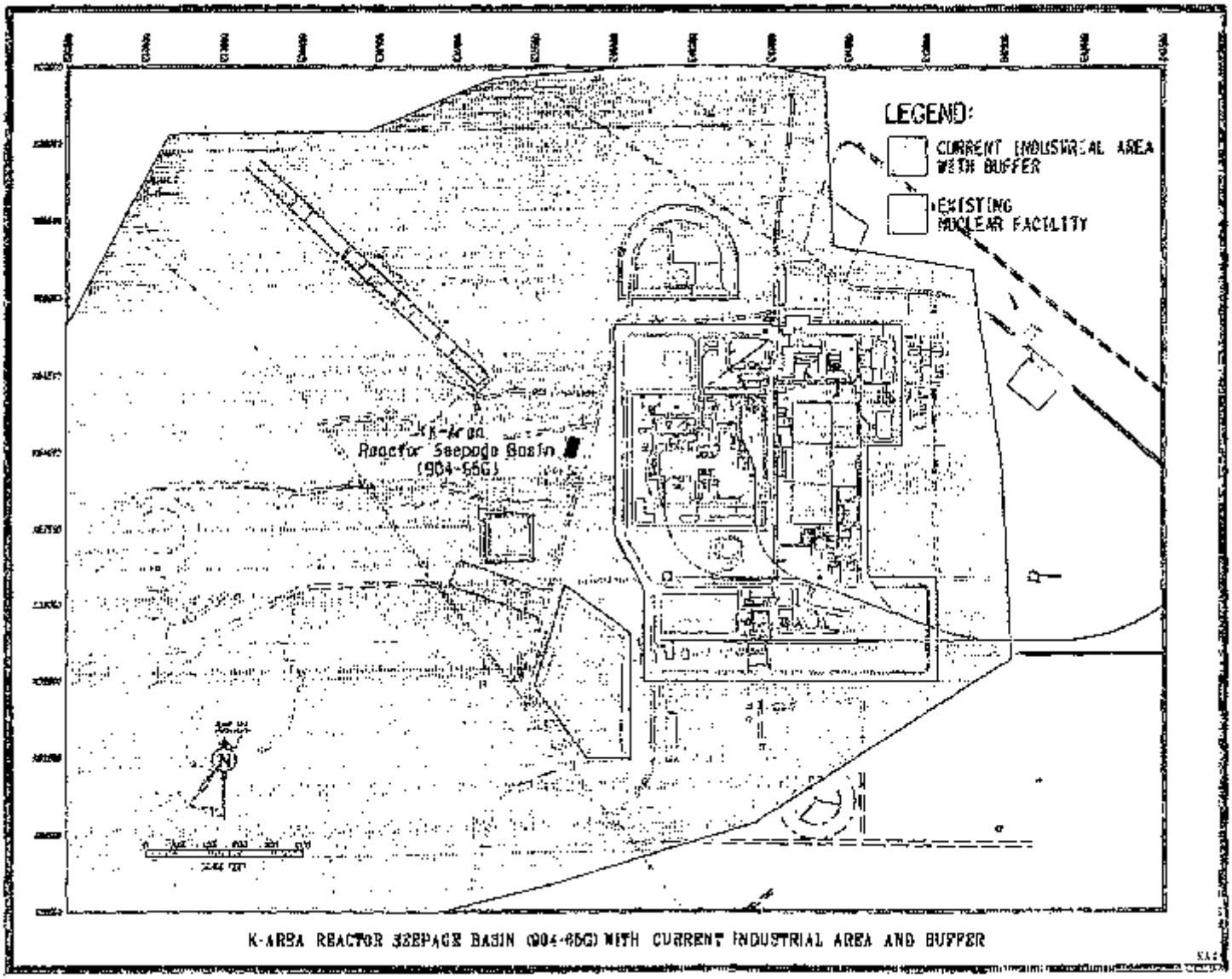

Figure 5. K-Area Reactor Seepage Basin (904-64G)

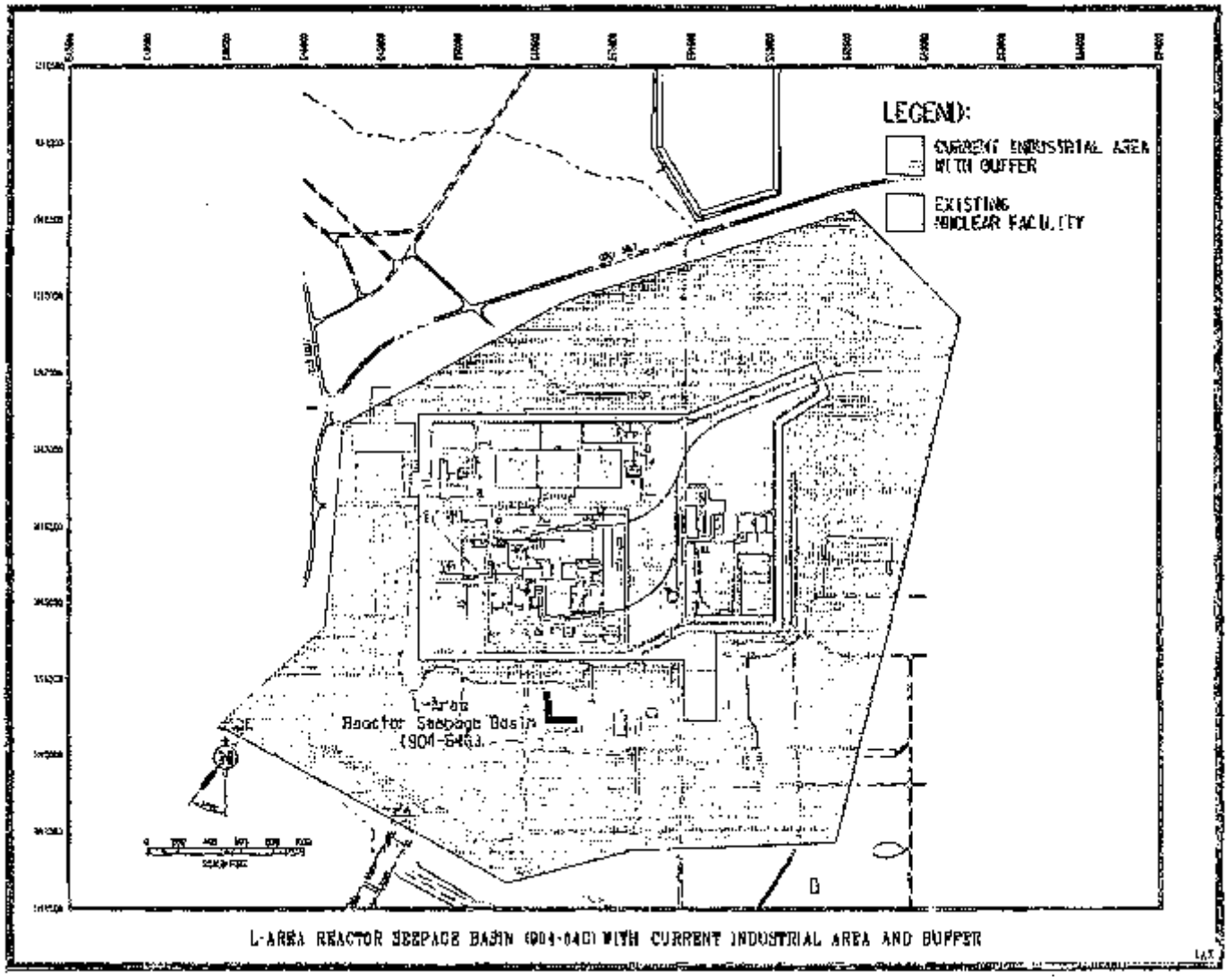

Figure 6. L-Area Reactor Seepage Basin (904-64G)

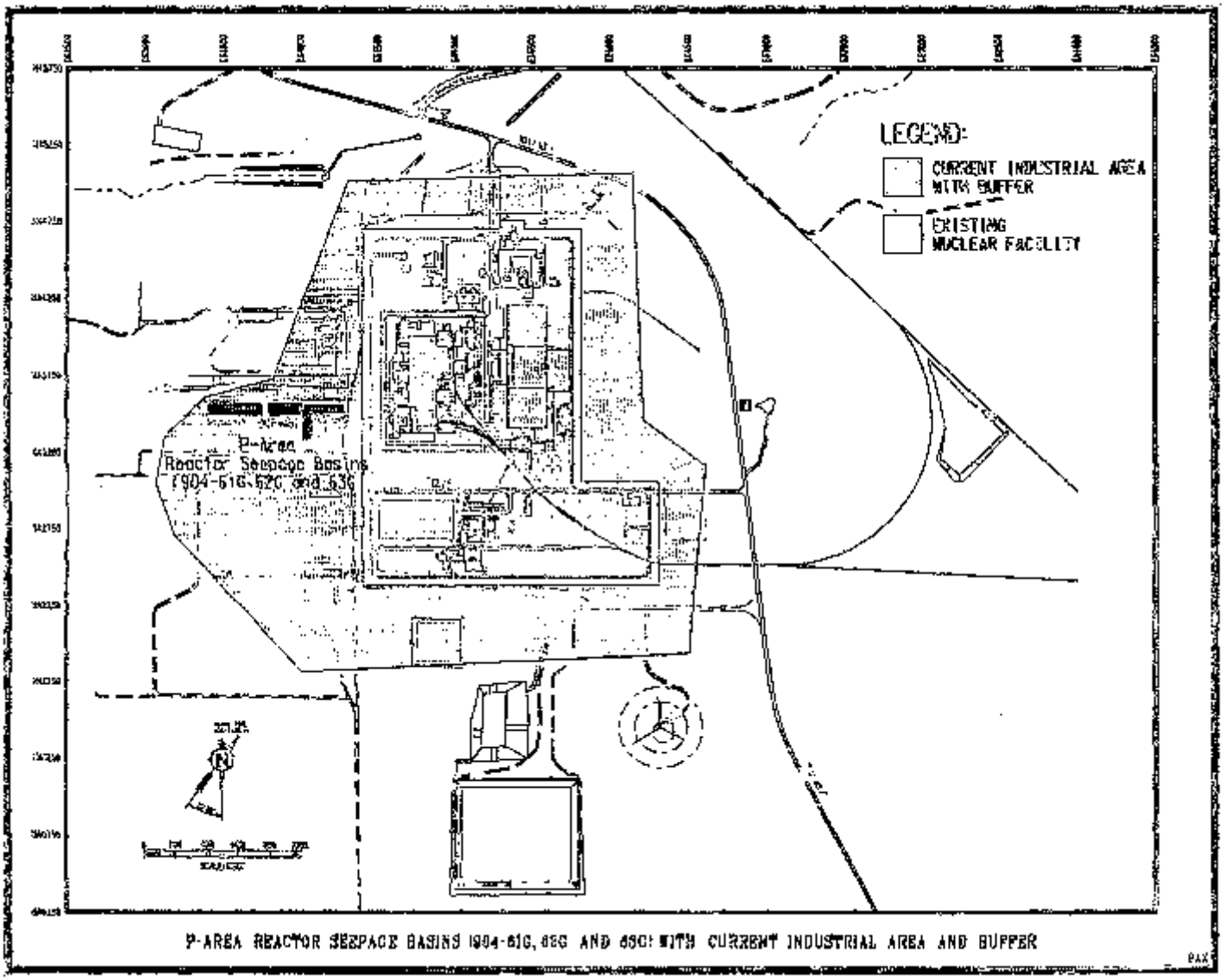

Figure 7. P-Area Reactor Seepage Basin (904-61G, -62G, -63G)

4.2 Ecology

Areas at SRS not used for production and related activities (more than 400 km^2, 156 mi^2) have remained virtually untouched for several decades, except for logging. The following provides an overview of the vegetation and wildlife existing at SRS.

Most of SRS is forested with longleaf and loblolly pines and sweet gum, maple, birch, and various oak and hickory hardwood trees. Major plant communities include cypress-gum and lowland hardwood swamps, sandhills, and old agricultural fields as well as aquatic and semi- aquatic areas. These habitats range from very sandy, dry hilltops to continually flooded swamps.

Some areas of SRS provide refuge for endangered and threatened species, including the red-cockaded woodpecker, the American alligator, the bald eagle, the wood stork, and the smooth purple coneflower. SRS is home to more than 100 species of reptiles and amphibians, including turtles, alligators, lizards, snakes, frogs, and salamanders; and home to over 200 species of birds. SRS is also populated by more than 50 species of mammals, including several thousand white-tailed deer, feral hogs, beavers, rabbits, foxes, raccoons, bobcats, river otters, and opossums.

The typical sizes of most of the radiologically contaminated units (e.g., seepage basins) are up to a few acres. They are generally located in open (non-forested) areas. Previous ecological assessments of similar units (WSRC 1997b) have concluded that the habitat is low in diversity and productivity. Based on the type of units this ROD addresses, small mammals are the most likely target receptors.

4.3 Meteorology

The climate of the area is temperate and characterized by mild winters and warm, humid summers. The annual average temperature at SRS is 17EC (64.3EF). Monthly mean temperatures are coolest in January 7EC (45.3EF) and warmest in July 27EC (83.3EF). Temperatures below freezing occur approximately 58 days per year. The average annual precipitation at SRS is 122 cm (48 in.), distributed fairly evenly throughout the year (USDA 1990). The highest calculated 24-hour precipitation event with a recurrence interval of 100 years is 20.8 cm (8.2 in) (US DOE 1990). Wind speed and direction in the area are variable, depending on the time of year.

4.4 Soils

The soils at SRS are generally characterized as gently sloping to moderately steep, with those on uplands and bottom land nearly level. Most of the soils are well to excessively drained, with a sandy surface layer underlain by a loamy subsoil. Exceptions are those soils in floodplains and wetlands, which are generally poorly drained (USDA 1990).

The soil types of the reactors areas, which include the four candidate units specified in this ROD, are predominantly of the Fuquay-Blanton-Dothan Association. This association consists of nearly level to sloping, well-drained soils on all of the broad upland ridges in the area (USDA 1990). Nearly all the soil in the vicinity of the waste units is Udorthent, soil that has had its profile disturbed by construction activities. These well-drained soils may be firm (e.g., soil at the bottom of an excavation) or friable (excavation spoils), with low organic content, low water capacity, and strongly too extremely acidic (USDA 1990). These soils typically exhibit significant natural

variation in their metals content, as demonstrated by the results from hundreds of background soil samples (WSRC 1990; US DOE 1996b).

4.5 Geology

SRS is located on the Atlantic Coastal Plain and is underlain by a seaward-thickening wedge of unconsolidated and semi-consolidated marine and fluvial sediments. These sediments, ranging in thickness at SRS from 152 to 457 m (500 to 1500 ft), are composed of stratified sands, clays, limestone, and gravels that dip gently seaward at about 71 m/km (35 ft/mile). The sediments range in age from Late Cretaceous to Holocene. Igneous and metamorphic rocks of Precambrian to late Paleozoic age and Triassic age sediments underlie these sediments. The three uppermost units are the Orangeburg Group, which consists of the Congaree, Warley Hill, and Santee Limestone Formation; the Barnwell Group, which consists of the Clinchfield, Dry Branch, and Tobacco Road Sand; and the Upland Unit.

The predominant geologic unit at the surface in the reactor areas is the Barnwell Group. The Clinchfield Formation consists of quartz sand, glauconitic, bimoldic limestone, and clay (Aadland et al 1995). The Dry Branch Formation is divided into the Irwinton Sand Member, the Twiggs Clay Member, and the Griffins Landing Member (Fallaw and Price 1995). The Griffins Landing Member, which overlies the Clinchfield Formation, is composed of variably indurated micrite, calcareous sand and clay and thins from about 15 m (50 ft) at the SRS southeast boundary where it pinches out near the center of SRS. Tan clays overlie and separate the Griffiths Landing Member from the Irwinton Sand Member. Lithologically similar tan clay is found at about this stratigraphic level in the Dry Branch Formation in Georgia and is referred to as the Twiggs Clay Member. The Irwinton Sand Member contains quartz

sand with interbedded clay and pebbly layers. Its thickness is variable, ranging from 12 m (40 ft) northwest to 21 m (70 ft) southwest (Aadland et al 1995). The Tobacco Road Formation, which overlies the Irwinton Sand Member of the Dry Branch Formation, consists of multicolored fine to coarse, clayey quartz sand with interbedded pebble layers and clay laminae (Aadland et al. 1995).

Overlying the Tobacco Road Formation is a unit commonly referred to as the "Upland unit", which consists of poorly sorted, silty, clayey sand, pebbly sand, and conglomerate. This unit caps many of the hills at higher elevations throughout SRS (Aadland et al. 1995). Preliminary findings of the Upland unit study (Colquhoun et al. 1994) suggest that the Upland unit, Tobacco Road Formation, and Dry Branch Formation are similar in texture and lithologic composition.

4.6 Hydrogeology and Hydrology

The Late Cretaceous and Tertiary age sediments that make up the Southeastern Coastal Plain hydrogeologic province in the SRS region have been grouped into three aquifer systems divided by two confining systems (Aadland et al 1995). In descending order, the aquifer systems in the study area include the Floridan, Dublin, and Midville aquifer systems. The Myers Branch and Allendale confining systems separate them in descending order. The Dublin and Midville systems merge in the central portion of the site, and are locally separated by the McQueen Branch confining unit. Locally individual aquifer and confining units are delineated within each of the aquifer systems. The Floridan aquifer system consists of two aquifers in the SRS area, the Upper Three Runs aquifer and the underlying Gordon aquifer. The Gordon confining unit separates these aquifers. The following discussion will focus on the Upper Three Runs aquifer unit as it is the uppermost aquifer unit associated with the

reactor areas and, therefore, first to be impacted by the source units addressed in this ROD.

The Upper Three Runs aquifer may include sands and clayey sands of the Santee/Tinker Formation, and sediments of the Dry Branch Formation, Tobacco Road Formation, and where present, Upland unit. The sediments become more calcareous moving southward across SRS.

The location and depth of creek incisement in the area (Aadland et al. 1995) control the hydraulic head distribution of the aquifer. This incisement has divided the interstream areas of the water table aquifer into “groundwater islands” that behave as independent hydrogeologic subsets of the water table aquifer with unique recharge and discharge areas. The stream acts as the groundwater discharge boundary for the interstrearn area. The head distribution pattern in these areas tends to follow topography, with higher heads at the higher elevations between streams with gradually declining heads toward the bounding streams.

The porosity and permeability of the Upper Three Runs aquifer are variable, generally increasing toward the south with increasing calcareous content (Aadland et al 1995). The aquifer typically yields low quantities of water based on the presence of interstitial silts and clays. This aquifer has been further separated into upper and lower aquifer zones by the tan clay-confining zone. The upper aquifer zone consists of the saturated strata in the Dry Branch Formation and Tobacco Road Formation and generally exhibits a downward hydraulic potential across the tan clay confining zone, which separates the upper and lower aquifer zones and impedes the vertical movement of water.

Recharge to the Upper Three Runs aquifer occurs by infiltration from the surface. In the upper aquifer zone, part of the groundwater moves laterally toward the bounding streams and part moves vertically downward across the tan clay. Most of the groundwater recharging the lower aquifer zone also moves laterally toward the bounding streams.

All of SRS is drained by the Savannah River, which forms the southwestern boundary of SRS and the Georgia-South Carolina border. Major tributaries to the Savannah River that flow southwestward across SRS are Upper Three Runs Creek, Tinker Creek, Four Mile Creek, Pen Branch, Steel Creek, and Lower Three Runs Creek. P and L Areas drain into Steel Creek. K Area drains into Pen Branch, and C Area drains into Fourmile Branch.

5.0 JUSTIFICATION OF THE COMMON REMEDY

The first part of this section will summarize the previous evaluations of radioactive disposal basins and the key aspects of the common conceptual site model (CSM). The second part of this section will discuss the known features of the candidate units, demonstrating that they share the same key aspects of the common CSM, and develop remedial action objectives. (RAOs) for the common remedy.

5.1 Rationale

Two radioactive disposal basins at SRS, the Old F-Area Seepage Basin (OFASB) and L-Area Oil and Chemical Basin (LAOCB) have undergone complete evaluations under the FFA environmental restoration program. Based on the detailed analysis completed for these two units, they share similar CSMs with the following key aspects:

- receipt of radioactively contaminated waste water,
- presence of elevated levels of radionuclides as primary soil contaminants at levels that can be classified as principal threat source material,
- location in an industrial area (with buffer) adjacent to a current nuclear facility,
- unacceptable risks to future workers in their current state,
- contaminated soils not in direct contact with surface water or groundwater, and
- potentially contaminated associated pipelines.

The same remedial action decision (in situ stabilization with a low permeability soil cover) was reached at both units (WSRC 1997b, 1997c). Based on these decisions, this remedy should be applicable to other radioactively contaminated units with similar CSMs. The case for a common remedy was further supported by an alternatives study of the radioactively contaminated operable units presented in the *Alternative Screening Report, Radioactive Soils/Debris Consolidation Facility* (WSRC 1997a).

5.2 Previous Unit Evaluations

Several questions can be derived from the previous evaluations performed on the LAOCB and OFASB that are key to showing that a common CSM exists.

- Are the operable units that were previously evaluated similar in the nature and extent of the contamination?
- Were the RAOs similar for the units?
- Was a comparable analysis of alternatives performed for the units and did the independent analysis reach the same conclusions?

5.2.1 Nature and Extent of Contamination

The following paragraphs briefly describe the history, physical description, and nature and extent of contamination for the OFASB and the LAOCB.

Old F-Area Seepage Basin (OFASB)

The OFASB is located in a current industrial use area (with buffer) adjacent to a current nuclear facility in the central portion of SRS, about 9.6 km (6 mi) from the nearest SRS boundary, which is the Savannah River (see Figure 3). It is located on the top of a gentle slope at an elevation of 87 m (285 ft) above mean sea level (msl). The basin is an open unlined basin measuring about 61 to 91 m (200 by 300 ft). The bottom of the basin is about 3 m (10 ft) below grade. The unit includes one effluent ditch line adjacent to the basin and 244 m (800 ft) of pipeline at an average depth of 3 m (9 to 10 ft) below the ground. The pipeline once gravity-fed the basin. The OFASB was used in 1955 and intermittently until 1969 for the disposal of wastewater from evaporators, nonreactor cooling water from F&H Areas, and other chemicals such as spent nitric acid solutions. Between 9 and 14 million gallons were discharged to the basin, which served as an unlined seepage basin for reducing radioactive substance concentrations and other nonradioactive chemicals. Approximately 1 to 8 Ci of radionuclides were released to the basin (see Table 3). The water table aquifer (Upper Three Runs aquifer zone) is about 23 m (75 ft) below the ground surface and discharges to Upper Three Runs Creek, which is the nearest surface water feature (over 762 m, 2500 ft from the unit). Standing water is present in the basin during the wet seasons.

The primary contamination associated with the OFASB consists of radionuclides in the first 0.6 m (2 ft) of soil, although contaminants were found up to 7.6 m (25 ft) below the basin bottom. Surficial soil contamination also occurs in the effluent ditch line. Cesium-137 and mercury are the major soil contaminants. The maximum cesium-137 concentration is 1,345 pCi/g at 0 to 0.3 m (1 ft) below the basin bottom.

Table 3. Estimated Inventory of Radioisotopes in Potential Plug-in ROD Waste Units

Isotope	LAOCB	OFASB	CRSBs	KRSB	LRSB	PRSBs
Am-241	1.78E-03	5.69E-03	2.49E-03	9.47E-04	6.39E-03	6.39E-03
C-14	1.70E-05	5.44E-05	2.38E-05	3.49E-03	6.10E-05	6.10E-05
Cs-137	7.50E-01	2.00E-00	1.15E+00	8.42E-01	2.94E+00	2.94E+00
I-129	1.47E-07	7.55E-02	2.06E-07	1.77E-07	5.28E-07	5.28E-07
Pu-239	1.12E-02	3.52E-01	1.57E-02	1.35E-02	4.04E-02	4.04E-02
Sr-90	6.58E-02	2.41E-02	1.01E-01	6.67E-02	2.58E-01	2.58E-01
Tc-99	1.79E-04	5.73E-04	2.51E-04	2.15E-04	6.43E-04	6.43E-04
U-238	5.68E-04	5.33E-01	7.95E-04	4.17E-03	2.04E-03	2.04E-03
H-3	<2.70E+02	NA	5.60E+04	NA	NA	NA

Note: All values are in curies.
Cobalt-60, which was present at significant activities in most waste streams, has no inventory information associated with it.
NA=Not Available
CRSBs=C-Area Reactor Seepage Basins
KRSB=K-Area Reactor Seepage Basin
LRSB=L-Area Reactor Seepage Basin
PRSBs=P-Area Reactor Seepage Basins
LAOCB=L-Area Oil and Chemical Basin
OFASB=Old F-Area Seepage Basin

The risks posed due to exposure to the basin soil are unacceptable for the future hypothetical worker. A carcinogenic risk of 9.4 x 10^{-3} was calculated for exposure to basin soils from external radiation. This pathway accounts for almost 99% of the exposure risks (as compared to inhalation and ingestion). The risk drivers are primarily cesium-137 (95%)and cobalt-60 (2.5%). Based on the significant risk (greater than 1 x 10^{-3}) that these soils would pose if exposure was to occur, these soils can be considered principal threat source materials (PTSMs) (US EPA 1991a). High levels of long-lived radionuclides were not found in the soils. Depth to groundwater is about 70 ft below ground surface (bgs). Iodine-129, nitrate, strontium-90, tritium, radium, and uranium were found in groundwater at concentrations that exceeded maximum contaminant levels (MCLs) or proposed MCLs (WSRC 1997c).

L-Area Oil and Chemical Basin (LAOCB)

The LAOCB is located in a current industrial use area (with buffer) adjacent to a current nuclear facility in the south central portion of SRS about 11. km (7 mi) from the Savannah River (see Figure 3). The basin is an open, unlined basin measuring 55 m by 33 m (182 ft by 108 ft) with an average depth of 3.6 m (12 ft) below grade. The basin received wastewater via gravity flow from a 6-in diameter steel pipeline extending 137 m (450 ft) from the L-Area Hot Shop as well as wastes from other reactors transported in drums and tank trucks. A 2-in steel pipeline also runs from the Hot Shop to the basin. The basin received waste from the Hot Shop from 1961 to 1979. The wastewater (largely decontamination fluids) contained radionuclides, detergents, and spent solvents. Approximately 2.2 Ci of alpha emitters and 270 Ci of nonvolatile beta emitters were received by the basin (see Table 3). The groundwater table is about 6 to 7.6 m (20 to 25 ft) below the surface and discharges to L-lake, which is the nearest surface water body and is located about 381 m (1,250 ft) south of the basin. Standing water is present in the basin at most times.

The primary contamination associated with the LAOCB consists of radionuclides and metals in the shallow soils 0 to 0.6 m (0 to 2 ft) in the basin. Standing water in the basin also contained elevated levels of radionuclides. Vegetative sampling indicated elevated levels of cesium-137 and cobalt-60. The basin bottom contains about 0.15 m (6 in) of sludge above the sediments. Twenty-four radionuclides were detected in this layer, including long-lived radionuclides such as plutonium-238, plutonium-239, and uranium-238. Radioisotopes present at activities over 1,000 pCi/g included cesium-137, cobalt-60, strontium-90, uranium-238, and tritium (as hydroxides). The concentration in the basin decreases rapidly with depth because of the nature of the sediments (clay hardpan) at the basin bottom. No man-made contamination was

found outside of the security fence around the basin. The risks posed by exposure to the basin soils are unacceptable to the hypothetical future worker. This thin zone of highly contaminated sediments and soils can be considered PTSM. A radionuclide-related carcinogenic risk of 2.4×10^{-2} from external exposure was calculated; cobalt-60 (84%) and cesium-137 (11%) were the risk drivers. (WSRC 1997b).

Similarities in Nature and Extent of Contamination

The unit characterizations indicated that the nature and extent of contamination for both units are similar and the CSMs for these two units are almost identical. A generic CSM that describes both OFASB and LAOCB is presented in Figure 8.

5.2.2 Previous Units Remedial Action Objectives (RAOs)

RAOs consist of medium-specific or OU-specific goals for protecting human health and the environment. The RAOs for both source units were similar and included the prevention or reduction of risks to human health and the environment. The RAOs summarized below were to prevent

- external exposure to radiological constituents,
- inhalation of radiological constituents,
- ingestion of soil or produce with radiological constituents, and
- leaching and migration of constituents of concern (COCs) to the groundwater.

5.2.3 Previous Units Evaluation of Alternatives

The following sections discuss the alternatives evaluated and selected for the OFASB and the LAOCB, (WSRC 1997b, 1997c). The alternatives evaluated in the *Alternative Screening Report, Radioactive Soils/Debris Consolidation Facility* (WSRC 1997a) are also discussed.

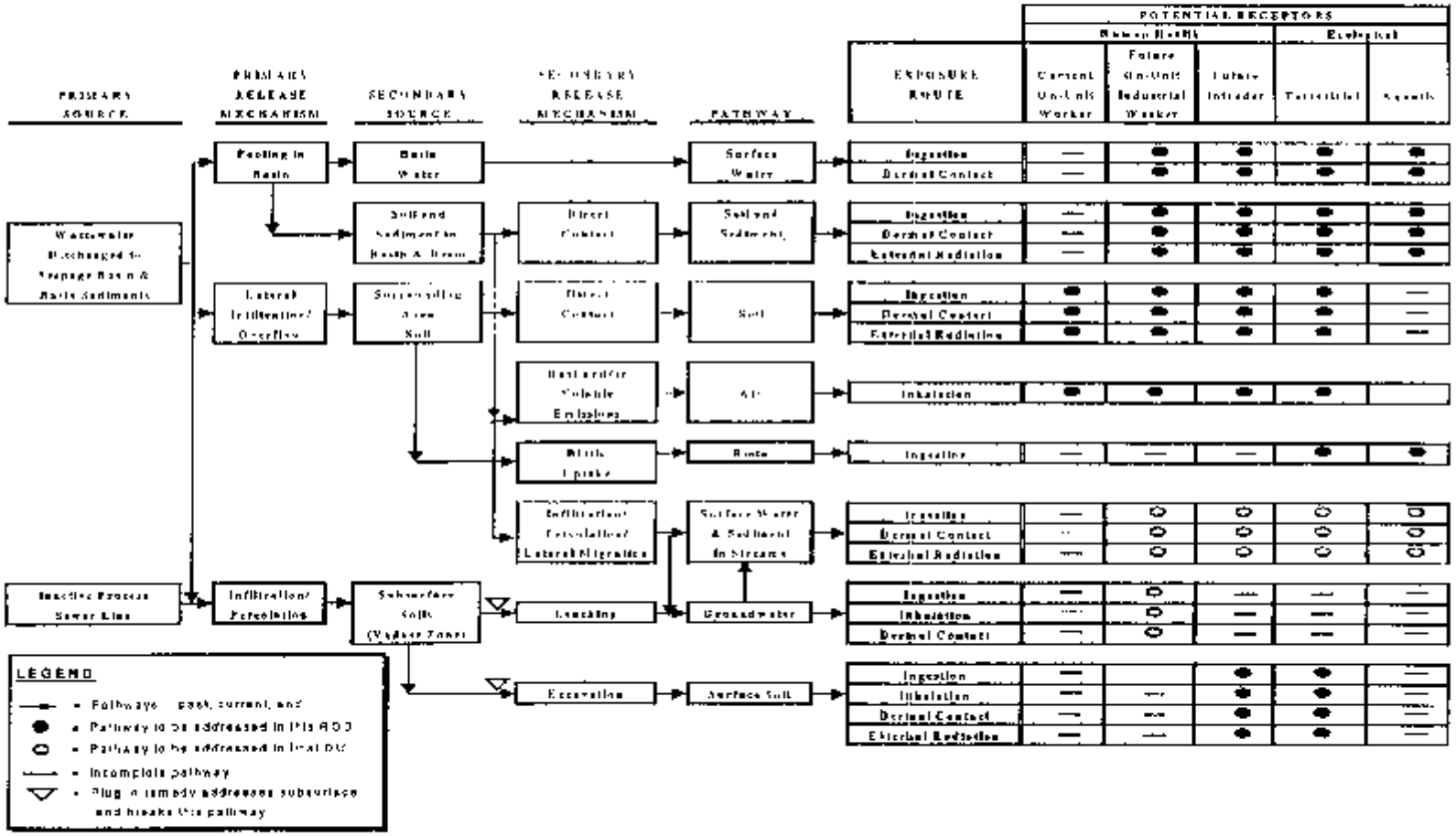

Figure 8. Conceptual Site Model for a Typical Candidate Radioactive Basin

The OFASB (WSRC 1997c) project evaluated the following remedial alternatives:

1. No Action

2. Cap the Basin and Vegetation

3. Consolidate Ditch Line Soils, In Situ Grout Soils to 0.6 m (2 ft), and Incinerate Vegetation at Consolidated Incinerator Facility or Dispose of Vegetation Off Unit

4. Ex Situ Grout Soils to 0.6 m (2 ft) and Incinerate Vegetation at Consolidated Incinerator Facility or Dispose of Vegetation Off Unit

5. Dispose of 0.6 m (2 ft) of Soils at Envirocare, Incinerate Vegetation at Consolidated Incinerator Facility and Cap

An alternative comparison summary table is provided in Appendix A.

The results of the evaluation of these alternatives indicated that all alternatives except No Action were comparable with respect to overall protectiveness of human health and the environment, compliance with ARARs, and implementability. Alternative 5 provided the greatest long-term protectiveness because the waste is completely removed. Alternatives 3 and 4, which included stabilization (grouting), were determined to be best at reducing toxicity, mobility, or volume through treatment. In situ stabilization and capping (alternatives 2 and 3) provided the greatest short-term protectiveness because contamination is not exhumed, handled, or disposed of off unit, as proposed for alternatives 4 and 5. Alternatives 2 and 3 also provide the most cost-effective solutions. Based on consideration of all of the criteria, Alternative 3, consolidate ditch line soils, in situ grout (stabilize) soils to 0.6 m (2 ft), and incinerate vegetation at the Consolidated Incinerator Facility or dispose of vegetation off-unit,

was determined to provide the most cost-effective protection over both the short and long term, as well as reduce the mobility of the contaminants, and was selected as the remedy. This alternative also includes grouting the pipelines at the manholes to limit access.

The following remedial alternatives were evaluated at the LAOCB (WSRC 1997b):

1. No Action
2. Backfill and Cap
3. Backfill, Install Slurry Cut-Off Walls Around the Basin, und Cap
4. In Situ Solidification/Stabilization, Backfill and Cap
5. Ex Situ Stabilize, Backfill and Cap
6. Excavation and Off-Unit Disposal

An alternative comparison summary table is provided in Appendix A.

The results of the evaluation of these alternatives indicated that all alternatives except No Action were comparable with respect to overall protectiveness of human health and the environment, compliance with ARARs, and implementability. The primary discriminators between the alternatives were cost, long-term effectiveness and permanence, and reduction of toxicity, mobility or volume through treatment. Alternative 6 provides the greatest long-term effectiveness due to removal of all the contaminated material. However, Alternatives 5 and 6 were discounted due to excessive cost and short-term risk to workers from potential exposures during excavation. Alternative 4 may provide greater protection from long-term residual on-unit risks than Alternatives 2 or 3, given that a stabilized waste form will be less accessible. Alternatives 3 and 4 were found to reduce mobility of contaminants more permanently than Alternative 2, and Alternative 4 also reduces the mobility of

contaminants through stabilization, thus meeting the National Contingency Plan (NCP) preference for treatment. The costs for Alternative 4 were not excessive as compared to Alternative 2 (2.5 times greater), based on the thin layer of soils that need to be stabilized. Alternative 4, in situ stabilization, backfill, and cap, was determined to be most effective at reducing mobility of contaminants through treatment over the long-term; therefore it was selected as the remedy. This remedy includes excavation and disposal of the pipeline into the basin.

At both the OFASB and the LAOCB, in situ stabilization with a low permeability soil cover system was preferable to other potential remedies (e.g., excavation and disposal) based upon an evaluation against the nine CERCLA criteria in the alternative analysis.

The *Alternative Screening Report, Radioactive Soils/Debris Consolidation Facility* (WSRC 1997a) evaluated whether the construction of a soils consolidation facility was warranted for the numerous radiologically contaminated units at SRS. The following alternatives were evaluated and compared for 20 potential operable units:

1. No Action
2. Cap Units
3. In Situ Grout (Stabilize) Contaminated Soils/Debris, Cap Units
4. Excavate Contaminated Soils/Debris, Ex Situ Grout, Replace Treated Soils and Debris, Cap Units
5. Excavate Contaminated Soils/Debris, Dispose at the SRS E-Area Vaults
6. Excavate Contaminated Soils/Debris, Dispose at the Radioactive Soils/Debris Consolidation Facility
7. Excavate Contaminated Soils/Debris, Dispose at the Nevada Test Site

Alternatives 1 and 2 are not protective of human health and the environment. Alternative 2 does not use treatment as part of the remedy. Alternative 4 is less cost effective than Alternative 3. Of the three offsite disposal alternatives, Alternative 6 was considered the best. A comparison of alternatives 3 and 6, the two best alternatives, is provided below. The text expands on the key discriminators of cost and short-term effectiveness.

Both alternatives 3 and 6 are protective of human health and the environment, meet ARARs, treat the contaminated soils to reduce mobility, and would be acceptable to the state. Both are implementable. Alternative 6 offers greater long-term effectiveness than alternative 3, since no wastes would be left at the units. However, the units are located in reactor areas that are not expected to be returned to unrestricted use.

The cost effectiveness of in situ stabilization and capping is shown below. The estimated costs for alternatives 3 and 6 were $56 million and $110 million, respectively. Some of the key assumptions that contributed to the overall cost of the two alternatives involve the volume of soils to be excavated and stabilized, and the long-term O&M costs. The report used very conservative estimates of the amount of soil to be treated, based on the limited characterization data available for each of the operable units. For alternative 3, it was assumed that soil stabilization to depths capturing the extent of contamination or 6 m (20 ft) would be required. However, based on the extent of PTSM present, the volume requiring in situ stabilization is less than assumed by about a factor of five. Likewise, for alternative 6, the volume to be excavated was based on the same assumption, and 75% of the soils excavated were estimated to require stabilization prior to disposal. The assumption regarding the volume of soil to be excavated from the four candidate OUs, if a central disposal

facility is to be used, is still valid. The excavation must include soils contaminated with mobile radionuclides (e.g., Sr-90) because no soil cover or cap would be included in the remedy to prevent further migration. The data available to date indicates mobile radionuclides are present at depths similar to those depths used in the SDCF report. However, the assumption that 75% of the excavated material would require stabilization is overly conservative. Based on the need to stabilize PTSM soil, about 20% of the excavated volume would require stabilization. If lower volumes of soil are used to estimate the costs for construction of a consolidation facility, the cost per unit volume of soil will be higher than the costs used in the report. This is because the fixed costs for this facility will be spread over a smaller volume of soil. Finally, although operation and maintenance (O&M) costs for the four OUs would be higher than for one common facility, the difference would be less than a factor of four. For example, much of the required groundwater monitoring will be needed in the vicinity of the seepage basins regardless of whether the soils are removed, as reactor area groundwater in all four areas is contaminated. Considering all these factors, the costs for treating the waste in place are significantly lower than for those involved in relocating the waste to a common facility.

The short-term effectiveness of alternative 3 is better than alternative 6. Disposal of the contaminated soil in a common facility would present a higher worker exposure risk than would in situ stabilization. In situ stabilization would involve very limited contact with the contaminated soil. A layer of clean fill would be placed over the contaminated soil before the stabilization equipment is moved into place. The entire stabilization process would, therefore, be carried out with very little opportunity for the workers to come in direct contact with the contaminated soil. Alternative 6 would require excavation, transport to the facility, ex situ stabilization, disposal in the new facility, and finally decontamination of all of the equipment used. These operations

would require greater worker hours than alternative 3; thus the risk of injury is increased for the workers.

In conclusion, except for those waste units located outside of the current industrial use area (with buffer) adjacent to a current nuclear facility, the evaluation determined that the construction of a soils consolidation facility was not appropriate, considering factors of short-term effectiveness, cost, and future land use. The report recommends those waste units located within the current industrial use area (with buffer) and adjacent to a current nuclear facility consider the use of a capping or in situ stabilization/capping response.

Table 4 is a summary level comparison of no action, the Soil/Debris Consolidation Facility, and in situ stabilization with a low permeability soil cover system against the nine CERCLA criteria. This comparison is based on the analyses done in the feasibility studies. for the OFASB and LAOCB and in the *Alternative Screening Report Radioactive Soils/Debris Consolidation Facility (WSRC 1997a).*

5.3 Comparison of Preliminary Candidate OUs to a Common CSM

Other radioactively contaminated units at SRS can be compared against the common CSM to determine if they should be addressed using the same remedy. Based on similar process histories and the available data, CRSB, KRSB, LRSB, and PRSB are some of the preliminary candidate units for the Plug-in ROD that will be described below. Other radioactively contaminated OUs may also be considered as future plug-in candidates as additional information is obtained. The locations of these preliminary candidate units (reactor seepage basins) are shown in Figures 3 through 7.

Table 4. Evaluation Summary of Soil/Debris Consolidation Facility Alternatives 3 and 6 using the Nine CERCLA Criteria

Nine CERCLA Criteria	No Action	Alternative 6 Soil/Debris Consolidation Facility	Alternative 3 In Situ Stabilization with a Low-Permeability Soil Cover System
Overall Protection of Human Health and the Environment	Does not protect human health and the environment.	Protects human health and the environment.	Protects human health and the environment.
Compliance With ARARs	Does not comply with identified ARARs.	Complies with all ARARs.	Complies with all ARARs.
Long-Term Effectiveness	No long-term effectiveness.	Long-term effectiveness provided through land use controls. Footprint of contaminated areas reduced.	Long-term effectiveness provided through land use controls. No footprint reduction; less critical for reactor areas.
Reduction in Toxicity, Mobility, or Volume	Does not reduce toxicity, mobility, or volume.	Reduces accessibility and mobility of contaminated soils through stabilization. Toxicity reduced through natural radioactive decay.	Reduces accessibility and mobility of contaminated soils through stabilization. Toxicity reduced through natural radioactive decay.
Short term Effectiveness.	Not applicable.	Short-term effectiveness poor. Higher worker exposure and injury risk; longer time to implement.	Provides good short-term effectiveness. Minimal worker exposure and lower potential injury risk. Time to implement is shorter.
Implementablity	Fully implementable.	Implementable, although probable excavation of deep soils to meet RGs difficult. A significant number of additional ARARs need to be met for construction and disposal of soil wastes in an engineered facility.	Fully implementable.
Cost	Minimal cost based on five-year ROD reviews.	Cost about 2x alternative 3.	Cost about one-half of alternative 6.
State Acceptance	Will not receive State acceptance.	Would likely receive State acceptance.	Would likely receive State acceptance.
Community Acceptance	Will not receive community acceptance.	Less likely to receive community acceptance.	Will likely receive community acceptance.

The CSMs for these four units are similar. Table 5 summarizes the general features for each of these basins. These open reactor seepage basins all received discharge water from the reactor disassembly basins. The water from the disassembly basins generally contained tritium and other radionuclides such as cesium-137 and strontium-90. Table 3 gives the estimated inventory of radioisotopes for each unit. As shown in this table, cesium-137 and strontium-90 are the predominant radionuclides that were discharged to the basins that would be present as soil contaminants. At CRSB, it is estimated approximately 56,000 Ci of tritium was discharged to the basins (WSRC 1996b).

Table 5. Data for the CRSB, KRSB, LRSB, and PRSB

Operable Unit	Basin	Source of Contamination	Years of Operation	Length (ft)	Width (ft)	Dept h (ft)	Depth to Groundwater (ft)
C-Area Reactor	904-066G	C-Reactor	1957-87	394	36	7	70
Seepage Basins	904-067G	Disassembly	1957-87	296	43	10	70
	904-068G	Basin	1957-87	148	89	13	70
K- Area Reactor Seepage Basin	904-65G	K-Reactor Disassembly Basin	1957-60	135	70	7	56-66
L-Area Reactor Seepage Basin	904-64G	L-Reactor Disassembly basin	1957-88	390	36	7	24
P-Area Reactor	904-61G	P-Reactor	1957-88	386	36	7	40
Seepage Basins	904-62G	Disassembly	1957-88	200	63	8	40
	904-63G	Basin	1957-88	330	60	11	40

Most of the basins were unlined and contaminated water was allowed to seep into the ground. At several of the reactor facilities, the basins were connected in series so that the first basin would fill and any overflow would go to the next until that basin was full. The second basin would then overflow into the third. This type of operation allowed the first few feet of soil in the first basin to become more highly contaminated while the soil in subsequent basins remained less contaminated because

Table 6. Radionuclide Distribution & Risk for CRSB, KRSB, LRSB, and PRSB

Operable Unit	Basin	Sample Depth (ft bbb)	Cs-137 (pCi/g)	Cs-137 (risk)	Sr-90 (pCi/g)	Sr-90 (risk)	Pu (pCi/g)	Pu (risk)	Co-60 (pCi/g)	Co-60 (risk)	Cumulative Risk
CRSB	904-066G	[illegible]	157.00	1.5E-03	5.60	9.6E-08	4.60	4.6E-07	9.90	4.4E-04	1.9E-03
		[illegible]	145.00	1.4E-03	34.50	6.0E-07	10.60	1.0E-06	10.70	4.7E-04	1.8E-03
		[illegible]	210.00	2.0E-03	136.10	2.4E-06	1.83	1.8E-07	6.72	3.0E-04	2.3E-03
		7-10'	1.60	1.5E-05	39.40	6.9E-07	0.04	4.0E-09	0.09	3.9E-06	1.9E-05
		10-13'	1.60	1.5E-05	18.40	3.2E-07	0.09	7.9E-09	0.16	7.0E-06	2.2E-05
		13-16'	1.90	1.8E-05	42	7.3E-07	u	0.0E+00	0.14	6.2E-06	2.5E-05
	904-067G	[illegible]	52.50	5.0E-04	2.40	4.2E-08	1.13	1.1E-07	0.22	9.7E-06	6.1E-04
		[illegible]	113.90	1.1E-03	18.50	3.2E-07	0.95	9.4E-08	0.37	1.6E-05	1.1E-03
		4-7'	0.38	3.6E-06	24.70	4.3E-07	u	0.0E+00	0.06	2.6E-06	6.7E-06
		7-10'	0.82	7.7E-06	7.20	1.3E-07	0.03	2.0E-09	0.01	4.4E-07	8.3E-06
		10-13'	0.05	4.7E-07	5.10	8.9E-08	u	0.0E+00	u	0.0E+00	5.6E-07
	904-068G	0-3'	9.00	8.5E-05	u	0.0E+00	0.21	2.1E-08	0.01	4.4E-07	8.6E-05
		1-4'	0.20	1.9E-06	u	0.0E+00	u	0.0E+00	0.01	4.4E-07	2.3E-06
		4-5.5'	0.17	1.6E-06	u	0.0E+00	u	0.0E+00	0.01	4.4E-07	2.0E-06
		7-10'	0.01	9.4E-08	0.2	3.5E-09	u	0.0E+00	0.01	4.4E-07	5.4E-07
KRSB	904-065G	[illegible]	1428	1.3E-02	111.4	1.9E-06	19.1	1.2E-06	1.73	7.6E-05	1.3E-02
		[illegible]	210	2.0E-03	86.2	6.9E-07	1.07	1.1E-07	0.25	1.1E-05	2.0E-03
		3-5'	24.2	2.3E-04	12.2	2.1E-07	0.48	4.8E-08	0.04	1.8E-06	2.3E-04
		5-7'	23.1	2.2E-04	3.3	5.8E-08	0.18	1.8E-08	0.02	8.8E-07	2.2E-04
		7-9'	46.8	4.4E-04	2.6	4.5E-08	0.65	6.4E-08	0.06	3.5E-06	4.5E-04
		9-11'	97.3	9.2E-04	0.14	2.4E-09	0.16	1.8E-08	0.03	1.3E-06	9.2E-04
		11-13'	15.5	1.5E-04	0.78	1.4E-08	0.41	4.1E-08	u	0.0E+00	1.5E-04
LRSB	904-64G		no data		no data						
PRSB	904-61G	[illegible]	115	1.1E-03	44	7.7E-07	na		u	0.0E+00	1.1E-03
		[illegible]	49.8	4.7E-04	109	1.9E-06	na		u	0.0E+00	4.7E-04
		[illegible]	33.4	3.2E-04	na		na		28.5	1.3E-03	1.6E-03
		4-6'	7.4	7.0E-05	na		na		2.4	1.1E-04	1.8E-04
		6-8'	4	3.8E-05	na		na		0.7	3.1E-05	6.9E-05
		8-10'	1.6	1.5E-05	106	1.9E-06	na		u	0.0E+00	1.7E-05
	904-62G	[illegible]	238	2.2E-03	73	1.3E-06	na		50	2.2E-03	4.5E-03
		1-2'	76	7.2E-04	0.8	1.4E-08	na		u	0.0E+00	7.2E-04
		2-4'	85	8.0E-04	na		na		u	0.0E+00	8.0E-04
		4-6'	10.5	9.9E-05	na		na		u	0.0E+00	9.9E-05
		6-8'	34	3.2E-04	na		na		u	0.0E+00	3.2E-04
		8-10'	51	4.8E-04	3	5.2E-08	na		u	0.0E+00	4.8E-04
	904-63G	0-1'	0.34	3.2E-06	0.9	1.6E-08	na		u	0.0E+00	3.2E-06
		1-2'	0.48	4.5E-06	1.1	1.9E-08	na		u	0.0E+00	4.5E-06
		2-4'	0.1	9.4E-07	na		na		u	0.0E+00	9.4E-07
		4-6'	u	0.0E+00	na		na		u	0.0E+00	0.0E+00
		6-8'	0.3	2.8E-06	na		na		u	0.0E+00	2.8E-06
		8-10'	u	0.0E+00	0.7	1.2E-08	na		u	0.0E+00	1.2E-08

Notes:
1) Concentrations shown are averages
2) u = not detected
3) na = not analyzed
4) Pu = Pu-238 and Pu-239/240
5) bbb is below basin bottom
6) risk >1.0E-03 is Principal Threat Source Material (PTSM)
7) **PTSM is BOLDED**
8) [illegible]
9) PRSB data is from 1978
10) Tritium data is not included because it is not analyzed as a soil constituent.

they received less of the discharge. This is especially evident in basin 3 at both CRSB and PRSB, which are minimally contaminated. The distribution of the key radionuclides based on the existing data is presented in Table 6.

The risk values exceeding 1×10^{-3} are bolded. For the purposes of the plug-in ROD, soils with radionuclide contaminants exceeding this risk value represent PTSM. The reactor seepage basins primarily differ from the OFASB and LAOCB in that they have significantly lower levels of transuranic radionuclides such as uranium and plutonium. However, this does not impact the application of the common remedy.

Based on risk calculations already completed at KRSB (WSRC 1998a), the risk to the future hypothetical worker is 2×10^{-2} . This risk almost exclusively results from external exposure to cesium-137, given an exposure concentration of 2,510 pCi/g. Given the cesium-137 concentration at PRSB (WSRC 1998c) and CRSB (WSRC 1998b), the estimated risks at these units are about 1×10^{-2} and 3×10^{-3} , respectively. These risks are comparable to those calculated for the OFASB and LAOCB and, based on using the risk value of 1×10^{-3} as a threshold from US EPA guidance (1991a), meet the definition of PTSM.

The COCs are traditionally defined in the Remedial Investigation/Baseline Risk Assessment (RI/BRA) report as unit-related constituents that contribute to risks to an industrial worker exceeding one additional potential cancer in a million (1×10^{-6}) or potential chronic effects due to toxicity (exceeds a hazard quotient of 0.1). COCs also include constituents that have the potential to leach from soils to groundwater at levels that could exceed maximum contaminant levels in groundwater.

Tritium is a unique potential COC in that it is not sorbed to the basin soils. If present in the vadose zone, tritium is present in the pore water (or soil moisture). Tritium within the vadose zone pore water will mitigate to the water table over time based on the infiltration rate of water.

Based on a typical pore-water velocity, depth to groundwater, and the time elapsed since the candidate units received effluent discharges, it is expected that the tritium has passed entirely through the vadose zone into the groundwater beneath the basins at all the candidate units except for possibly CRSB. Some residual tritium may be present beneath CRSB just above the water table, since the distance to groundwater is greater than the other basins. Additional unit-specific detail on tritium will be provided in the technical evaluation report for each candidate unit.

The COCs for the Plug-in ROD are expected to be primarily radionuclides (the COCs at KRSB based on the RI/BRA were americium-241, carbon-14, cesium-137, cobalt-60, plutonium-239/240, and strontium-90). COCs will be established in the technical evaluation report for each unit based primarily on PTSM criteria, and also considering the CSM, and comparison against the human health and contaminant migration remedial goals (RGs) established in this ROD.

5.4 Conclusion

Based on the similarities between the physical settings and the nature and extent of contamination at OFASB, LAOCB, and the open reactor seepage basins, it is evident that the open reactor seepage basins fit the common CSM and that a common remedy, including treatment of highly contaminated soils, is warranted.

In situ stabilization with a low permeability soil cover system is the preferred alternative for radiologically contaminated units exhibiting characteristics common to the generic CSM. This alternative was evaluated against the nine CERCLA criteria and was found to be protective of human health and the environment, compliant with ARARs, and cost-effective. The summary of this comparison was presented in Table 4. Use of this plug-in remedy will

- streamline the cleanup process,
- employ remedial actions already selected for similar OUs with minimal additional documentation and alternatives analysis, and
- meet the CERCLA preference for treatment and enhance the long-term effectiveness of the remedy.

6.0 DESCRIPTION OF THE COMMON REMEDY

This section will establish the common RAOs to be met at any candidate unit, describe in detail the common remedy, in situ stabilization with a low permeability soil cover system, and demonstrate how the plug-in remedy meets the RAOs.

6.1 Remedial Action Objectives

RAOs consist of medium-specific or OU-specific goals for protecting human health and the environment. The RAOs specify the COCs, the exposure routes (environmental media) and receptors, and an acceptable contaminant level or range of levels (remedial goals) for each exposure route. Remedial goals (RGs) are developed based on ARARs or other information such as risk-based concentrations (RBCs). The remedy is concerned only with the source control OU and will, therefore, not develop RAOs for cleanup of the groundwater.

Based on the characteristics and CSM for the candidate units, the following RAOs have been developed:

(RAO 1) Prevent human exposure to highly contaminated basin soils (PTSM) by performing stabilization treatment to the extent practicable and filling the basins. Reduce risks to the future worker from surface soils (0 to 0.3 m [0 to 1 ft]) outside the basin by establishing RGs for COCs at concentrations equivalent to 1×10^{-6} for carcinogens and a hazard quotient of 1 for non carcinogens or background (where background levels of COCs exceed 1×10^{-6}).

(RAO 2) Prevent the release of COCs in soil to groundwater beneath the unit above MCLs or RBCs (when MCLs are not available). The soil RGs are back calculated based on these values.

(RAO 3) Protect the ecological receptors indigenous to the area by preventing or limiting contact with contaminated basin soils and pipelines and preventing plants and animals from bringing contaminants up toward the surface.

With respect to the first RAO listed above, nearly all of the contamination associated with the reactor seepage basins is found at the basin bottom, typically 3 to 3.6 m (10 to 12 ft) below grade. A baseline risk assessment evaluates exposure to this contamination as surficial, since the basins are open. The highly contaminated soils in the basin bottoms can be considered PTSM. PTSM is defined by the US EPA as follows (US EPA 1991a):

"Principal threat wastes are those source materials considered to be highly toxic or mobile that generally cannot be reliably contained or would present a significant risk

to human health or the environment should exposure occur. They include liquids and other highly mobile materials (e.g., solvents) or materials having high concentrations of toxic compounds. No "threshold level" of toxicity/risk has been established to equate to "principal threat." However, where toxicity and mobility of source material combine to pose a potential risk of 10^{-3} or greater, generally treatment alternatives should be evaluated."

For the purposes of this plug-in remedy only, PTSM is defined as those highly contaminated basin sediments and any other unit-related soils that pose a radiological risk (using baseline risk assessment exposure assumptions) to a future industrial worker equal to or greater than 1×10^{-3}. Based on the presumptive approach used in this ROD and the previous decisions, a bias for treatment of PTSM will be used. Application of the remedy will stabilize the PTSM to the extent practicable. This will convert the waste into a form less likely to result in human exposure. The basins will also be filled to grade, eliminating this surficial exposure pathway.

Any soils contamination associated with the pipelines (if leaking) will generally be below 0.6 in (2 ft) (the depth of the pipelines), thus the probability of any surficial contamination is low. This conclusion is consistent with data from LAOCB, OFASB (except for the discharge ditch), and KRSB. However, the necessary data will be collected for all candidate units for confirmation and to demonstrate that the RGs associated the first RAO are met. Regardless of depth, if contaminated soils exceed PTSM criteria, they will be consolidated in the primary discharge basin and stabilized. The methodology for determining the RGs outside of the basins is, described in detail in Appendix E. Back-calculated RGs for the radionuclides are included in that appendix.

The second remedial action objective specifically requires soil COCs to be addressed so that the groundwater is protected to meet MCLs or RBCs, if MCLs are not available. The combination of in situ stabilization of PTSM and a low permeability soil cover has been demonstrated to be effective in meeting this RAO (WSRC 1997b and 1997c). In addition, a calculation will be performed to determine whether a low permeability soil cover (1×10^{-5} cm/s) will be adequate to prevent groundwater impact. The migration of tritium, if present beneath the basins in the vadose zone pore water, will be minimized through the use of a low-permeability soil cover. For those contaminated soils that will not be stabilized outside of the basin(s), it will be necessary to determine if action needs to be taken to protect groundwater. Based on the target groundwater RGs, acceptable residual soil contamination levels ran be conservatively back calculated. Calculation of these soil leachability remedial goals (SLRGs) will be conducted on a unit-specific basis, since the SLRGs depend on unit-specific variables such as the thickness of the source contamination, the depth to the water table, and the groundwater velocity. The unit-specific SLRGs will be presented in the unit-specific decision document.

Appendix D presents the methodology for the back calculation in detail. The remedial action objective is to prevent leaching of constituents to groundwater above MCLs or RBCs if MCLs are not available. The approaches for back calculating the acceptable soil limits based on these target remedial goals in groundwater are consistent with US EPA guidance (US EPA 1996a and 1996b). For radionuclides, the target remedial goals are set to existed and proposed standards. The 4 mrem/yr. standard is used for beta particle and photon (gamma) emitters, except as specified for tritium and strontium-90. Based on this dose standard, an equivalent water concentration (activity) is calculated as required by 40 CFR 141.16 (*Safe Water Drinking Act*). For alpha emitters, the existing final standard for radium-226 and

radium-228 (5 pCi/L), the proposed standard for total uranium (20 µg/L), and the existing final standard for other alpha emitters (15 pCi/L) are used. For non-radionuclides with no available MCL, the RBC is established based on the incremental excess cancer risk of 1 x 10^{-6} or a hazard quotient of 1.0 for noncarcinogens.

Relevant to the third RAO, the previous ecological assessment for OFASB and LAOCB (WSRC 1997b and 1997c) have concluded that no constituents of potential concern in the soils are estimated to pose significant ecological risk based on their toxicity at the concentration at which they are present. If concentrations of COCs are present above levels of concern for ecological receptors, the consolidation and stabilization of any PTSM soils will ensure that ecological receptors are protected, since human health PTSM thresholds for radionuclides are lower than ecological thresholds . Protection to the ecological receptors indigenous to the area can be achieved by preventing or limiting contact with highly contaminated basin soil/pipelines, and preventing the plant and animals from bringing contaminants up toward the surface. As discussed above, the principal zone of contamination will generally be at least 2.1 to 3.6 m (7 to 12 ft) below the surface subsequent to the remedy, which is below the burrowing depth of all indigenous animals (see references from American Society of Mammalogists). Trees, which could root to those depths, and harvester or fire ants, which are known to have nests potentially deeper than 1.8 m (6 ft), will be controlled as part of the soil cover system maintenance.

6.2 Plug-in Remedy

This plug-in remedy, in situ stabilization with a low-permeability soil cover system, consists of the following five key aspects discussed in detail below: institutional

controls, consolidation of contaminated soil outside of the basins and around the pipelines, in situ stabilization, a low-permeability soil cover system, and pipeline grouting.

6.2.1 Institutional Controls

Institutional controls will be applied to all OUs that plug in to this ROD. The specific area of each candidate unit that will fall under institutional controls will be shown in the Land Use Control Implementation Plan (LUCIP) for that unit, in order to ensure that land use is consistent with the exposure assumptions on which the RAOs are based. Institutional controls will be used to support the first RAO discussed above. The institutional controls alternative will require both near- and long-term actions for protection of human health and the environment.

The four preliminary candidate OUs are all in industrial zones as identified on the proposed SRS future land use map of the SRS FFA *Implementation Plan* (WSRC 1996) for both current and anticipated future land use. US DOE has recommended that residential use of SRS land in the vicinity of these OUs be prohibited; therefore, future residential use and potential residential water usage in this area are unlikely. Institutional controls will. be maintained consistent with industrial land use.

In accordance with the US EPA Region IV Land Use Controls Policy, a LUCAP for SRS has been developed. The LUCAP is a programmatic document developed to assure the effectiveness and reliability of the required land use controls for as long as any land use control continues to be required. The selected remedial alternative for these operable units incorporates institutional (i.e., land use) controls and, therefore, a LUCIP for each of the OUs will be developed. The unit-specific LUCIP will be submitted as part of the post-ROD documentation. The LUCIP will detail the

implementation, maintenance, and monitoring of the land use control elements for each OU to ensure that the remedy remains protective of human health and the environment. Upon regulatory approval, the unit-specific LUCIP will be appended to the SRS LUCAP.

The primary institutional control objectives necessary to ensure the protectiveness of the preferred alternative are as follows:

- prevent contact, removal, or excavation of buried waste or pipelines in the OU areas designated in technical evaluation report and ESD and
- preclude residential or agricultural use of the area.

These objectives will be met by near- and long-term land use controls. The following near-term land use controls are expected to prevent exposure to the contaminated media at the plug-in OUS:

- SRS boundary security gates prevent exposure to intruders, , ,
- visible warning signs at the most probable access points requiring contact of the waste unit custodian prior to entry to the operable unit; and
- the site use/site clearance program prevents excavation in the area of the unit pipeline or cover system.

Long-term institutional controls will include evaluation of the need for deed notification/restrictions if the property is ever transferred to non-federal ownership, as required under CERCLA Section 120(h). It is expected that deed restrictions will prohibit residential or agricultural use and excavation activities in the area under institutional control. However, the need for deed restrictions may be reevaluated at the time of transfer in the event that exposure assumptions differ and/or contamination no longer poses an unacceptable risk under residential use.

In addition, a survey plat of the area under institutional controls will be prepared, certified by a professional land surveyor, and included with the LUCIP.

6.2.2 Consolidation

Consolidation of contaminated soils outside of the basins within the AOC of a given unit will be conducted to ensure that the footprint of the OU is reduced to the extent practical. This will reduce both the footprint of the remaining units and the maintenance costs associated with the implementation of the remedy. This is expected to include contaminated soils associated with pipelines (supporting RAO 2), incidentally impacted surface soils such as those found at OFASB (supporting RAO 1), and any PTSM.

Subsurface soil (deeper than 1 ft) containing COCs present at concentrations above contaminant migration RGs will be consolidated. These soil RGs are calculated to prevent migration of contaminants to groundwater for 1,000 years at concentrations that will exceed MCLs. Should the back-calculated soil concentrations protective to these levels be below background concentrations, background concentrations will be used as the RG. This is consistent with the second RAO. Soils present below leachability criteria not meeting this criterion will be left in place. The methodology for this calculation is presented in Appendix D.

For surficial soils, the amount of contaminated soils being consolidated would be driven by the first RAO. Industrial worker exposure RGs for COCs are established at 1×10^{-6} for carcinogens at the surface (0 to 1 ft) or background (where background levels of COCs exceed 1×10^{-6}) , as required by SCDHEC. Contaminant concentrations of nonradionuclides (if present) would be reduced to acceptable risk

levels (HQ=1) for the industrial worker. The methodology for the RG calculations is presented in Appendix E, which also contains a look-up table for the radionuclides.

Any soil to be consolidated that meets the definition of PTSM will be excavated, consolidated into the primary seepage basin for that OU, and stabilized. Soils exceeding RGs that are not PTSM will be placed in the basin before filling to grade, but may not be stabilized.

6.2.3 In Situ Stabilization

In situ soil stabilization is a treatment technology application that reduces the accessibility and mobility of contaminants. It will be applied to soils that are considered to be PTSM. In situ stabilization will support the first and second RAOs.

Stabilization treatment for this principal threat will meet the CERCLA preference for treatment. Stabilization treatment will provide for greater long-term effectiveness in protecting groundwater, and will also serve to augment prevention of potential direct exposure to the PTSM by converting the waste into a form less susceptible to uptake by human intruders.

In situ soil stabilization is performed by injecting or mixing the solidification agents directly into or with the contaminated soil. The two general methods used to deliver the stabilizing agents to the soil include shallow soil mixing (e.g., using crane- or truck-mounted, single-shaft auger heads) or soil injection/jet grouting (e.g., drilling holes to the desired depth and injecting soil stabilizing agents into the soil with high pressure pumps). The type of delivery system used will depend on the unit-specific physical soil properties present.

Solidification agents for injection technologies can be broken into two main categories: suspension grouts and chemical grouts. Suspension grouts are non-Newtonian fluids that consist of finely divided particulate matter suspended in water. Common examples of suspension grout materials include Portland cement and bentonite clay. Application of suspension grouts is limited by the viscosity of the solid/liquid suspension and the size of the suspended particle in relation to the pore size of the soil. The smallest void that can be effectively grouted is no smaller than three times the grain size of the suspended solid. Chemical grouts are Newtonian fluids that can have viscosities as, low as water. These grouts can be injected essentially any place that water can penetrate and as a result, can be used to solidify very fine soil voids. The most common chemical grout material is an aqueous solution of sodium silicate. Stabilization agents will be matched to the contaminants present to maximize the effectiveness of the stabilization agents in reducing mobility.

Unit-specific stabilization details will be provided as part of the remedial design report/ remedial action work plan for each unit.

6.2.4 Low Permeability Soil Cover System

A low permeability soil cover system will be placed over all the open basins. The soil cover system will be designed with permeability low enough to prevent migration of soil contaminants to groundwater for 1,000 years at concentrations that will exceed MCLs. This analysis will be completed in the decision document for each unit. The soil cover system will also help to reduce the migration rate of tritium, if any is still present in the vadose zone pore water. The soil cover system will consist of a layer of soil placed over the contaminated area. The soil used in the cover is clean, native soil selected from a nearby area (it is expected that an SRS borrow pit will be used). The primary purpose of the cover is to reduce the infiltration rate through the

contaminated zone and thus reduce contaminant migration, which supports RAO 2. The cover also acts to provide a barrier between potential receptors and the contaminants, which supports RAOs 1 and 3. If the hydraulic conductivity requirements cannot be achieved with compaction of native soil, a combination of geosynthetic materials will be used. These would include a geotextile clay liner, high-density polyethylene geomembrane liner, and a high-density polyethylene geonet (for drainage).

Based on the use of natural materials and its simple structure, the soil cover system can be maintained to provide long-term protection. Typically the soil cover is mounded, feathered into the surrounding area, and vegetated to minimize the impact of erosion. To support RAO 3, the depth to the waste will be at least six feet to prevent inadvertent plant or animal intrusion into the waste through the soil cover system (Suter, et al. 1993). Six feet is conservative based on a review of animal burrowing depths for SRS species (see References section). If a candidate unit is configured such that the depth to PTSM soil is less than six feet, a bio-barrier will be added to the cover system to prevent ecological intrusion. The soil cover system will be maintained to prevent bioturbation by ants and the growth of trees that may have root systems deep enough to reach the PTSM soil. Figure 9 shows a typical cross-section of an open reactor seepage basin and the contaminant pathways. Figure 10 shows a typical cross-section of the same basin with in situ stabilization and a low permeability soil cover system applied.

6.2.5 Pipelines

The pipelines associated with the candidate units will be grouted in place. The pipelines associated with each basin are 3-inch diameter high-density polyethlene. The pipelines will be grouted from the disassembly basin to the exit point at the

seepage basin. This action will meet the third RAO by preventing access by small animals. This will also stabilize any potential contamination left inside the pipeline.

6.3 Applicable, or Relevant and Appropriate Requirements (AGARS)

Section 121(d) of CERCLA of 1980, as amended by SARA of 1986, requires that remedial actions comply with requirements or standards set forth under federal and state environmental laws. Requirements or standards may be classified as either applicable or relevant and appropriate. Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site (US EPA 1988).

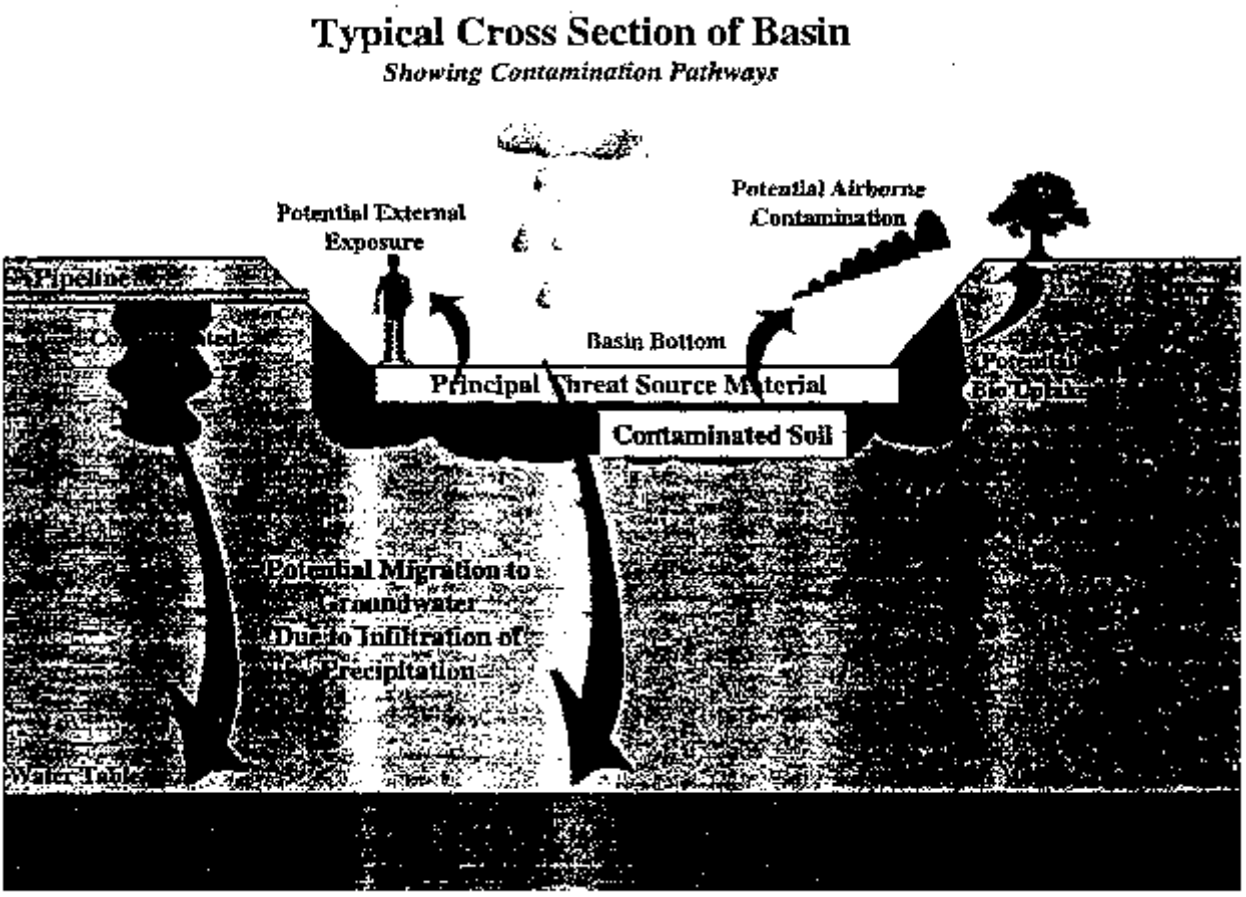

Figure 9. Cross Section of a Typical Basin Showing Contaminant Pathways

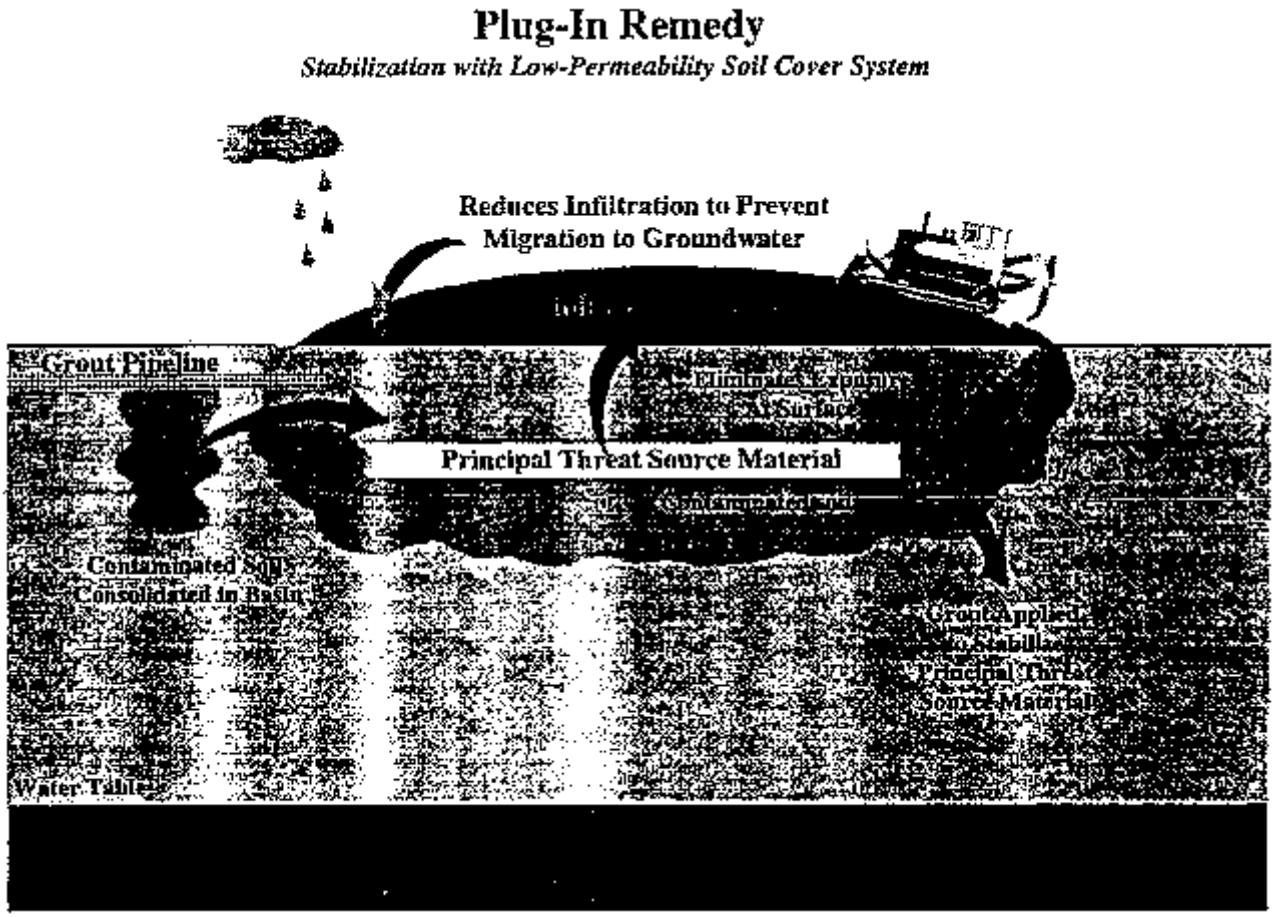

Figure 10. Cross Section of a Typical Rad Basin with Plug-in Remedy Applied

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site so that their use is well suited to the particular site (US EPA 1988).

In addition to AGARS, many federal and state environmental and public health programs have also developed to-be-considered (TBC) criteria, guidance, and proposed standards that are not legally binding, but that may provide useful information or recommended procedures (US EPA 1988). These TBCs are not AGARS, but are considered when determining remedial action objectives. For example, US DOE orders are not AGARS since they have not been formally promulgated under federal or state law. U S DOE orders are legally binding for US DOE and all of its contractors through the Price Anderson Amendments Act of 1988, which is the amendment to the Atomic Energy Act. US DOE orders for protection of the public and the environment are addressed through compliance with relevant and appropriate federal regulations. Thus, no TBCs are identified for the plug-in ROD.

6.3.1 Types of AGARS

AGARS are classified as being location specific, chemical specific, or action specific to further clarify how to identify and comply with environmental requirements.

Location-specific AGARS must consider federal and state requirements that reflect the physiographical and environmental characteristics of the unit or the immediate area.

Remedial actions may be restricted or precluded based on the location or characteristics of the unit and the resulting requirements. Chemical-specific ARARs are media-specific concentration limits promulgated under federal or state law. Remedial actions must be capable of meeting chemical-specific ARARs. Action-specific ARARs control the design, performance, and other aspects of implementation of specific remedial activities. For example RCRA regulated off site disposal of hazardous residuals.

6.3.2 Identification of ARARs for the Plug in R0D

The following sections identify location-specific, chemical-specific, and action-specific ARARs and TBCs for the Plug-in ROD. Table 7 presents the ARARs for the Plug-in ROD.

6.3.2.1 Location-Specific ARARs

The South Carolina Water Classification Standards (SC. R,61-68) are applicable to the water table aquifers beneath the candidate OUs. The resultant classification of the water table aquifers as potential drinking water sources consequently triggers state groundwater protection standards.

6.3.2.2 Chemical-Specific ARARs

Applicable federal regulations, which establish exposure limits for employees and the public, are promulgated in 10 CFR 835 (*Occupational Radiation Protection*). This regulation, which will apply to remediation workers, also specifies applicable airborne contamination values and personnel exposure control measures (i.e., protective clothing).

Table 7. ARARs

CITATION/REQUIREMENT	REMARKS
CHEMICAL-SPECIFIC	
NRC Requirements for Land Disposal of Radioactive Waste	
10 CFR 61.40 - Maximum annual dose from all pathway of 25 mrem to the whole body, 75 mrem to thyroid. and 25 merm to any other organ of any member of the public, including ALARA	Relevant and appropriate regulation. This regulation is intended for the same types and levels of radionuclides that will remain in the operable units that are managed in facilities regulated under 10 CFR 61. Cleanup levels for radionuclides to be left in place must at least meet these levels. This remedy meets 1 x 10^{-6} cleanup levels, which are lower than those based on 10 CFR 61.
SC Radioactive Material Regulations	
R.61-63, 7.19- Protection of Individuals from Inadvertent Intrusion. Closure of land disposal facility shall prevent inadvertent intrusion into the site, or contact with the waste after active institutional controls are removed.	Relevant and appropriate regulation. This regulation is intended for the same types and levels of radionuclides that will remain in the operable units as after the closure of a state- licensed facility for land disposal of radioactive waste. Deed restrictions and stabilization of PTSM will meet intent of this regulation.
R.61-63, 7.18- Protection of the General Population from Releases of Radioactivity. Maximum dose from all pathways of 25 mrem to the whole body, 75 mrem to thyroid. and 25 mrem to any other organ of any member of the public, including ALARA principles.	Relevant and appropriate regulation. This regulation is intended for the same types and levels of radionuclides that will remain in the operable units as after the closure of a state licensed facility for land disposal of radioactive waste. Cleanup levels for radionuclides to be left in place must at least meet these levels.. This remedy meets 1 x 10^{-6} cleanup levels, which are lower than those based on 10 CFR 61.
40 CFR 141 - MCLs and MCLGs for groundwater that may be a source of drinking water	Relevant and appropriate regulation. This standard for maintaining quality of groundwater that could be used as a drinking water source. Used as basis to back calculate soils' RGs to prevent future leaching to groundwater at unacceptable levels.
SC R.61-58.5 - MCLs and MCLGs for groundwater that may be a source of drinking water	Relevant and appropriate standards for maintaining quality of groundwater through source controls Used as basis to back calculate soils' RGs to prevent future leaching to groundwater at unacceptable levels.
Occupational Radiation Protection	
10 CFR 835.202 - Max. exposure for employees of 5 rem/yr.	Applicable regulation to workers during remediation activities.
10 CFR 835.206 - Exposure limits for embryo/fetus of 0.5 rem	Applicable regulation to workers during remediation activities.
10 CFR 835.208 - Exposure limits for members of the public during direct on-site access shall not exceed 0.1 rem TEDE	Applicable regulation to workers during remediation activities.

Table 7. ARARs (Continued)

CITATION/REQUIREMENT	REMARKS
LOCATION-SPECIFIC ARARs	
Drinking Water Standards	
Clean Air Act	
40 CFR 61.92 - Emissions of radionuclides to the ambient air from US DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr	Applicable during construction activities.
SC Water Classification Standards	
SC R. 61-68. - Definition of and classification of state groundwaters.	Relevant and appropriate standard for the classification of groundwater in the state, which subsequently triggers state groundwater protection standards. Used as basis to back calculate soils Rgs to prevent future leaching to groundwater at unacceptable levels
ACTION-SPECIFIC ARARs	
National Environmental Policy Act	
10 CFR 1021 - National Environmental Policy Act - Implementing procedures and guidelines	Applicable regulation to remedial actions. Met by categorical exclusion for CERECLA remedial actions.
SC Storm Water Regulations	
SC R. 72-300 - Storm Water Management and Sediment Reduction Regulation. Section 305 specifies a Stormwater Management and Sediment Control Plan required for any land disturbing activities.	Applicable regulation to construction activities. Compliance with this regulation will also meet federal Clean Water Act regulations. Must be considered during soil cover system design and followed during construction activities.

Applicable federal regulations for ambient air emissions of radionuclides are promulgated in 40 CFR 61.92 (*Clean Air Act*). This applicable regulation protects the general public during remediation activities.

Relevant and appropriate regulations for the protection of groundwater include the federal regulations in 40 CFR 141 (*Safe Water Drinking Act*) and South Carolina drinking water regulations promulgated in SC R.61-58.5. MCLs derived from these regulations are the targets that cannot be exceeded in back-calculating acceptable residual levels of contamination in the soil.

In establishing soil remedial goals at the surface, two relevant and appropriate regulations are identified: 1) 10 CFR 61.40 (NRC *Requirements for Land Disposal of Radioactive Waste*), and 2) SC R.61-63 (*South Carolina Radioactive Material Regulations*). 10 CFR 61.40 and SCR 61.63 establish the maximum allowable annual those to the public at 25 mrem/yr to the whole body, 75 mrem/yr to the thyroid, or 25 mrem/yr to any critical organ. SC R.61-63 also specifies exposure limits for employees and airborne contamination. 10 CFR 20, a more recent regulation concerning post-closure unrestricted use of a facility, was not considered because it is less protective than 10 CFR 61.40.

SCDHEC does not consider these ARARs to be protective enough. Therefore, RGs for surficial exposure to radionuclides have been set at 1×10^{-6} or background, if .background risk levels for COCs exceed 1×10^{-6}. Since the 1×10^{-6} RGs are significantly lower than the RGs would be if they were ARAR-based, the ARARs will be met for all radionuclides. The details for the methodology for the back calculation of both ARAR-based and risk-based RGs are provided in Appendix E.

6.3.2.3 Action-Specific ARARs

Applicable environmental regulations for construction activities during remediation include 10 CFR 1021 (National Environmental Policy Act), and SC R.72-300 (*Storm Water Management and Sediment Reduction*). The small scale of the remediation activities will result in these actions being classified as categorical exclusions under the National Environmental Policy Act (NEPA), consistent with other CERCLA actions at the SRS. Fill material for the soil cover will be obtained from existing on site borrows pits. Compliance with the.South Carolina Storm water management sediment reduction regulation will also meet federal Clean Water Act regulations. Specifically, SC R.72-305 requires a Stormwater Management and Sediment Control Plan for any land-disturbing activities. The Occupational Safety and Health Administration (OSHA) regulations are not generally considered environmental regulations and, therefore, are not identified as ARARs for the plug-in remedy. However, all remediation activities will be required to comply with OSHA regulations.

6.4 Costs

Table 8 summarizes the estimated costs for applying the remedy to each of the four OUs. The costs are broken down into four general categories: 1) the soil cover system, 2) in situ stabilization, 3) engineering, construction, and other project support services, and 4) operation and maintenance, including 5-year remedy reviews. These costs are preliminary and considered to be feasibility study type estimates that are +50% -30% accurate.

At LRSB, it is assumed that the first 0.6 m (2 ft) of soil from the basin bottom will require in situ stabilization. At KRSB, it is assumed that the first 0.9 m (3 ft) of soil

from the basin bottom will require in situ stabilization. At CRSB, it is assumed that the first 1.8 m (6 ft) of soils from the basin bottom in basin #1 and 1.2 m. (4 ft) of soil from the basin bottom in basin #2 will require in situ stabilization. At PRSB, it is assumed that the first 1.2 m (4 ft) of soil from the basin bottom in basins #1 and #2 will require in situ stabilization. The estimates at LRSB and PRSB will be refined as additional data is collected.

A discussion of the cost-effectiveness of the remedy is provided in Section 4.0.

Table 8. Estimated Costs for In Situ Stabilization with a Soil Cover System for the Candidate OUs

Cost Category	LRSB	KRSB	CRSB	PRSB
Soil Cover System	$203,366	130,939	$883,151	$845,617
In Situ Stabilization	1,004,991	$982,879	$2,864,706	$2,034,573
Engineering and Other Service	$740,458	$740,458	$895,491	$895,491
Operation and Maintenance	$566,268	$458,813	$1,515,515	$1,249,383
Total	**$2,515,083**	**$2,313,089**	**$6,158,863**	**$5,025,064**

7.0 PLUG-IN DECISION PROCESS

This section (1) describes the plug-in criteria to determine if a candidate unit can use the plug-in ROD (2) summarizes the administrative mechanics of using the plug-in ROD, and (3) provides a preliminary evaluation of the KRSB, CRSB, PRSB, and LSRB against the plug-in criteria. The basic process for the plug-in ROD is shown in Figure 11.

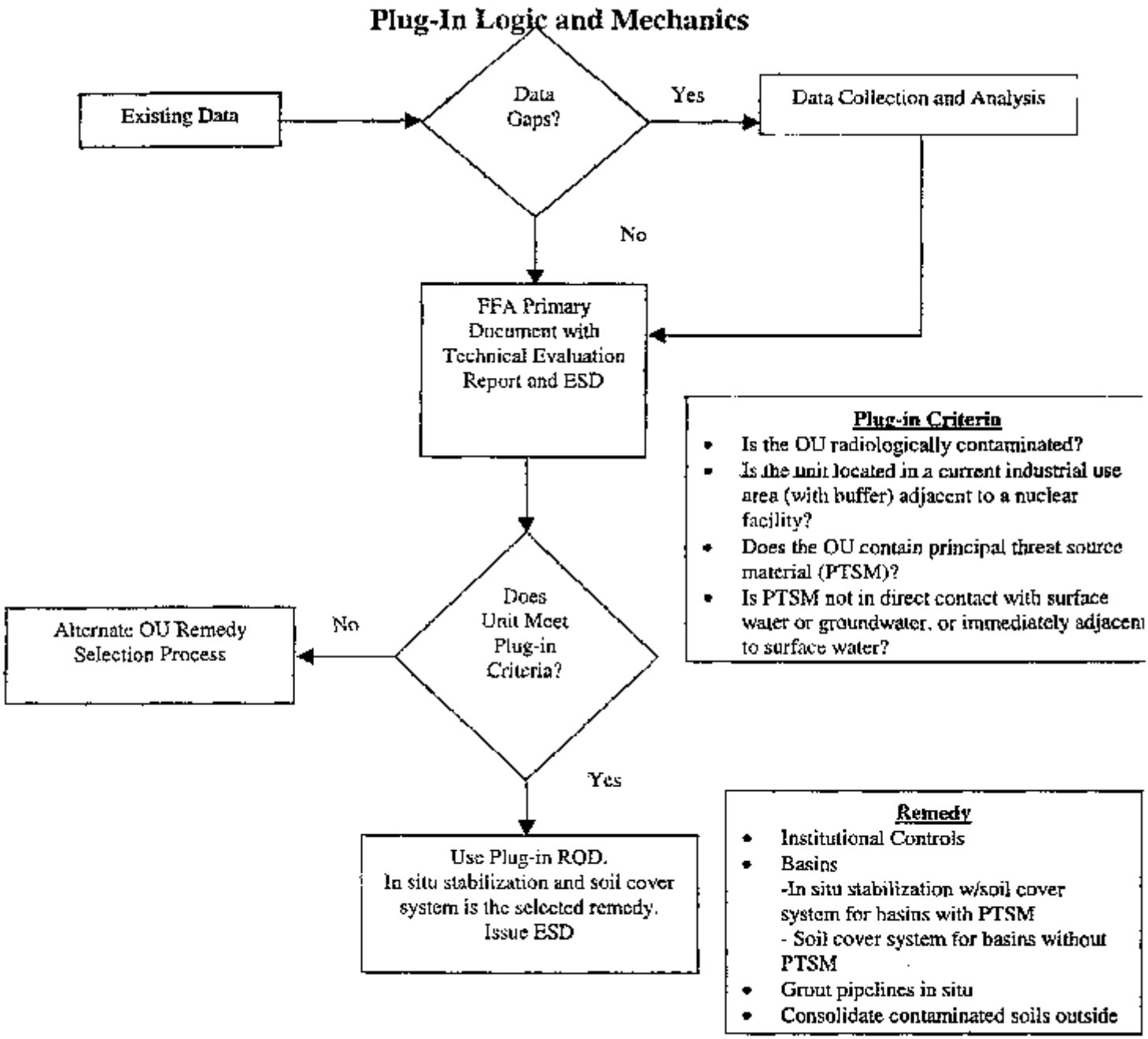

Figure 11. Plug-in Logic and Mechanics

7.1 Plug-in Criteria

The plug-in criteria are used to ensure that the waste units match the conditions that the plug-in remedy has been designed to meet. Therefore, the threshold criteria have been developed based on the conditions for which in situ stabilization with a low permeability soil cover system is technically effective and the conditions for which SRS precedents have established in situ stabilization with a low permeability soil cover system as a preferred response action.

The plug-in criteria have been formulated as key questions that the decision-makers (US DOE, US EPA and SCDHEC) must consider when evaluating a unit for a plug-in. Figure 12 shows a plug-in criteria logic flowchart. If the answer to any of the four questions is "No," then this plug-in ROD is not directly appropriate and an alternate OU remedy selection process will be used. If the candidate unit will receive waste from another operable unit, the decision to transfer the waste under the proper documentation should take place before the unit is evaluated for the plug-in ROD remedy.

Question 1 - Is the unit radiologically contaminated?

The signed RODs for the OFASB and the LAOCB both indicate that on-unit containment is the preferred response for addressing threats posed by radiologically contaminated soils. The primary contaminants at the unit should be radionuclides. Should no radionuclides be found at the unit, then the plug-in ROD would not be applicable because no SRS precedent has been established for using in situ stabilization with a low permeability soil cover

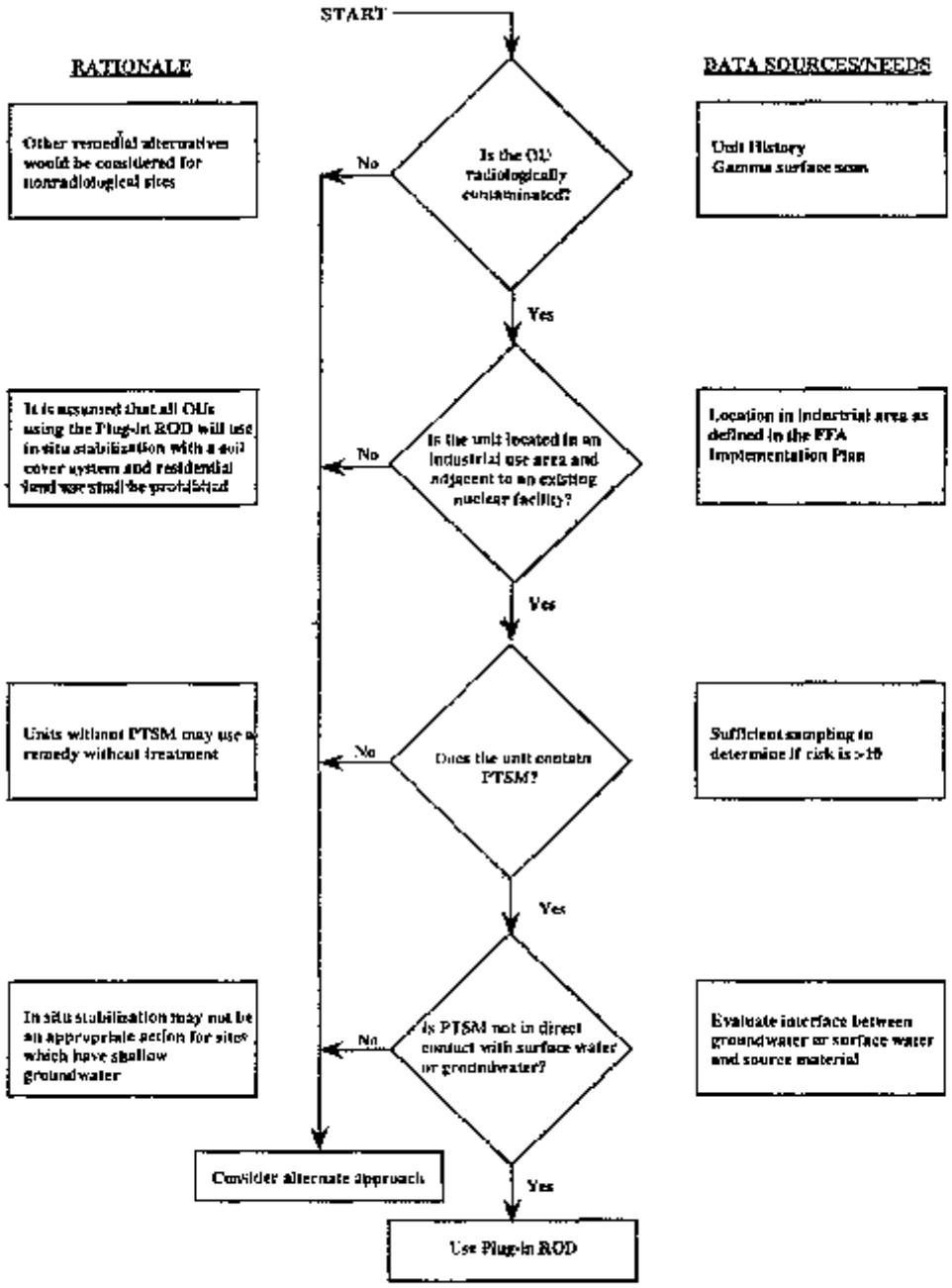

Figure 12. Plug-in Criteria for the Plug-in ROD

system at nonradioactively contaminated units. Units with nonradionuclides as the primary risk drivers would be evaluated on a case-by-case basis.

Question 2 - Is the unit located in a current industrial use area (with buffer) adjacent to an existing nuclear facility?

During the development of the RAOs, one of the key assumptions was that land use controls that would not allow unrestricted use would be placed on the OUs. This assumption was made because applying in situ stabilization with a low-permeability soil cover system will leave contaminants in place, at levels which preclude unrestricted use. At the present time, agreement has been reached that the areas around the current industrial use area (with buffer) adjacent to a nuclear facility (e.g., the reactor facilities, see Figure 3) will be used in the future only for industrial uses (WSRC 1995 and US DOE 1996a). Therefore, if the unit meets these location criteria, it meets the requirements for industrial future land use and satisfies the assumptions of the RAOs.

Question 3 - Does the unit contain PTSM?

This plug-in ROD is biased toward active remediation and treatment of units known, or expected, to present a significant threat to human health and the environment. If the unit does not contain PTSM as defined in this ROD (risk to a future industrial worker equal to or greater than 1×10^{-3}), the OU does not plug in since additional remedial alternatives without treatment should also be considered.

Question 4 - Is PTSM not in direct contact with surface water or groundwater or immediately adjacent to surface water?

The two cases to be considered are groundwater intrusion into the PTSM and surface water proximity to the waste such that the PTSM or the soil cover system could be eroded over time. The long-term stability of stabilized soils in the saturated zone would have to be further evaluated. These situations would preclude the use of this remedy unless engineering controls were first implemented to mitigate the problem. After the engineering controls were completed to prevent contact of PTSM with surface water or groundwater, the Plug-in remedy could be evaluated for use at a candidate unit. Should contaminated soils extend down through the vadose zone to the water table, the efficacy of the remedy will be addressed in the technical evaluation report for that unit.

7.2 Mechanics of Plugging an OU in

In order to determine if an OU meets the criteria of this plug-in ROD, the historical data will be evaluated, and adequate field characterization data will be collected and analyzed. The evaluation of an OU to determine if it meets the criteria of this plug-in ROD will be summarized in a proposed ESD and a technical evaluation report.. A generic example of the technical evaluation report is found in Appendix B. The technical evaluation document will be submitted with a primary CERCLA document (e.g., Workplan) for the OU. However, for KRSB and CRSB the ESD and technical evaluation report will be submitted as stand-alone documents, since these two units have already had work plans submitted.

Once the three parties agree that the unit meets the criteria contained in this plug-in ROD, the proposed ESD will be issued for a 30-day public comment period. An ESD typically describes a significant difference in the remedy from that described in the ROD. For the plug-in ROD, it will serve to document use of the plug-in remedy at a

specific operable unit. Any public comments will be addressed in the final ESD, and a public notice of the final ESD will be issued.

7.3 Preliminary Evaluation of the Four Reactor Seepage Basins Against the Plug-in Criteria

A preliminary evaluation of the four OUs against the plug-in criteria is presented in Table 9. Based on this preliminary evaluation against the plug-in criteria, CRSB, KRSB, and PRSB would meet the plug-in criteria.

LRSB will require additional data to determine if the unit can use the plug-in ROD. The existing data for PRSB is about 10 years old. Additional data will be required to support the detailed application of the remedy. The decision to plug these preliminary candidate units into the plug-in ROD will be fully documented in an ESD and associated technical evaluation report.

Table 9. Preliminary Evaluation of the Four Reactor Seepage Basins

Preliminary Candidate Operable Unit	Criteria 1: Is the OU radiologically contaminated?	Criteria 2: Is the OU in a current industrial use area (with buffer) adjacent to a current nuclear facility?	Criteria 3: Does the OU contain (PTSM)?	Criteria 4: Is the PTSM not in direct contact with groundwater or immediately adjacent to surface water?
C-Area Reactor Seepage Basins (904-066G, -067G, -068G)	**Yes,** based on past process history and sampling.	**Yes** (see Figure 4)	**Yes,** radionuclide contaminant concentrations > PTSM threshold of 1E-03 risk.	**Yes,** groundwater is 21 m (70 feet) below the ground surface. No adjacent surface water features.
K-Area Reactor Seepage Basins (904-65G);	**Yes,** based on past process history and sampling.	**Yes** (see Figure 5)	**Yes,** radionuclide contaminant concentrations > PTSM threshold of 1E-03 risk.	**Yes,** groundwater is 18 m (60 feet) below the ground surface. No adjacent surface water features.
L-Area Reactor Seepage Basins (904-64G)	**Yes,** based on past process history.	**Yes** (see Figure 6)	**Insufficient data available.** Assuming radionuclide contaminant concentrations will be > PTSM threshold of 1E-03 risk.	**Yes,** groundwater is 7.4 m (24 feet) below the ground surface. No adjacent surface water features.
P-Area Reactor Seepage Basins (904-61G, -62G, -63G)	**Yes,** based on past process history and sampling.	**Yes** (see Figure 7)	**Yes,** radionuclide contaminant concentrations > PTSM threshold of 1E-03 risk.	**Yes,** groundwater is 12.2 m (40 feet) below the ground surface. No adjacent surface water features.

8.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

CERCLA requires that the public be given an opportunity to review and comment on the proposed remedial alternative. CERCLA provides public input through the PP comment period. Public participation requirements are listed in Sections 113 and 117 of CERCLA. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternatives for addressing the soil and groundwater. The Administrative Record File must be established at or near the facility at issue. The SRS public involvement plan (US DOE 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and the selection of remedial alternatives. The SRS public involvement plan addresses the requirements of CERCLA and the National Environmental Policy Act. Section 117(a) of CERCLA, as amended, requires the advertisement of the draft permit modification and notice of any proposed remedial action and provide the public an opportunity to participate in the selection of the remedial action.

The Administrative Record File, which contains the information pertaining to the selection of the response action, is available at the US EPA office in Atlanta and at the following locations:

U.S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina-Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Reese Library
Augusta State University
2500 Walton Way
Augusta, Georgia 30910
(706) 737-1744

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

Asa H. Gordon Library
Savannah State University
Tompkins Road
Savannah, Georgia 31404
(912) 356-2183

The SRS Citizens Advisory Board has had the opportunity to provide input into the plug-in ROD concept and has passed two motions to implement this concept at SRS. Recommendation #2 stated that the plug-in ROD remedy should be applied to all sites that meet the plug-in criteria. Recommendation #76 added that the plug-in remedy should be specifically applied at the candidate units identified in this ROD. The public was notified of the public comment period through mailings of the *SRS Environmental Bulletin*, a newsletter sent to approximately 3500 citizens in South Carolina, Georgia, and several other states, and through notices in the *Aiken Standard*, the *Allendale Citizen Leader*, the *Augusta Chronicle*, the *Barnwell People-Sentinel*, and *The State* newspapers.

The 45-day public comment period on the Plug-in Proposed Plan began on June 12, 1999 and ended on July 26, 1999. No public comments were received.

For each candidate unit evaluated for the plug-in ROD, an ESD will be made available for a 30-day public comment period. The technical evaluation report, which will provide the technical detail used to prepare the ESD, will be available through the Administrative Record File. If the three agencies agree that the plug-in remedy should be used for the candidate unit, any public comments will be addressed, the ESD will be finalized, and a public notice will be issued.

9.0 STATUTORY DETERMINATIONS

Based on previous evaluations for similarly contaminated OUs the OFASB and the LAOCB and the existing data available, the radiologically contaminated candidate OUs identified within this ROD pose significant risk to human health. Therefore, actual or threatened releases of radionuclides and hazardous constituents from these units, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

For waste units meeting the plug-in criteria, the selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technology to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment to reduce toxicity, mobility, or volume as a principal element. Contaminated basin sediments and soils identified as PTSM will be in-situ stabilized. Application of a low permeability cover system will prevent exposure of human and ecological receptors to highly contaminated soils. Soils exceeding human health or leachability RGs outside the basin will be consolidated into the most contaminated basin. The levels of radionuclides in the soil warrant a common remedy in which institutional controls are a required aspect of the remedy. In situ stabilization with a low permeability soil cover system is considered a short- and long-term permanent solution.

Section 300.430 (f)(4)(ii) of the National Oil and Hazardous Substances Pollution Contingency Plan requires that if hazardous substances, pollutants, or contaminants above levels that allow for unlimited use and unrestricted exposure remain in the

waste operable unit. The action must be reviewed no less than every five years after its initiation. Because this remedy will result in hazardous substances remaining onsite above levels that allow for unlimited use and unrestricted exposure, the three parties (US DOE, SCDHEC, and US EPA) have determined that a five-year review of any decision made to use the plug-in interim ROD will be performed to ensure continued protection of human health and the environment.

10.0 EXPLANATION OF SIGNIFICANT CHANGES

The PP provided for involvement with the community through a document review process and a public comment period. No public comments were received.

The three parties decided to expand the public participation process in determining if a candidate unit meets the plug-in criteria, and should, therefore, use the plug-in remedy. The proposed plan indicated that for the four reactor seepage basins, the public would be notified that the OU met the plug-in criteria and was using the plugin remedy. The public will now be given a 30-day public comment period for all candidate operable units before a decision is made by US DOE, US EPA, and SCDHEC to use the plug-in remedy.

The proposed plan specified that near-term institutional controls would limit land use activities at the unit for the next 100 years to monitoring and maintenance activities. This ROD has revised the remedial goals for cleanup of potential contamination outside of the basins to allow for any industrial use excluding excavation or other activities that would disturb the cover system.

11.0 RESPONSIVENESS SUMMARY

No comments were received during the public comment period and, therefore, no responsiveness summary is required.

12.0 POST-ROD DOCUMENT SCHEDULE

A technical evaluation report and a proposed ESD, will be developed for each candidate unit that identifies the appropriateness of a given OU to use the plug-in remedy. Following public comment and final approval of the ESD, unit-specific post-ROD documents will be developed. It is expected that a single post-ROD document containing design information and remedial action implementation details will be submitted before the remedial action. A remedial action report will be submitted after the implementation of the remedial action.

Figure 13 represents the planning case for applying the plug-in approach to the four reactor seepage basins. Implementation schedules for individual source units will be placed in unit-specific documents. A FFA compliance date of January 31, 2001 has been established for the L-Area Reactor Seepage Basin Operable Unit work plan submittal. The work plan will include the proposed ESD and technical evaluation report provided the operable unit meets the plug-in criteria. The planning date for the submittal of the P-Area Reactor Seepage Basin Operable Unit work plan, is August 31, 2002.

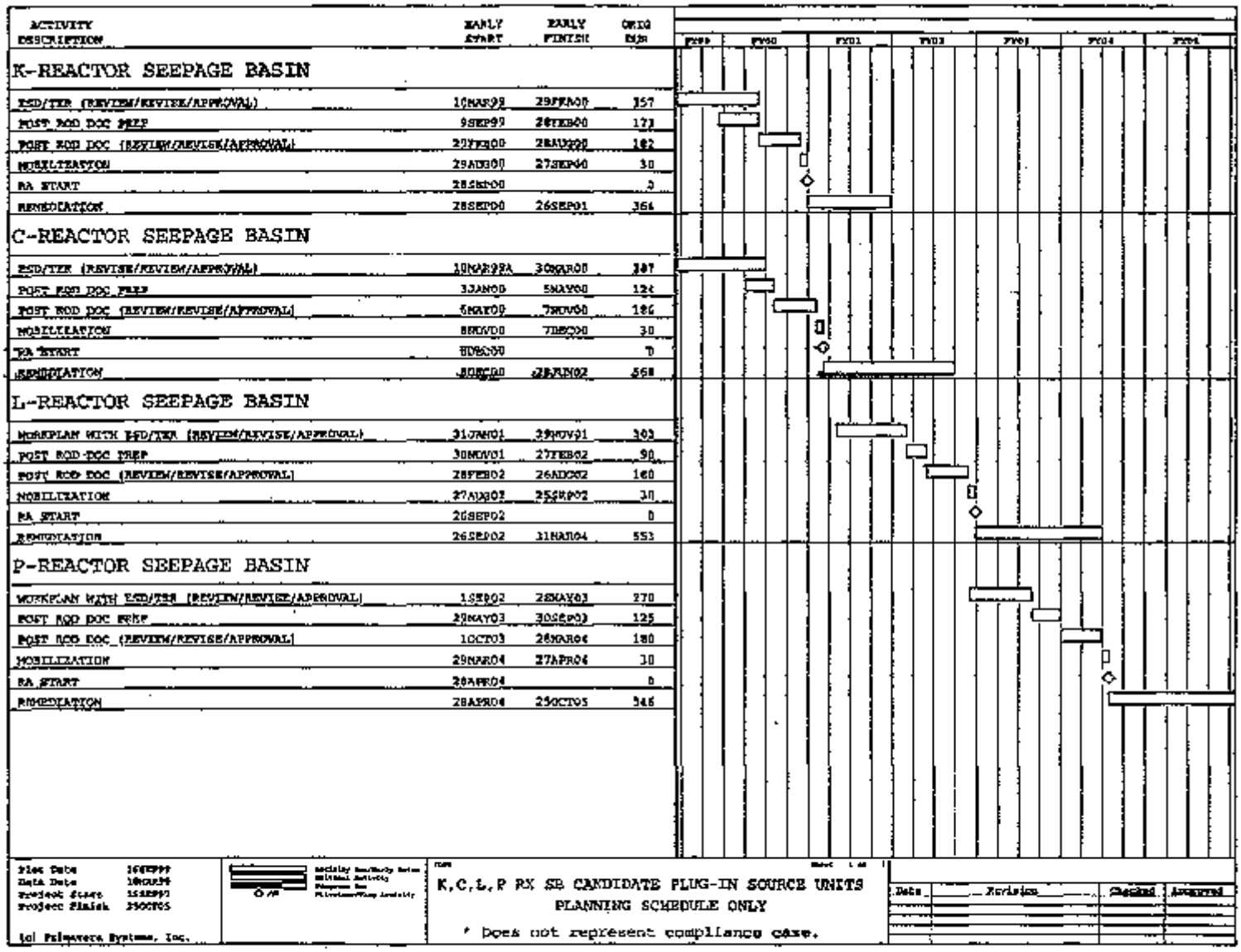

Figure 13. Planning Generic Schedules for KRSB, CRSB, PRSB, and LRSB

CERCLA Sec. 120(e)(2) requires continuous physical onsite remedial action within 15 months of the "completion of the investigation and study". For the purpose of assessing compliance for the plug-in ROD units, the date of a "completion of the investigation and study" shall be the date the three parties (US EPA, SCDHEC, and US DOE) provide final approval of the ESD for the unit, following the public comment period.

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APPENDIX A

OFASB AND LAOCB ALTERNATIVE COMPARISONS

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APPENDIX A OFASB AND LAOCB ALTERNATIVE COMPARISONS

A summary of the comparative analysis for remedial alternatives at the Old F-Area Seepage Basin (OFASB) and the L-Area Oil and Chemical Basin (LAOCB) are provided in Tables A-1 and A-2, respectively.

Table A-1. Comparative Analysis of Alternatives for OFASB (Soil/Vegetation)

Criterion	OFASB Soil and Vegetation Alternatives			
	Alternative 1 (No Action)	Alternative 2 (Capping)	Alternative 3A (In situ Grout to 2 ft/Incinerate Vegetation	Alternative 3B (In situ Grout to 2 ft/Dispose Vegetation)
Overall Protectiveness				
Human Health	Protective as long as institutional controls are maintained	Protective	Protective	Protective
Environment	Not Protective	Protective	Protective	Protective
Compliance with ARARs				
Chemical Specific	Meets UMTRA levels	Meets UMTRA levels	Meets UMTRA levels	Meets UMTRA levels
Location Specific	Not Applicable	Requires measures to prevent impact to neighboring wetlands	Requires measures to prevent impact to neighboring wetlands	Requires measures to prevent impact to neighboring wetlands
Action Specific	None	Requires NESHAPs air modeling/permitting	Requires NESHAPs air modeling/permitting	

Table A-1. Comparative Analysis of Alternatives for OFASB (Soil/Vegetation) (Cont)

Criterion	OFASB Soil and Vegetation Alternatives			
	Alternative 1 (No Action)	**Alternative 2 (Capping)**	**Alternative 3A (In situ Grout to 2 ft/Incinerate Vegetation**	**Alternative 3B (In situ Grout to 2 ft/Dispose Vegetation)**
Long-term Effectiveness and Permanence				
Magnitude of residual risks	OFASB waste unit would be a continual source of contamination to the environment; residual risks would be very high, particularly in the absence of institutional controls.	Much reduced over current conditions, but failure of the cap could pose risks to groundwater, onsite workers, and others unless further action is taken.	Residual risks would be much lower than Alternative 2, but failure of the cap could pose risks to groundwater, onsite workers, and others unless further action is taken; vegetative debris would not pose significant risks.	Same as Alternative 3A.
Adequacy of Controls	Existing institutional controls are effective for the protection of human health; but they cannot be guaranteed for as long as the contamination poses a risk to human health	Existing and supplemental institutional controls would be effective, but they cannot be guaranteed for as long as the contamination poses a risk to human health.	Existing ans supplemental institutional controls would be effective and grouting of the most contaminated soils would limit risk to groundwater should the cap ever fail.	Same as Alternative 3A.
Reduction of Toxicity, Mobility or Volume				
Treatment type	No Active treatment.	No active treatment	Stabilization/solidification of the most contaminated soils; incinerate vegetation.	Stabilization/solidification of the most contaminated soils; no treatment of vegetation.
Reduction of toxicity, mobility or volume	None through treatment.	Capping would effectively reduce contaminant mobility as long as cap integrity is maintained; not a permanent reduction in contaminant mobility.	Permanently reduces contaminant mobillity in the most threatening soils; reduce contaminant mobility and volume in vegetation.	Permanently reduce contaminant mobillity in the most threatening soils.

Table A-1. Comparative Analysis of Alternatives for OFASB (Soil/Vegetation) (Cont)

Criterion	OFASB Soil and Vegetation Alternatives			
	Alternative 1 (No Action)	**Alternative 2 (Capping)**	**Alternative 3A (In situ Grout to 2 ft/Incinerate Vegetation**	**Alternative 3B (In situ Grout to 2 ft/Dispose Vegetation)**
Short-term Effectiveness				
Risk to remedial workers	None; would involve no handling of contaminated media.	Minimal; volume of soils excavated: 130m^3 (4.5 x 103 ft^3; 1.6 x 10^3 yd^3); volume of vegetation processed 19 m^3 (660 ft^3; 24 yd^3).	Low; volume of soils excavated and processed: 130m^3 (4.5 x 103 ft^3; 1.6 x 10^3 yd^3); volume of vegetation processed 19 m^3 (660 ft^3; 24 yd^3).	Low; volume of soils excavated and processed: : 130m^3 (4.5 x 103 ft^3; 1.6 x 10^3 yd^3); volume of vegetation processed 19 m^3 (660 ft^3; 24 yd^3).
Risk to community	Negligible	Minimal	Very low; would involve transport of vegetation to CIF in E-Area.	Very low; would involve transport of vegetation to off unit disposal facility.
Construction Schedule	Immediately implementable	6 months	12 months	12 months
Implementability				
Potential Concerns	Potential for public concern in No Action is implemented.	None	Possibility in delay of CIF startup scheduled for Jan. 1996.	None
Relative implementability	Readily implementable	Readily implementable, but would require much more effort than No Action	Readily implementable after CIF startup; would require more effort than capping alone (Alt. 2).	Readily implementable; would require more effort than capping alone (alt. 2), but slightly less effort than Alt. 3A.
Cost				
Basis for O&M costs	30 years	30 years	30 years	30 years
Present worth capital costs	$0	$800,000	$1,6000,000	$1,300,000
Present worth O&M costs	$280,000	$500,000	$500,000	$500,000
Total present worth costs	$280,000	$1,300,000	$2,100,000	$1,800,000

Table A-1. Comparative Analysis of Alternatives for OFASB (Soil/Vegetation) (Cont)

Criterion	OFASB Soil and Vegetation Alternatives		
	Alternative 4A (Ex situ Grout to 2 ft/Incinerate Vegetation)	**Alternative 4B (Ex situ Grout to 2 ft/Dispose Vegetation)**	**Alternative 5 (Dispose Soil to 2 ft/Dispose Vegetation)**
Overall Protectiveness			
Human Health	Protective	Protective	Protective
Environment	Protective	Protective	Protective
Compliance with ARARs			
Chemical Specific	Meets UMTRA levels	Meets UMTRA levels	Meets UMTRA levels
Location Specific	Requires measures to prevent impact to neighboring wetlands	Requires measures to prevent impact to neighboring wetlands	Requires measures to prevent impact to neighboring wetlands
Action Specific	Requires NESHAPs air modeling/permitting	Requires NESHAPs air modeling/permitting	Requires NESHAPs air modeling/permitting
Long-term Effectiveness and Permanence			
Magnitude of residual risks	Residual risks would be lower than Alternatives 4A/B since treatment effectiveness would be confirmed; vegetative debris would not pose significant risks.	Same as Alternative 4A.	An estimated 53% of known Cs-137 and 97% of mercury in contaminated soil would be permanently removed; remaining Cs-137 and mercury would remain untreated and beneath cap.
Adequacy of Controls	Existing and supplemental institutional controls would be effective; risk to groundwater would be very low should the cap ever fail.	Same as Alternative 4A.	Existing and supplemental institutional controls would be effective; removal of the most contaminated soils would limit risk to groundwater should the cap ever fail.

Table A-1. Comparative Analysis of Alternatives for OFASB (Soil/Vegetation) (Cont)

Criterion	OFASB Soil and Vegetation Alternatives		
	Alternative 4A (Ex situ Grout to 2 ft/Incinerate Vegetation)	**Alternative 4B (Ex situ Grout to 2 ft/Dispose Vegetation)**	**Alternative 5 (Dispose Soil to 2 ft/Dispose Vegetation)**
Reduction of Toxicity, Mobility or Volume			
Treatment Type	Stabilization/solidification of all contaminated soils required to protect groundwater; incinerate vegetation.	Stabilization/solidification of all contaminated soils required to protect groundwater; disposal of vegetation.	Incinerate vegetation.
Reduction of toxicity, mobility or volume	Permanently reduce contaminant mobillity in contaminated soils requiring treatment; reduce contaminant mobility and volume in vegetation.	Permanently reduce contaminant mobility in contaminated soils requiring treatment.	Permanently reduce vegetative contamination mobility and volume.
Short-term Effectiveness			
Risk to remedial workers	Minimal; volume of soils excavated: 130 m^3 (4.5 x 10^3 ft^3; 1.6 x 10^3 yd^3); volume of vegetation processed 19 m^3 (660 ft^3; 24 yd^3).	Same as Alternative 4A.	High; volume of soils excavated: 3.6 x 10^3 m^3 (1.3 x 10^5 ft^3; 4.7 x 10^3 yd^3).
Risk to community	Very low; would involve transport of vegetation to CIF in E Area.	Very low; would involve transport of vegetation to Burial Grounds Debris Trenches in E Area.	Significant; assuming highway transport, Alt. 7A would involve approximately 313 round trips from SRS to Utah totaling 1.25 x 10^6 mi).
Construction Schedule	<12 months	<12 months	8 months

Table A-1. Comparative Analysis of Alternatives for OFASB (Soil/Vegetation) (Cont)

Criterion	OFASB Soil and Vegetation Alternatives		
	Alternative 4A (Ex situ Grout to 2 ft/Incinerate Vegetation)	**Alternative 4B (Ex situ Grout to 2 ft/Dispose Vegetation)**	**Alternative 5 (Dispose Soil to 2 ft/Dispose Vegetation)**
Implementability			
Potential concerns	Possibility in delay of CIF startup scheduled for January 1996; need for specialized grouting equipment.	Need for some specialized grouting equipment.	Possibility in delay of CIF startup scheduled for January 1996; potential for public opposition due to waste transport concerns.
Relative implementability	Implementable after CIF startup; would require much more than effort than grouting under Alternatives 3A/3B.	Implementable; would require slightly less effort than Alt. 4A for vegetation.	Readily implementable after CIF startup; would require a little more effort than ex situ grouting under 4A/4B.
Cost			
Basis for O&M costs	30 years	30 years	30 years
Present worth capital costs	$1,800,000	$1,400,000	$8,500,000
Present worth O&M costs	$500,000	$500,000	$500,000
Total present worth costs	$2,300,000	$1,900,000	$9,000,000

Table A-2. Comparative Analysis of Soil/Sediment Alternatives LAOCB

Criterion	LAOCB Soil Remedial Alternatives					
	Alternative S-1 No Action	Alternative S-2 Capping	Alternative S-3 Slurry Cut-Off Wall & Capping	Alternative S-4 In situ S/S & Capping	Alternative S-5 Ex situ S/S & Capping	Alternative S-6 Disposal at the Nevada Test Site
Overall Protectiveness						
Human Health	Protective as long as institutional controls are maintained	Protective	Protective	Protective	Protective	Protective
Environment	Protective as long as clay layer beneath Basin restricts migration	Protective	Protective	Protective	Protective	Protective
Compliance with ARARs						
Chemical-specific	Meets TSCA/UMTRCA levels; would not meet 40 CFR 191 or DOE Order 5400.5 (TBC) under hypothetical future conditions	Meets TSCA/UMTRCA levels; Complies with 40 CFR 191 and DOE Order 5400.5 (TBC)	Meets TSCA/UMTRCA levels; Complies with 40 CFR 191 and DOE Order 5400.5 (TBC)	Meets TSCA/UMTRCA levels; Complies with 40 CFR 191 and DOE Order 5400.5 (TBC)	Meets TSCA/UMTRCA levels; Complies with 40 CFR 191 and DOE Order 5400.5 (TBC)	Meets TSCA/UMTRCA levels; Complies with 40 CFR 191 and DOE Order 5400.5 (TBC)
Location-specific	Not Applicable	None	None	None	None	None
Action-specific	None	Requires NESHAPs air modeling & permitting; RCRA cap performance standards; erosion control plan; OSHA worker health & safety plan	Requires NESHAPs air modeling & permitting; RCRA cap performance standards; erosion control plan; OSHA worker health & safety plan	Requires NESHAPs air modeling & permitting; RCRA cap performance standards erosion; erosion control plan; OSHA worker health & safety plan	Requires NESHAPs air modeling & permitting; RCRA cap performance standards; erosion control plan; OSHA worker health & safety plan	Requires NESHAPs air modeling & permitting; RCRA cap performance standards; erosion control plan; OSHA worker health & safety plan

Table A-2. Comparative Analysis of Soil/Sediment Alternatives LAOCB (Cont)

Criterion	LAOCB Soil Remedial Alternatives					
	Alternative S-1 No action	Alternative S-2 Capping	Alternative S-3 Slurry Cut-off Wall & Capping	Alternative S-4 In situ S/S & Capping	Alternative S-5 Ex situ S/S & Capping	Alternative S-6 Disposal at the Nevada Test Site
Long-Term Effectiveness and Permanence						
Magnitude of residual risks	Residual risk could be high, particularly in the absence of institutional controls; clay layer beneath Basin could retard impact to groundwater	Much reduced over current conditions; capping and clay layer would retard migration of COCs	Residual risks would be lower than Alternative 2, total encapsulation of COCs.	Residual risk lower than Alternatives 2 and 3 due to grouting of the contaminants (protection of the environment)	Residential risk would be the same as Alternative 4	Residual risk would be minimal; contaminated soils would be permanently removed
Adequacy of controls	Existing institutional controls are effective for the protection of human health, but cannot be guaranteed; adequacy of the clay layer has proven effective, but can not be verified	Existing and supplemental institutional controls would be effective; cap and the clay layer beneath the Basin would retard migration of COCs	Existing and institutional controls would be effective; slurry wall, cap and the clay layer beneath the Basin would retard migration of COCs	Existing and supplemental institutional controls would be effective and grouting of the contaminated soils would further limit risk to the environment	Existing and supplemental institutional controls would be effective and grouting of the contaminated soils would further limit risk to the environment	No controls required; could be released for unrestricted land use

Table A-2. Comparative Analysis of Soil/Sediment Alternatives LAOCB (Cont)

Criterion	LAOCB Soil Remedial Alternatives					
	Alternative S-1 No action	Alternative S-2 Capping	Alternative S-3 Slurry Cut-off Wall & Capping	Alternative S-4 In situ S/S & Capping	Alternative S-5 Ex situ S/S & Capping	Alternative S-6 Disposal at the Nevada Test Site
Reduction of Toxicity, Mobility or Volume						
Treatment type	No active treatment	No active treatment	No active treatment	Stabilization/ solidification on the contaminated soil	Stabilization/ solidification of the contaminated soil	None
Reduction of toxicity, mobility or volume	None through treatment	Capping and the clay layer beneath the Basin would effectively reduce contaminant mobility as long as cap integrity is maintained; not a permanent reduction in contaminant mobility	Slurry wall, capping, and the clay layer beneath the Basin would effectively reduce contaminant mobility as long as cap integrity is maintained; not a permanent reduction in contaminant mobility	Permanently reduced contaminant mobility in the soils	Permanently reduce contaminant mobility in the soils	Contaminated soils removed, and relocated
Short-Term Effectiveness						
Risk to remedial workers	None; would involve no handling of contaminated media	Minimal	Minimal	Low	Medium; volume of soils excavated: 760 m^3 (27,000 ft^3, 1,000 yd^3)	Medium to high; volume of soils excavated and transported: 760 m^3 (27,000 ft^3, 1,000 yd^3)
Risk to community	Negligible	Minimal	Minimal	Minimal	Minimal	Medium; would involve transport of soils to the NTS
Construction schedule	Immediately implementable	3 months	6 months	12 months	15 months	3 months

Table A-2. Comparative Analysis of Soil/Sediment Alternatives LAOCB (Cont)

Criterion	LAOCB Soil Remedial Alternatives					
	Alternative S-1 No action	Alternative S-2 Capping	Alternative S-3 Slurry Cut-off Wall & Capping	Alternative S-4 In situ S/S & Capping	Alternative S-5 Ex situ S/S & Capping	Alternative S-6 Disposal at the Nevada Test Site
Implementability						
Potential concerns	Potential for public concern of no action is implemented	Potential for public concern since no treatment is performed	Potential for public concern since no treatment is performed	None	Medium; would require pre-excavation treatment for waste handling purposes	High; would involve transport of soils outside SRS boundaries; would require pre- & post-excavation treatment for waste handling & packaging purposes
Relative implementability	Readily implementable	Readily inplementable, but would require much more effort than No Action	Readily implementable; would require more effort than capping alone (Alt 2)	Readily implementable; would require more effort than capping alone (Alt 2)	Implementable; however, waste handling may cause down time during remediation; also requires pre-excavation treatment	Implementable; however, waste handling may cause down time during remediation; also requires pre- & post-excavation treatment
Cost*						
Basis for O&M costs	30 years	30 years	30 years	30 years	30 years	Not applicable
Present worth capital costs	$0	$1,000,000	$3,000,000	$3,150,000	$3,940,000	$9,100,000
Present worth O&M costs	$280,000	$430,000	$430,000	$430,000	$430,000	$0
Total present worth costs	$280,000	$1,430,000	$3,430,000	$3,580,000	$4,370,000	$9,100,000

*Costs are developed for comparison purposes only and are not intended to forecast actual expenditures. S/S = Stabilization/Solidification

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APPENDIX B

TECHNICAL EVALUATION REPORT TEMPALTATE

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United States Department of Energy

Savannah River Site

Technical Evaluation of the Plug-in Remedy for use at the (*Insert Operable Unit Name)***Operable Unit Report (U)**

WSRC-RP-99-XXX

Revision 0

(Insert Date)

Prepared By:
Westinghouse Savannah River Company
Savannah River Company
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Prepared for the U. S. Department of Energy under Contract No. DE-AC09-96-SR18500

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FIGURE 2. *(INSERT OU NAME)* WITH CURRENT INDUSTRIAL USE AREA AND INSTITUTIONAL CONTROL AREA) B-14

FIGURE 3. PLUG-IN LOGIC AND MECHANICS B-16

LIST OF ACRONYMS

AOC	area of contamination
COCs	contaminants of concern
DNAPL	dense non-aqueous phase liquid
FFA	Federal Facility Agreement
MCLs	maximum contaminant levels
mrem/yr	millirem/year
OU	operable unit
RAOs	remedial action objectives
RBCs	risk-based concentrations
RGs	remedial goals
ROD	Record of Decision
SCDHEC	South Carolina Department of Health and Environmental Control
SRS	Savannah River Site
US DOE	United States Department of Energy
US EPA	United States Environmental Protection Agency
VOC	volatile organic compound

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1.0 INTRODUCTION

The Plug-in Record of Decision for In Situ Stabilization With a Low Permeability Soil Cover System for Radiological Contaminants in Soil (U), WSRC-RP-98-4099 (plug-in record of decision [ROD]) identifies in situ stabilization with a low permeability soil cover system as the preferred response action for radioactively contaminated source units that meet specific criteria, such as reactor seepage basins. The remedy includes the use of institutional controls and allows for consolidation when appropriate. This conclusion was reached based on review of SRS decision precedents (i.e.,previous RODs) and supports the use of a plug-in approach. Because United States Department of Energy (US DOE), United States Environmental Protection Agency (US EPA), and South Carolina Department of Health and Environmental Control (SCDHEC) have agreed to apply the remedy at radioactively contaminated source units that meet the conditions defined in the plug-in ROD.

The purpose of this document is to demonstrate that the *(insert OU name)* meets the criteria specified in the plug-in ROD. This document will also specifically describe how the remedy will be applied to *(insert OU name).* When approval of this technical evaluation report and an associated ESD is received from the US EPA and the SCDHEC the OU shall adopt the plug-in remedy, in situ stabilization with a low permeability soil cover system, as described in the plug-in ROD.

The remedy selected in the Plug-in ROD is designed to meet the following remedial action objectives (RAOs):

1) Prevent human exposure to highly contaminated basin soils (PTSM) by performing stabilization treatment to the extent practicable, and filling the basins. Reduce risks to the future worker from surface soils (0 to 0.3 m [0-1 foot]) outside the basin by establishing remedial goals (RGs) for, constituents of concern (COCs) at concentrations equivalent to

1 x 10^{-6} for carcinogens and a hazard quotient of 1 for non-carcinogens or background (where background levels of COCs exceed 1 x 10^{-6}).

2) Prevent the release of COCs in soil to groundwater beneath the unit above maximum contaminant levels (MCLs) or risk-based concentrations (RBCs) if MCLs are not available. The soil RGs are back calculated based on these values.

3) Protect the ecological receptors indigenous to the area by preventing or limiting contact with contaminated soils and pipelines, and preventing the plant and animals from bringing contaminants up towards the surface.

2.0 SCOPE AND ROLE OF THE *(INSERT OU NAME)* OU

Releases of radioactive contaminants at non-permitted waste units are subject only to Comprehensive Environmental Response Compensation and Liability Act (CERCLA) requirements. *(Insert the OU Name)* is identified in the SRS Federal Facility Agreement (FFA) and as such is required to be investigated to determine if the OU contains unacceptable risks and if remedial actions are warranted. Sampling has been completed as part of the *(Fill in appropriate administrative document).*

(Insert the name of the OU) OU consists of *(describe applicable media).* The source term at this waste unit accounts for a significant portion of the current risk to human health and the environment and may present a potential long-term threat to groundwater. The source term area of contamination (AOC) consists of *(describe appropriate basins, pipelines, soil areas, etc.).*

The remedy selected in the plug-in ROD is designed to significantly reduce the risk from the source term to acceptable levels for future nonresidential land use. It is also designed to prevent migration of soil contaminants to the groundwater in quantities that exceed target groundwater concentrations MCLs or RBCs.

The plug-in ROD designates the final remedial decision for the source term at the *(Insert the OU Name)* OU. However, because the plug-in ROD does not include all media (target applicable media such as groundwater), this decision is considered an interim ROD for the OU. A final OU ROD will be required to complete remedial decision-making on *(Insert the OU Name)* OU. (modify if groundwater is being addressed as part of a separate OU)

The final ROD for this OU will be completed according to the schedule proposed in the *(insert name of the primary document that the decision document was submitted with).*

3.0 BACKGROUND OF THE *(INSERT OU NAME)* OU

This section would include a history of the OU and any other pertinent background data and reference to Figure 1 and Figure 2.

4.0 PLUG-IN CRITERIA

The plug-in criteria are used to evaluate whether the waste units match the conditions that the plug-in remedy has been designed to address. Therefore, the plug-in criteria have been developed based on the conditions for which in situ stabilization with a low permeability soil cover system is the preferred response action.

The plug-in criteria have been formulated as four key questions that the decision-makers (US DOE, US EPA and SCDHEC) must consider when evaluating a unit for a plug-in. If any of the answers to the indicated four questions is “No,” then the Plug-in ROD is not appropriate and an alternate administrative pathway will be used.

The four key questions are:

1. Is the operable unit radiologically contaminated?
2. Is the operable unit in a current industrial use area (with buffer) adjacent to an existing nuclear facility (as defined in Figure 2)?

3. Does the unit contain PTSM? For the purposes of the plug-in remedy only, PTSM is defined as soil which poses a radiological risk (using baseline risk assessment exposure assumptions) to a future industrial worker equal to or greater than 1×10^{-3}.

4. Is PTSM not in direct contact with surface water or groundwater or directly adjacent to surface water?

Figure 1. Map of SRS Showing the Location of (Insert OU Name) Relative to the Industrial Use Area (With Buffer)

Insert Map of SRS with the Industrial Use Areas (With Buffer) indicated.

Figure 2. *(Insert OU name)* with Current Industrial Use Area and Institutional Control Area)

Insert map of OU.

Figure 3 is a flowchart that indicates the plug-in logic and mechanics for determining if an OU meets the plug-in criteria.

4.1 Is the Unit Radiologically Contaminated?

This section should summarize the radiological data for the OU and end with a determination whether the OU is radiologically contaminated and thus meets plug-in criteria #1

4.2 Is the Unit Located in a Current Industrial Use Area (With Buffer) Adjacent to a Nuclear Facility?

This section should discuss the location of the OU and reference figures showing that it is located within the current industrial use (with buffer) area and thus meets plug-in criteria #2.

4.3 Does the OU Contain PTSM?

This section should determine whether the risk to a future industrial worker exceeds 1 x 10^{-3} (see Plug-in ROD, Appendix C) and thus meets plug-in criteria #3.

4.4 Is PTSM Not in Direct Contact with Surface Water or Groundwater or Immediately Adjacent to Surface Water?

This section should discuss the specific hydrology of the OU, depth to the water table, and any groundwater contamination in the vicinity of the unit. The fate and transport of tritium discharged to the basin should also be discussed. This section should also evaluate the efficacy of the remedy if vadose zone soils are contaminated to the depth of the water table. The final conclusion should state whether plug-in criteria #4 is met.

Figure 3. Plug-in Logic and Mechanics

Insert Figure 5 from the Proposed Plan

5.0 IN SITU STABILIZATION WITH A LOW PERMEABILITY SOIL COVER SYSTEM APPLIED TO (INSERT OU NAME)

This section should describe how the five remedy aspects (institutional controls, in situ stabilization, soil cover system, soils consolidation, and pipeline grouting) would be applied at this OU, and will meet each of the relevant RAOs.

5.1 Institutional Controls

Reference Figure 2 and explain how the OU is located within the current industrial use (with buffer) area.

5.2 Soils Consolidation

Discuss the location, volume, and depth of any surficial soil outside the basin or soil contaminated from pipeline leaks that will be consolidated into the primary discharge basin, explaining how it was determined that this soil needed to be consolidated (characterization data compared to soil RGs developed for soils outside the basin based on industrial worker exposure, a fate and transport model calculation to protect groundwater, and if PTSM criteria is exceeded). The calculations based on Appendix D of the Plug-in ROD are shown in Appendix A.

5.3 In Situ Stabilization

Describe the area and depth of soil to be in situ stabilized. Discussion should include why jet grouting or soil mixing was selected, why the depth was selected, etc. A discussion of any material that will be consolidated before stabilization should also be included.

5.4 Soil Cover

The cover system will be designed with a permeability low enough to prevent migration of the radionuclides to the groundwater for 1,000 years at levels that will exceed MCLs. Modeling based on Appendix D of the Plug-in ROD will be conducted to determine if a reduced infiltration rate based on a soil cover system with a hydraulic conductivity of 10^{-5} will be adequate for the basin(s). The calculations based on Appendix D of the Plug-in ROD are shown in Appendix A. This section will also describe how the soil cover would be applied. If a soil cover system with a hydraulic conductivity of less than 1×10^{-5} cm/s is required based on the modeling, the components of this cover system would be described. Figures showing the areal coverage and cross-sectional view of the cover system should be provided.

5.5 Pipelines

Discuss the location and length of the pipeline to be grouted. Include a discussion of any of details of the pipe that would likely interest the regulators or public such as diameter, length, material of construction, location of leaks (if any), depth of pipeline, etc. Include drawings or sketches, if available.

6.0 SUMMARY/CONCLUSIONS

The technical evaluation of (insert OU name) against the four plug-in criteria demonstrates that (Insert OU name) does/does not plug-in to the Plug-in ROD, and thus the remedy is specified in Section 5.0 should/should not be applied to (insert OU name).

The application of the remedy as described in Section 5.0 will meet the RAOs established in the Plug-in ROD and presented in Section 1.0.

7.0 REFERENCES

APPENDIX A
***(1nsert Operable Unit Name)* Fate and Transport Calculations.**

APPENDIX C

PRINCIPAL THREAT SOURCE MATERIAL CALCULATION

APPENDIX C PRINCIPAL THREAT SOURCE MATERIAL CALCULATION

This appendix provides the methodology for determining whether soil contamination associated with a candidate OU can be classified as principal threat source material (PTSM). For the purposes of this plug-in remedy only, PTSM is defined as soil which poses a radiological risk (using baseline risk assessment exposure assumptions) to a future industrial worker equal to or greater than 1×10^{-1}. This plug-in ROD is biased towards active remediation and treatment of units that are known to present a significant threat to human health and the environment. Thus, PTSM must be present (carcinogenic risks must exceed $1 \text{ X } 10^{-3}$) before this plug-in remedy is considered for a candidate OU.

Accordingly, a detailed evaluation of unit risks (e.g., baseline risk assessment) will not be performed for each plug-in candidate unit. Instead, a table of risk-based treatment threshold values (TTVs) (Table C-2) will be used to identify whether PTSM is present, based on the presence of radionuclides in soil contributing to a risk greater than 10^{-3} . These screening values will be based on the external and ingestion exposure pathways to soil for radionuclides as they account for nearly 100 percent of the risk related to radionuclides.

Exposure assumptions will be based on default assumptions used as part of the future worker scenario, and are presented on Table C-1. Ingestion and external radiation slope factors needed for the derivation of TTVs for radionuclides were taken from the Health Effects Assessment Summary Tables (HEAST) (US EPA 1995a). If decay products are in secular equilibrium with the parent isotope, as given by the "+D" listings in the Health Effects Assessment Summary Tables (HEAST) (US EPA 1995a), contributions for the daughter products are incorporated into the slope factor for the parent isotope. The slope factors for all potential radionuclides measured in soils are presented on Table C-2. This table also presents half-lives for each radionuclide.

The following equations were used to calculate the treatment threshold soil concentrations for radionuclides.

$$TTV_{Rad} = TR / (EF \times ED) \times ((IRo \times SFo) + (DE \times [1-Se] \times CF \times SFe))$$

where:

TTV_{Rad}	=	treatment threshold value for radionuclides (pCi/soil)
TR	=	target risk (1×10^{-3}) for deriving cancer-based TTV for radiological constituents (unitless)
EF	=	exposure frequency --(days/year)
ED	=	exposure duration --(yr)
IRo	=	oral intake rate (g soil)
SFo	=	oral slope factor (risk/pCi)
DE	=	direct exposure factor for external radiation pathway --0.33 (8hrs/24/hrs)
Se	=	shielding factor—0.2
CF	=	Conversion factor 2.74×10^{-3} yrs/day
SFe	=	external exposure slope factor (risk/year per pCi/g soil)

The back-calculated TTVs are presented in Table C-2. The surficial basin bottom (0- to1-foot) radionuclide concentrations (reasonable maximum exposure concentration) for an individual discharge basin can be directly compared to the values in this table. If the OU soil concentrations for an individual radionuclide does not exceed its respective TTV, an additive calculation can be performed to determine if the additive risk from all radionuclides and non-radionuclides exceeds the $1 \text{ X } 10^{-3}$ risk threshold.

References

US EPA, 1991b. *Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors*. OSWER Directive 9285.6-03, Office of Emergency and Remedial Response. US Environmental Protection Agency, Washington, DC.

US EPA. 1991c. *Risk Assessment Guidance for Superfund: Volume 1 - Human Health Evaluation Manual (Part B), Development of Risk-Based Preliminary Remediation Goals*. Office of Emergency Response. US Environmental Protection Agency, Washington, DC.

US EPA. 1995a. *Health Effects Assessment Summary Tables: FY-1995 Supplement*. EPA/540/R-95/142. Office of Solid Waste and Emergency Response. US Environmental Protection Agency, Washington, DC.

US EPA. 1995b. *Supplemental Guidance to RAGS: Region 4 Bulletins (Data Collection and Evaluation, Toxicity Assessment, Exposure Assessment, Risk Characterization, Development of Risk-Based Remedial Options).* Interim Draft, Office of Technical Services, Atlanta, GA.

Table C-1. Exposure Factors for the Derivation of TTVs

Pathway	Assumption	Unit	Exposure Factor	
General				
	Exposure Duration	years	25	a
	Exposure Frequency	day/year	250	a
Soil Ingestion				
	Ingestion Rate	g soil/day	0.050	b
	Conversion Factor-Radionuclides	year/day	2.74 E-03	
External Radiation				
	Gamma Shielding Factor	unitless	0.2	c
	Gamma Exposure Time Factor	unitless	0.33	

[a] US EPA 1995b
[b] US EPA 1991b
[c] US EPA 1991c

Table C-2 Half-lives, Slope Factors, and Treatment Threshold Values for Radionuclides

Isotope		Half-life [a]	Slope Factors Ingestion (Risk/pCi) [a]	Slope Factors External (Risk/yr per pCi/g soil) [a]	Target Cancer Risk	TTV (pCi/g)
Actinium-228	c	6.13 h	1.62E-12	3.28E-06		
Americium-241		432 y	3.28E-10	4.59E-09	1.0E-03	8.11E+03
Americium-243	+D	7380y	3.31E-10	2.66E-07	1.0E-03	7.66E+02
Carbon-14		5730y	1.03E-12	0.00E+00	1.0E-03	3.11E+06
Cesium-137	+D	30.2 y	3.16E-11	2.09E-06	1.0E-03	1.06E+02
Cobalt-60		5.27 y	1.89E-11	9.76E-06	1.0E-03	2.27E+01
Curium-243/244	b		2.51E-10	1.71E-07	1.0E-03	1.17E+03
Curium-243		28.5 y	2.51E-10	1.71E-07	1.0E-03	1.17E+03
Curium-244		18.1 y	2.11E-10	2.07E-11	1.0E-03	1.51E+04
Curium-245/246	b		3.35E-10	5.51E-08	1.0E-03	2.83E+03
Curium-245		8,500 y	3.35E-10	5.51E-08	1.0E-03	2.83E+03
Curium-246		4,750 y	3.32E-10	1.81E-11	1.0E-03	9.63E+03
Europium-152		13.3y	5.73E-12	4.08E-06	1.0E-03	5.42E+01
Europium-154		8.8 y	9.37E-12	4.65E-06	1.0E-03	4.76E+01
Iodine-129		1.57E7y	1.84E-10	2.69E-09	1.0E-03	1.44E+04
Lead-212	c	10.6 h	1.80E-11	3.00E-07		
Neptunium-237	+D	2.14E+06y	3.00E-10	4.62E-07	1.0E-03	4.58E+02
Neptunium-239	c	2.355d	4.27E-12	2.42E-07		
Nickel-63		100 y	5.50E-13	0.00E+00	1.0E-03	5.82E+06
Plutonium-238		87.8 y	2.95E-10	1.94E-11	1.0E-03	1.08E+04
Plutonium-239/240	b		3.16E-10	1.87E-11	1.0E-03	1.01E+04
Plutonium-239		24,100 y	3.16E-10	1.26E-11	1.0E-03	1.01E+04
Plutonium-240		6,570 y	3.15E-10	1.87E-11	1.0E-03	1.02E+04
Promethium-147		2.62 y	1.41E-12	6.35E-12	1.0E-03	2.13E-06
Radium-226	+D	1600y	2.96E-10	6.74E-06	1.0E-03	3.27E_01
Radium-228	+D	5.76y	2.48E-10	3.28E-06	1.0E-03	6.71E+01
Sodium-22		2.60 y	8.02E-12	8.18E-06	1.0E-03	2.70E+01
Strontium-90	+D	28.6 y	5.59E-11	0.00E+00	1.0E-03	5.72E+04
Technetium-99		2.13E+05 y	1.40E-12	6.19E-13	1.0E-03	2.27E+06
Thorium-228	+D	1.91 y	2.31E-10	6.20E-06	1.0E-03	3.56E+01
Thorium-230		7.7E+04 y	3.75E-11	4.40E-11	1.0E-03	8.39E+04
Thorium-232		1.41E+10 y	3.28E-11	1.97E-11	1.0E-03	9.67E+04
Uranium-233/234	b		4.48E-11	3.52E-11	1.0E-03	7.06E+04
Uranium-233		1.59E+05 y	4.48E-11	3.52E-11	1.0E-03	7.06E+04
Uranium-234		2.45E+05 y	4.44E-11	2.14E-11	1.0E-03	7.16E+04
Uranium-235		7.04E8y	4.70E-11	2.65E-07	1.0E-03	8.25E+02
Uranium-238	+D	4.47E+09 y	6.20E-11	5.25E-08	1.0E-03	3.90E+03

[a] Cancer slope factor and nuclear half-lives are provided in Health Effects Assessment *Summary Tables (FY-1995)* (EPA,1995a)

[B] Where there are dual designations for cancer slope factors (e.g., curium-243/244), the Most restrictive value for each exposure route was used in the calculation Of the TTV.

[C] TTV associated with the parent radionuclide

D+ Includes short-lived daughters (half-lives less than or equal to 6 months).

APPENDIX D

SOIL LEACHABILITY REMEDIAL GOALS

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APPENDIX D SOIL LEACHABILITY REMEDIAL GOALS

1.0 APPLICATION

The methodology provided in this appendix can be used to (1) determine whether contaminated soils outside of the area to be in-situ stabilized and soil covered pose a leachability threat to groundwater, and (2) determine if the 1 x 10^{-5} cm/s hydraulic conductivity soil cover system is adequate to prevent groundwater impact from contaminated soils that are present in the basins.

The second remedial action objective specifically requires that the groundwater be protected to meet MCLs or RBCs if MCLs are not available. Based on these target groundwater remedial goals, acceptable soil levels can be back calculated. Calculation of these soil leachability remedial goals (SLRG) will be conducted on a unit-specific basis, since the SLRGs are dependent upon unit-specific variables such as the thickness of the source contamination, the depth to the water table, and the groundwater velocity.

For radionuclides, the target groundwater remedial goals are set to existing and proposed standards. The 4 mrem/yr standard is used for beta particle and photon (gamma) emitters, except as specified for tritium and strontium-90. Based on this dose standard, an equivalent water concentration (activity) is calculated as required by 40 CFR 141.16. For alpha emitters, the existing final standard for radium-226 and radium-228 (5 pCi/L), the proposed standard for total uranium (20 ug/L), and the existing final standard for other alpha emitters (15 pCi/L) are used. For non-radionuclide contaminants of concern (COC) with no available MCL, the RBC is established based on the incremental excess cancer risk of 1 x 10^{-6} or a hazard quotient of 1.0 for non-carcinogens.

The approaches for back-calculating the acceptable soil limits based on these target remedial goals in groundwater are consistent with US EPA (1996a), considering biological and physical half-lives, and mass limit values. A time limit of 1,000 years is also used to

determine those constituents that pose a future leachability risk, consistent with the approved SRS approach used for residual source contamination. This time frame is also consistent with the standard for effectiveness in considering control of residual radioactive material from inactive uranium processing sites (10 CFR 192.02).

If a contaminant concentration exceeds its SLRG, migration to groundwater is a concern, and a low-permeability soil cover system should be applied.

2.0 COMPARISON OF UNIT-SPECIFIC SOIL DATA TO SOIL LEACHABILITY REMEDIATION GOALS

Soils data for unit-specific constituents (USC) are compared to unit-specific SLRG and mass limit soil leachibility remedial goals (MLSLRG) calculated by a unit-specific model in accordance with US EPA guidance (US EPA 1996a,b). The SLRG is a conservative soil contaminant concentration below which there may be negligible concern, provided that the conditions at the unit match those established for use in calculating the SLRG. The SLRG, however, may violate mass balance considerations due to the assumption of an infinite source (US EPA 1996a). The MLSLRG provides an equally protective soil screening level that assumes that the entire mass of contamination leaches over the 70-year exposure duration (US EPA 1996a). The MLSLRG is established such that the mass of contaminant leached into groundwater cannot exceed the total mass of contaminant present in the soils.

The nature of the input data and the analytical model assumptions are such that the resulting estimates of groundwater concentrations are conservative. The following sections discuss the input data and analytical model assumptions, and the results of the modeling.

2.1 Input Data and Assumptions

The soil leachability estimate can be performed using analytical equations programmed into an Excel® spreadsheet. The major assumptions made in the soil leachability analysis are:

- Infinite and uniform source of contaminants
- One-dimensional, steady flow with uniform average soil properties
- Reversible, equilibrium, linear soil-water distribution of contaminants
- Biological decay is aerobic and is described by a first-order rate constant
- No volatilization of contaminants
- Dilution factor (US EPA 1996a) calculation method is reasonable
- The pH of the soil water is approximately 5

A uniform and infinite source of contaminants is conservatively assumed to simplify leaching estimates.

Steady one-dimensional flow in the vadose zone is assumed to represent average flow over the period of interest. Dispersion is not incorporated into the vadose zone estimate because it does not significantly affect the maximum groundwater concentration or the time that it occurs (assuming that the contamination is not a “point source”).

Reversible, equilibrium adsorption of contaminants is incorporated through a distribution coefficient (K_d).

First-order decay of contaminants is incorporated by utilizing published half-lives. For radionuclides, the half-life is due to radioactive decay, and for organic contaminants the half-life is due to biological reaction. Parent radionuclide USCs with half-lives less than 1 year are not included in the leachability analysis if the subunit has been inactive for 10 years or longer. Metals are assumed not to undergo any non-adsorptive-type reactions (decay), which is reasonable and slightly conservative.

Volatilization of potentially volatile organic compounds is not incorporated into the estimate because it is expected to be minimal and because not incorporating volatilization is slightly more conservative.

The final element of the CSM is a hypothetical water well installed at the boundary of the unit. This well is the target for which MCLs apply.

Constituent-specific information, such as biological half-lives (for the organic contaminants), radiological half-lives (for the radioactive contaminants), and distribution coefficients are required for the soil leachability model. Values of biological half-lives chosen for this calculation are those reported for soil (where aerobic biological half-lives are typically two to 20 times less than those in groundwater because oxygen is more readily available in soil).

The average concentration of each USC across the contaminated zone is used. This is consistent with the conceptual model for seepage basins that received wastewater discharge. Hot spots may be modeled if consistent with the characterization data.

2.2 Method and Calculations

Based on previously presented assumptions, the equation that describes the SLRG in a sub-unit is given by:

$$SLRG = \frac{C_w * K_d * DF}{EXP(-0.693 * T_{max}/t_{1/2})}$$

where:

SLRG = soil leachability remedial goal (mg/kg or pCi/g)

C_w = target groundwater concentration (MCL or RBC in µg/L, or pCi/L for radionuclides)

Kd = distribution coefficient (L/kg, L/g for radionuclides)

T_{max} = time (years) that the maximum soil water concentration occurs at the water table surface

$t_{1/2}$ = environmental or radiological half-life of the constituent (years)

DF = groundwater dilution factor (unitless)

T_{max} is estimated by dividing the distance from the source to the top of the water table surface (L_v) by the retarded soil water velocity. Using a uniform source concentration over the thickness of the soil layer modeled also results in the maximum groundwater concentration being achieved at T_{max}. That is,

$$T_{max} = \frac{L_v * R}{V_s}$$

where:

L_v = distance from the source to the water table (ft) determined for each USC by measuring from the bottom of the deepest sampling interval in which the USC was detected to the top of the water table

V_s = soil water velocity in the vadose zone (ft/year)

R = retardation coefficient (unitless)

V_s is calculated based on the recharge rate (ft/yr), effective porosity (dimensionless), and moisture content at a specific unit (US EPA 1996b) as follows:

$$V_s = \frac{I * n_t}{\Theta * n_e}$$

where:

I = recharge rate (ft/year)

n_e = effective porosity (unitless)

n_t = total porosity (unitless)

Θ = fraction moisture content (unitless)

and:

$$\Theta = n_t \left(\frac{I}{K} \right)^m$$

where:

K = hydraulic conductivity (ft/year)

m = 1/(2b + 3), where b is empirically based on the soil type (unitless)

The recharge (infiltration) rate of 1.25 ft/year, total porosity of 0.5, and the effective porosity of 0.2 is based on Looney et al. (1987) and represents the lower, more conservative range of effective porosities typically used.

The retardation coefficient is calculated for each USC as:

$R = 1 + (K_d * {}_{Pb}/n_T)$

where:

K_d = distribution coefficient (L/kg)

P_b = bulk soil density (kg/L)

n_T = total porosity (unitless)

The bulk soil density of 1.6 kg/L and the total porosity of 0.5 are based on Looney et al. (1987). The hydrogeologic parameters required for the model are presented in Table D-1.

For a given substance, distribution coefficients can vary widely depending upon soil chemistry (cation exchange capacity, amount of organic carbon, etc.) and soil water (vadose zone) chemistry (pH, total dissolved ions, etc.). The value selected for the distribution coefficient significantly affects the estimated groundwater concentrations in the saturated zone and thus the SLRG. Initial conservative, yet reasonable, estimates of distribution coefficients, the resultant retardation coefficients, and biological/radiological half-lives of the USCs are provided in Tables D-2 through D-6.

The distribution coefficient (K_d) of an organic compound is related to the organic-carbon partition coefficient (K_{oc}) by:

$K_d = f_{oc} K_{oc}$

where:

f_{oc} is the soil organic-carbon content as volume fraction

A default f_{oc} of 0.002 (US EPA 1996a) is used for the site. A unit-specific value should be substituted if the organic content of the soil at the unit is known. Constituent-specific K_{oc} values were obtained from the literature, some of which were calculated using empirical formulas relating the octanol-water partitioning coefficient (K_{ow}) to the K_{oc}.

It is important to recognize, with regard to distribution coefficients, that some "contaminants" such as iron affect adsorption and are controlled by solubility at a pH of 5 in oxidizing environments. Thus a K_d for iron is not appropriate. Many metals naturally occur at relatively high levels in the environment in soil, and the use of K_d may not be appropriate, since only the incremental contamination above background is available for leaching to groundwater in the time frame of interest.

The groundwater dilution factor for this analysis is calculated as described by US EPA (1996a):

DF = 1+(Ki*d/IL) (dimensionless)

where:

K = horizontal hydraulic conductivity (ft/year)

i = hydraulic gradient (length per unit length)

d = mixing zone depth (ft)

I = infiltration rate (ft/year)

L = length of source parallel to flow (ft)

The horizontal hydraulic conductivity, hydraulic gradient, and length of source parallel to flow are unit-specific parameters.

The mixing zone depth is calculated as follows (US EPA 1996a):

$d = (0.0112L^2)^{1/2} + d_a\{1 - \exp[(-LI)/(Kid_a)]\}$

where:

d_a = aquifer depth (ft)

The actual mixing zone depth used is the minimum of the calculated mixing zone depth (d) and the aquifer thickness (d_a) (i.e., to be physically realistic, the mixing zone cannot be greater than the aquifer thickness).

The dilution factor calculation is slightly conservative from an exposure viewpoint because it does not account for additional dilution that occurs when groundwater is pumped at a supply well. Additional dilution could occur at a pumped well for at least two reasons: (1) the assumed mixing depth would probably be different from the actual depth of the screen location of a water supply well, and (2) the capture zone of a supply well may intercept water from significant areas of uncontaminated aquifer, which also decreases the contaminant exposure concentration.

The MLSLRGs are calculated by:

$$\text{MLSLRG} = \frac{C_{gw} * DF * I * ED}{\rho_b * d_s}$$

where:

MLSLRG = unit-specific MLSLRG (mg/kg, pCi/g for radionuclides)

C_{gw} = target groundwater concentration, MCL, or health-based RBC

I = infiltration rate (1.42 ft/yr)

ED = US EPA default exposure duration (70 yr)

Pb = soil bulk density (1.6 kg/L, 1600 g/L for radionuclides)

d_s = vertical thickness of the contaminated zone, unit-specific

2.3 Results

Output tables will provide the SLRGs and MLSLRGs for all potential USCs upon input of unit-specific information for radionuclides, metals, VOCs, SVOCs, and pesticides/PCBs, respectively. The tables will also include the calculated retardation coefficient, time for the maximum concentration to occur, maximum groundwater concentration, and applicable MCL or RBC. Where the soil concentration of an individual constituent exceeds the greater of the SLRG or MLSLRG, that constituent is identified in the "analytes greater than MCL/RBC column.

The SLRGs presented are based on fairly conservative assumptions. The assumption that the source of a constituent is uniformly distributed to the depth of detection at an average concentration may be conservative and overestimates the distribution and mass of the constituent in the subsurface, where the constituents are only sporadically detected and not uniformly distributed. Alternatively, localized hot spots may not be adequately addressed by averaging, although contaminant concentrations in soils impacted by liquid effluent discharges are expected to be relatively uniform. The receptor well is conservatively placed at the edge of the source unit; therefore, the dilution that would occur when clean water is withdrawn at the receptor well is not incorporated. This effect becomes more important when the source of contamination is of small areal extent, such as for a pipeline leak. The leachability analysis assumes that the entire mass of a constituent is mobile when, for many naturally occurring metals and radionuclides, a large fraction is immobile (e.g., background concentrations of metals). The distribution coefficients that are utilized are predominantly for sand, when in reality the geology is a heterogeneous system of sand, silt, clay and organic matter. In general, silt, clay and organic matter are more likely to retard the movement of contaminants. This heterogeneous stratigraphy also impacts results in variable vertical hydraulic conductivity, which may significantly slow infiltration through the vadose zone, but was not accounted for in this calculation.

Based on these assumptions, many of which are conservative, it may be appropriate to conduct additional unit-specific modeling to more accurately calculate appropriate SLRGs. The modeling results should always be compared to empirical groundwater and soils data to the extent available in order to verify the model.

In order to determine if a 10^{-5} cm/s permeability soil cover will provide adequate protection of groundwater, the infiltration rate in the model can be reduced by 60 percent to mimic the reduced infiltration that will be achieved over native conditions through application of the soil cover. This 60 percent reduction in the infiltration rate was predicted by the HELP model, an EPA model used to determine infiltration reduction for various landfill design systems. The reduction infiltration is due to a combination of increased runoff due to the soil cover slope, evapotranspiration from the vegetative cover, and lower infiltration rates due to lower permeability of the soil cover as compared to native soils. If a constituent is identified in the "analytes greater than MCL/RBC column", a more rigorous cap should be considered.

3.0 DATA NEEDS

In order to calculate the unit-specific SLRGs, the following information will be required on an operable unit level:

- the horizontal hydraulic conductivity of the aquifer
- the hydraulic gradient
- the aquifer thickness
- if available, empirical groundwater contaminant concentration data (to verify the model)

The following information will be required for each basin or discrete contaminated area:

- average soil concentrations for the volume of soil impacted (hot spot averages may also be appropriate)
- the thickness of the contaminated soil zone
- the length of the source parallel to flow
- the depth from the bottom of the contaminated zone to the water table

4.0 REFERENCES

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Table D-1. Hydrogeological Parameters for Soil Leachability Remedial Goal Calculations

PARAMETER		VALUE	DATA SOURCE
I	Recharge rate (ft/yr)	1.25	Looney et al. 1987
f_{oc}	fraction of organic carbon	0.002	US EPA 1996a
P_b	Bulk Soil Density (gm/cm^3)	1.6	Looney et al. 1987
n_T	Total Porosity	0.5	Looney et al. 1987
n_e	Effective Porosity	0.2	Looney et al. 1987
DF	Dilution Factor	TBD	WSRC 1997
d_s	Thickness of Source (ft)	TBD	WSRC 1997
d_a	Dept to Groundwater (ft)	TBD	WSRC 1997

TBD- to be determined

Table D-2. Input Parameters for Radionuclides

Radiological Analytes	koc (RAD) L/kg	Kd[10] (RAD) L/g	T1/2 (RAD) Years	Cs (RAD) pCi/g
Acitinium-228	NA	0.45	0.0007	
Americium-241	NA	0.1	432	
Americium-243	NA	0.1	7380	
Antimony-124	NA	4	0.165	
Antimony-125	NA	4	2.77	
Carbon-14	NA	0.002	5730	
Cesium-134	NA	0.5	2.06	
Cesium-137	NA	0.5	30.2	
Cobalt-57	NA	0.01	0.742	
Cobalt-60	NA	0.01	5.27	
Curium-242	NA	3.1	0.447	
Curium-243/244	NA	3.1	28.5	
Curium-245/246	NA	3.1	8,500	
Curium-247	NA	3.1	15,600,000	
Europium-152	NA	0.245	13.6	
Europium-154	NA	0.245	8.8	
Europium-155	NA	0.245	4.96	
Iodine-129	NA	0.0036	15,700,000	
Lead-212	NA	0.27	0.00012	
Manganese-54	NA	0.05	0.858	
Neptunium-237	NA	0.01	2,140,000	
Neptunium-239	NA	0.01	0.0065	
Nickel-63	NA	0.065	100	
Plutonium-238	NA	0.1	87.8	
Plutonium-239/240	NA	0.1	24100	
Potassium-40	NA	0.075	1,280,000.000	
Promethium-147	NA	0.24	2.62	
Radium-226	NA	0.1	1600	
Radium-228	NA	0.1	5.75	
Sodium-22	NA	0.1	2.6	
Strontium-90	NA	0.008	28.6	
Technitium-99	NA	0.0001	217,000	
Thorium-228	NA	0.1	1.91	
Thorium-230	NA	0.1	77,000	
Thorium-232	NA	0.1	14,100,000,000	
Uranium-233/234	NA	0.04	245,000	
Uranium-235	NA	0.04	704,000,000	
Uranium-238	NA	0.04	4,470,000,000	
Zinc-65	NA	0.062	0.668	
Zirconium-95	NA	0.6	0.175	

Table D-3.Input Parameters for Metals

Metal Analytes	KOC (Metal) L/Kg	Kd[10] (Metal) L/Kg	T1/2 (Metal) Years	Cs (Metal) mg/kg
Aluminum, total recoverable	NA	1500	Infinite	
Antimony,total recoverable	NA	400	Infinite	
Arsenic, total recoverable	NA	39	Infinite	
Barium, total recoverable	NA	41	Infinite	
Beryllium, total recoverable	NA	790	Infinite	
Cadmium, total recoverable	NA	75	Infinite	
Calcium, total recoverable	NA	No Kd available	Infinite	
Chromium, total recoverable	NA	1,800,000	Infinite	
Cobalt, total recoverable	NA	10	Infinite	
Copper, total recoverable	NA	25	Infinite	
Cyanide	NA	9.9	Infinite	
Iron, total recoverable	NA	220	Infinite	
Lead, total recoverable	NA	270	Infinite	
Magnesium, total recoverable	NA	No Kd available	Infinite	
Manganese, total recoverable	NA	50	Infinite	
Mercury, total recoverable	NA	52	Infinite	
Nickel, total recoverable	NA	65	Infinite	
Potassium, total recoverable	NA	NA	Infinite	
Selenium, total recoverable	NA	55	Infinite	
Silver, total recoverable	NA	8.3	Infinite	
Sodium, total recoverable	NA	No Kd available	Infinite	
Thallium, total recoverable	NA	71	Infinite	
Vanadium, total recoverable	NA	1000	Infinite	
Zinc, total recoverable	NA	62	Infinite	

Table D-4. Input Parameters for VOCs

Volatile Organic Analytes	Koc (VOC) L/Kg	Kd[10] (VOC) L/Kg	T1/2 (VOC) Years	Cs (VOC) mg/kg
1,1,1-Trichloroethane	135	0.432	0.75	
1,1,2,2-Tetrachlororethane	79	0.2528	0.123	
1.1.2-Trichloroethane	75	0.24	1	
1,1-Dichloroethane	53.4	0.17088	0.423	
1,1-Dichloroethylene	65	0.208	0.5	
1,2-Dichloroethane	38	0.1216	0.5	
1,2-Dichloroethylene	65	0.208	0.5	
1,2-Dichloropropane	47	0.1504	3.5	
2-Hexanone	Not Available	#VALUE!	0.038	
Acetone	2.2	0.00704	0.019	
Benzene	61.7	0.19744	0.044	
Bromodichloromethane	55	0.176	0.05	
Bromoform	126	0.4032	0.5	
Bromomethane (Methyl bromide)	9	0.0288	0.077	
Carbon disulfide	54	0.1728	0.00934	
Carbon tetrachloride	152	0.4864	1	
Chlorobenzene	224	0.7168	0.411	
Chloroethane	15	0.048	0.077	
Chloroethane (Vinyl chloride)	8.2	0.02624	0.5	
Chloroform	52.2	0.168	0.5	
Chloromethane (Methyl chloride)	5.5	0.0176	0.077	
cis-1,3-Dichloropropene	27.1	0.08672	0.031	
Dibromochloromethane	107	0.3424	0.5	
Dichloromethane (Methyl chlo	10	0.032	0.077	
Ethylbenzene	204	0.6528	0.027	
Methyl ethyl ketone	4.51	0.014432	0.019	
Methyl isobutyl ketone	Not Available	#VALUE!	0.019	
Styrene	912	2.9184	0.077	
Tetrachloroethylene	265	0.848	1	
Toluene	140	0.448	0.06	
trans-1,3-Dichloropropene	48	0.1536	0.031	
Trichloroethylene	265	0.848	1	
Vinyl acetate	17	0.0544	0.0397	
Xylenes	238	0.7616	0.077	

Table D-5. Input Parameters for SVOCs

Semi-Volatile Analytes	Koc (SVOC) L/Kg	Kd[10] (SVOC) L/Kg	T1/2 (SVOC) Years	Cs (SVOC) mg/kg
1,2,4-Trichlorobenzene	1660	5.312	0.5	
1,2-Dichlorobenzene	379	1.2128	0.5	
1,3-Dichlorobenzene	1700	5.44	0.5	
1,4-Dichlorobenzene	616	1.9712	0.5	
2,4,5-Trichlorophenol	2365	7.568	1.89	
2,4,6-Trichlorophenol	1040	3.328	0.192	
2,4-Dichlorophenol	159	0.5088	0.192	
2,4-Dimethyl phenol	209	0.6688	0.192	
2,4-Dinitrophenol	0.03	0.000096	0.731	
2,4-Dinitrotoluene	95.5	0.3056	0.5	
2,6-Dinitrotoluene	69.2	0.22144	0.5	
2-Chloronaphthalene	48000	153.6	44.4	
2-Chlorophenol	398	1.2736	0.007	
2-Methyl-4,6-dinitrophenol	No Koc Available	#VALUE!	NA	
2-Methylnaphthalene	7940	25.408	0.132	
2-Nitrophenol	27	0.0864	0.077	
3,3'-Dichlorobenzidine	1550	4.96	0.5	
4-Bromophenyl phenyl ether	16,900	54.08	NA	
4-Chloroaniline	No Koc Available	#VALUE!	NA	
4-Chloro-m-cresol	66.1	0.21152	NA	
4-Chlorophenyl phenyl ether	7410	23.712	NA	
4-Nitrophenol	50	0.16	0.003	
Acenaphthene	4900	15.68	0.279	
Acenaphthylene	2500	8	0.164	
Anthracene	23,500	75.2	1.26	
Benzidine	11	0.0352	0.022	
Benzo(a)anthracene	358,000	1145.6	1.86	
Benzo(a)pyrene	969,000	3100.8	1.45	
Benzo(b)fluoranthene	1,230,000	3936	1.67	
Benzo(g,h,i)perylene	1,600,000	5120	1.78	
Benzo(k)fluoranthene	1,230,000	3936	5.86	
Benzoic acid	5.5	0.0176	NA	
Benzyl alcohol	6	0.0192	NA	
Bis(2-chloroethoxy) methane	7	0.0224	0.137	
Bis(2-chloroethyl) ether	76	0.2432	0.5	
Bis(2-chloroisopropyl) ether	61	0.1952	0.5	
Bis(2-ehtylhexyl) phthalate	111,000	355.2	0.063	

Table D-5. Input Parameters for SVOCs (continued)

Butylbenzyl phthalate	13,700	43.84	0.019	
Carbazole	3390	10.848	NA	
Chrysene	398,000	1273.6	2.72	
Dibenz(a,h)anthrcene	1,790,000	5728	2.58	
Dibenzofuran	9120	29.184	0.077	
Diethyl phthalate	82.2	0.26304	0.154	
Dimethyl phthalate	46	0.1472	0.019	
Di-n-butyl phthalate	1570	5.024	0.063	
Di-n-octyl phthalate	83,200,000	266240	0.077	
Fluoranthene	49,000	156.8	1.21	
Fluorene	7710	24.672	0.164	
Hexachlorobenzene	80,000	256	5.7	
Hexachlorobutadiene	53,700	171.84	0.5	
Hexaxhlorocyclopentadiene	20,000	64	0.077	
Hexachloroethane	1780	5.696	0.5	
Indeno(1,2,3-c,d)pyrene	3,740,000	11968	2	
Isophorone	46.8	0.14976	0.077	
m/p-Cresol	91.2	0.29184	0.079	
m-Nitroaniline	14	0.0448	NA	
Naphthalene	1190	3.808	0.132	
Nitrobenzene	119	0.3808	0.55	
N-Nitrosodiphenylamine	1290	4.128	0.093	
N-Nitrosodipropylamine	24	0.0768	0.5	
o-Cresol (2-Methylphenol)	91.2	0.29184	0.019	
o-Nitroaniline	38	0.1216	30.4	
p-Cresol (4-Methylphenol)	17	0.0544	0.002	
p-Nitroaniline	15	0.048	2030	
Pentachlorophenol	9055	28.976	0.488	
Phenanthrene	14,000	44.8	0.548	
Phenol	28.8	0.09216	0.027	
Pyrene	68,000	217.6	5.2	

Table D-6. Input Parameters for Pesticides and PCBs

Pesticides/PCBs	Koc (PEST) L/Kg	Kd[10] (PEST) L/Kg	T1/2 (PEST) Years	Cs (PEST) mg/kg
Aldrin	48,700	155.84	1.6	
alpha-Benzene hexachloride	1,760	5.632	0.37	
apha-Chlordane	51,300	164.16	3.8	
beta-Benzene hexachloride	2,140	6.848	0.34	
delta-Benzene hexachloride	6,600	21.12	0.274	
Dieldrin	25,500	81.6	3	
Endosulfan I	2,030	6.496	2030	
Endosulfan II	2,220	7.104	2220	
Endrin	10,800	34.56	10800	
Endrin ketone	No Koc Available	#VALUE!	NA	
gamma-Chlordane	51,300	164.16	3.8	
Heptachlor	9,530	30.496	0.015	
Heptachlor epoxide	83,200	266.24	1.51	
Lindane	20,000	64	0.658	
Methoxychlor	80,000	256	1	
p,p'-DDD	45,800	146.56	15.6	
p,p'-DDE	86,400	276.48	15.6	
p,p'DDT	678,000	2169.6	15.6	
PCB 1016	309,000	988.8	34200	
PCB 1221	309,000	988.8	34200	
PCB 1232	309,000	988.8	34200	
PCB 1242	309,000	988.8	34200	
PCB 1248	309,000	988.8	34200	
PCB 1254	309,000	988.8	34200	
PCB 1260	309,000	988.8	34200	
Toxaphene	95,800	306.56	6.35	

APPENDIX E

HUMAN HEALTH REMEDIAL GOALS

APPENDIX E HUMAN HEALTH REMEDIAL GOALS

This appendix provides the approach and methodology for calculating soil remedial goals protective of the future hypothetical industrial worker as part of this remedy.

1.0 CALCULATIONS FOR INDUSTRIAL WORKER EXPOSURE TO RADIONUCLIDES

The following two sections present a risk-based methodology and dose-based methodology (to show relevant and appropriate chemical -specific ARARs are met).

The values for radionuclide-specific parameters (dose conversion factors) are the same used in RESRAD, which are based on published values by the International Commission on Radiological Protection, US DOE, and the US EPA (JCRP 1979-1982; US DOE 1988a, 1988b; US EPA 1988). The radionuclide specific values are presented in Table E-1.

1.1 Risk-Based Remedial Goal (RG) Calculations

Recent guidelines from US EPA Region IV (US EPA 1995d) specify that remedial goal options (RGOs) may be calculated using one of two methods. A simplified method based an the ratio of the calculated risk to the target risk may be used, or RGs may be calculated in a more comprehensive manner where the risk equations are re-arranged and substituted with target risk levels to allow the back-calculation of a target concentration. Because the comprehensive approach provides a more thorough consideration of media and pathway-specific contributions to risk, this method is selected for calculating the RGs for the plug-in ROD.

The comprehensive approach used to develop these RGs includes (1) specific exposure factors such as intake rates and exposure frequencies as recommended by US EPA (1991), (2) standard EPA slope factors and reference doses, as specified by US EPA (1995 and 1996), and (3) target cancer and noncancer risk levels recommended by US EPA Region IV. Based on the location of plug-in candidate units in non-residential-use areas, the RGOs are

based on the assumption of a future industrial worker land use scenarios, which is the most conservative of the non-residential land use scenarios.

The re-arranged risk equations used to calculate RGs are equivalent to those presented in the recent US EPA Region IV guidance (US EPA 1995d). These equations represent an extension of the approach used in *RAGS, Part B: Development of Risk-Based Preliminary Remediation Goals* (US EPA 1991b) and include consideration of site-specific exposure factors and the appropriate exposure pathways. Section 1.1.1 presents the specific equations used to calculate soil RGs for radionuclide constituents of concern (COCs); and Section 1.1.2 presents the equations used to calculate soil RGs for RGs for nonradionuclide COCs.

1.1.1 RG Calculations for Radionuclides

Risk-based RGs were calculated for soil to provide a comparison to the ARAR-based dose RGs. For each radionuclide, the RGOs corresponding to 1 x 10^{-6} is presented. The 95th percentile of the background distribution for naturally occurring radionuclides is also provided for comparison (US DOE 1996). For some naturally occurring radionuclides, the background concentration is significantly higher than the 1 x 10^{-6} RG, and the background concentration would be used as the RG. The calculation considers intake from ingestion and inhalation exposure pathways, as well as direct exposure for the future industrial worker.

Radionuclide-Risk-Based RGs

$$RG = \frac{TR}{EF \times ED \times \left(\left(SFo \times IRo\right) + \left(SFi \times IRi \times CF1 \times \left(\frac{1}{PEF} \right) \right) + \left(SFe \times DE \times \left(1 - Se\right) \times CF2\right) \right)}$$

where:

TR = Target Risk Level -- 1.0 x 10^{-4}, and 1.0 x 10^{-6}

EF = Exposure Frequency – 250 days/year

ED = Exposure Duration – 25 years

Sfo = Oral Slope Factor -- radionuclide specific

IRo = Oral Intake Rate – 0.050 g/day

Sfi = Inhalation Slope Factor -- radionuclide specific

Iri = Inhalation Rate – 2.5 m^3/hr

PEF = Particulate Emissions Factor – 4.63 x 10^9 m^3/kg (US EPA default)

CF1 = Conversion Factor -- 8.0 x 10^3 hr-g/day-kg

SFe = External Exposure Slope Factor -- radionuclide specific

DE = Direct Exposure Rate – 0.33 (8 hrs/ 24 hrs)

Se = Shielding Factor – 0.2

CF2 = Conversion Factor -- 2.74 x 10^{-3} years/day

Values for radionuclide-specific parameters are found in Table E-2. For those chemicals where toxicity values (e.g., inhalation slope factors) are not available, the relevant portion of the equation is omitted.

1.1.2 Nonradionuclide RGOs

Although radionuclides will be the remediation drivers for the candidate units for this plug-in ROD, a methodology for determination of RGOs for non-radionuclides is presented in order to ensure that risks are reduced to acceptable levels for all COCs. For nonradionuclide constituents, separate calculations are made target risk levels for both carcinogens and noncarcinogens, in accordance with US EPA Region IV recommendations (US EPA 1995d). The target excess cancer risk levels is 1 x 10^{-6}, and the target HQs (noncancer) is 1.0. Where background concentrations of naturally occurring metals exceed the target RGOs, background levels would be used as the RGO. The specific remedial goal (RG) for each COC should be determined for each specific unit, considering site-specific factors.

RGOs calculated for soil account for intake from the ingestion and inhalation pathways of exposure.

Carcinogenic-Risk-Based RGOs

RGO =

$$TR \times \frac{BW \times ATC \times CF1}{(EF \times ED) \times \left((SFo \times IRo) + \left(SFi \times IRi \times CF2 \times \left(\frac{1}{PEF}\right)\right)\right)}$$

where:

TR = Target Risk Level -- 1.0×10^{-4}, 1.0×10^{-5}, or 1.0×10^{-6}

BW = Body Weight – 70 kg

ATC = Averaging Time (Carcinogen) -- 25,550 days (=70 years)

CF1 = Conversion Factor -- 1.0×10^{6} mg/kg

EF = Exposure Frequency – 250 days/year

ED = Exposure Duration – 25 years

SFo = Oral Slope Factor -- chemical specific

IRo = Oral Intake Rate – 50 mg/day

SFi = Inhalation Slope Factor -- chemical specific

IRi = Inhalation Rate – 2.5 m^3/hr

CF2 = Conversion Factor – 8×10^{6} hour-mg/day-kg

PEF = Particulate Emissions Factor – 4.63×10^{9} M^3/kg (US EPA default)

For those chemicals where toxicity values (e.g., inhalation slope factors) are not available from the US EPA, the relevant portion of the equation is omitted.

Noncarcinogenic-Risk-Based RGOs

RGO =

$$THI \times \frac{BW \times ATN \times CF1}{(EF \times ED) \times \left(\left(\frac{IRo}{RfDo}\right) + \left(\frac{IRi \times CF2 \times \left(\frac{1}{PEF}\right)}{RfDi}\right)\right)}$$

where:

THI = Target Hazard Index (3.0, or 1.0)

BW = Body Weight – 70 kg

ATN = Averaging Time (Noncarcinogen) – 9,125 days

CF1 = Conversion Factor -- 1.0×10^6 mg/kg

EF = Exposure Frequency – 250 days/year

ED = Exposure Duration – 25 years

IRo = Oral Intake Rate – 50 mg/day

RfDo = Oral Reference Dose -- chemical specific

IRi = Inhalation Rate – 2.5 m^3/hr

CF2 = Conversion Factor -- 8×10^6 hour-mg/day-kg

PEF = Particulate Emissions Factor – 4.63×10^9 m/kg (US EPA default)

RfDi = Inhalation Reference Dose -- chemical specific

For those chemicals where toxicity values (e.g., inhalation reference doses) are not available from the US EPA, the relevant portion of the equation is omitted.

1.2 Dose-based RGO calculations

The remedial goal for cleanup of radioactively contaminated soils must consider existing relevant and appropriate requirements, as required by the National Contingency Plan [40 CFR 300.430 (e)(2)(i)(A)]. Three relevant and appropriate regulations were considered, including (1) 10 CFR 61.40 - NRC Requirements for Land Disposal of Radioactive Waste, (2) 10 CFR 20 - NRC Radiological Criteria for License Termination, and (3) R.61-63-Radioactive Materials.

NRC's Requirements for Land Disposal of Radioactive Waste (10 CFR 61.40) state that the maximum annual dose to the public shall not exceed 25 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other organ of any member of the public. This requirement is further specified in DOE Order 5400.5, Radiation Protection of the Public and the Environment, which states that exposure to the public to direct radiation or radioactive

materials released shall not cause members of the public to receive, in a year a. dose equivalent greater than 25 mrem to the whole body. DOE Order 5820.2A, Low-level Waste Management, states that low-level wastes shall be managed to assure that external exposure to waste and materials released will not result in an effective dose of 25 mrem/yr to the public.

Similarly, the SCDHEC Regulation 61-63 Part VII, Licensing Requirements for Land Disposal of Radioactive Waste, 7.18, Protection of the General Population from Release of Radioactivity, is relevant and appropriate. Section 7.18 states that concentrations of radioactive material which may be released to the general environment in groundwater, surface water, air, soil, plants, or animals shall not result in an annual dose exceeding an equivalent of 25 mrem to the whole body.

Also, NRC's Radiological Criteria for License Termination (10 CFR 20) requires the licensee to meet a dose requirement in order to allow unrestricted use of a facility. Sec.20.1402 states "A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a TDE to an average member of the critical group that does not exceed 25 mrem per year, including that from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are as low as reasonable achievable (ALARA)." US EPA does not consider the 25 TDE based on 10 CFR 20 to be protective enough.

Based on these regulations, 25 mrem/yr (as calculated based on 10 CFR 161.40) is used as the target dose equivalent. The calculations are performed to ensure the risk-based values are as low or lower than the ARAR-based values. The soil exposure pathway accounts for intake from ingestion, inhalation, and external exposure to radionuclides, as presented in the equation below.

Industrial Worker Dose-Based RGOs

RGO =

$$\frac{TDE}{\left(\left(EF \times CF1 \times DCFo \times IRo\right) + \left(DCFi \times DIFi \times \left(\frac{t}{PEF}\right)\right) + \left(DCFe \times CF2\right)\right)}$$ where:

TDE	=	Target Dose Equivalent (25 mrem/yr)
$t_{1/2}$	=	half-life in years -- radionuclide specific
CF1	=	Conversion Factor -- 1.0 X 10^{-3} g/mg
EF	=	Exposure Frequency – 250 days/yr
IR_o	=	Oral Intake Rate – 50 mg/day
DCF_o	=	Oral Dose Conversion Factor-- radionuclide specific
DCF_j	=	Inhalation Dose Conversion Factor -- radionuclide specific
DIFi	=	Inhalation Dose Intake Factor – 5.0 x 10^6 m^3-g/kg-yr
IR_i	=	Inhalation Rate – 2.5 m^3/hr
PEF	=	Particulate Emissions Factor – 4.63 x 10^9 m^3/kg, default - US EPA 1991
DCF_e	=	External Dose Conversion Factor -- radionuclide specific
CF2	=	Conversion Factor – 1.0 g/cm^3

and DIFi = IRi x ET x EF x CF3

where:

ET	=	Exposure Time – 8 hrs/day
CF3	=	Conversion Factor – 1 x 10^3 g/kg

The values for radionuclide-specific parameters (dose conversion factors) are the same used in RESRAD, which are based on published values by the International Commission of Radiological Protection, DOE, and US EPA (ICRP 1979-1982; DOE 1988a,b; US EPA 1988). They are presented in Table E-1. The 25 mrem/year TDE soil concentration equivalents are presented in Table E-2. Based on use of 1 x 10^{-6} risk-based soil concentration

equivalents as the RG, as required by SCDHEC, Table E-2 shows that for all radionuclides the dose-based RGO is met.

2.0 REFERENCES

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Table E-1. Radionuclide Slope Factors and DCFs

Isotope		Half-life[a]	Slope Factors			Dose Conversion Factors		
			Inhalation (Risk-pCi)	Ingestion (Risk-pCi)a	External (Risk/yr per pCi/g soil)	Inhalation (mrem/pCi)	Ingestion (mrem/pCi)	External (mrem/yr per pCi/cm^3)
Actinium-228	c	6.13 h	3.27E-11	1.62E-12	3.28E-06	1.25E-04	2.16E-06	[c]
Americium-241		4.32 y	3.85E-08	3.28E-10	4.59E-09	4.44E-01	3.64E-03	2.99E-02
Americium-243	+D	7.380 y	3.82E-08	3.31E-10	2.66E-07	5.20E-01	4.50E-03	6.75E-01
Carbon-14		5730 y	6.99E-15	1.03E-12	0.00E+00	2.09E-06	2.09E-06	0.00E+00
Cesium-137	+D	30.2 y	1.91E-11	3.16E-11	2.09E-06	3.19E-05	5.00E-05	3.14E+00
Cobalt-60		5.27 y	6.88E-11	1.89E-11	9.76E-06	2.19E-04	2.69E-05	1.42E+01
Curium-243/244	b		2.89E-08	2.51E-10	1.71E-07	3.50E-01	2.90E-03	4.54E-01
Curium-243		2.85/E+01 y	2.89E-08	2.51E-10	1.71E-07	3.50E-01	2.90E-03	4.54E-01
Curium-244		18.1 y	2.43E-08	2.11E-10	2.07E-11	2.70E-01	2.30E-03	9.44E-04
Curium-245/246	b			3.35E-10	5.51E-08	5.40E-01	4.50E-03	3.43E-01
Curium-245		8.50E+03 y	3.92E-08	3.35E-10	5.51E-08	5.40E-01	4.50E-03	3.43E-01
Curium-246		4.750 y	3.92E-08	3.35E-10	1.89E-11	5.40E-01	4.50E-03	9.18E-04
Europium-152		13.3 y	7.91E-11	5.73E-12	4.08E-06	2.20E-04	6.00E-06	6.19E+00
Europium-154		8.8 y	9.15E-11	9.37E-12	4.65E-06	2.86E-04	9.55E-06	6.88E+00
Iodine-129		1.57E+07 y	1.22E-10	1.84E-10	2.69E-09	1.74E-04	2.76E-04	2.03E-02
Lead-212	c	10.6 h	3.85E-11	1.80E-11	3.00E-07	1.69E-04	4.55E-05	[c]
Neptunium-237	+D	2.14E+06 y	3.45E-08	3.00E-10	4.62E-07	4.90E-01	3.90E-03	1.01E+00
Neptunium-239	c	2.3 d	2.41E-12	4.27E-12	2.42E-07			[c]
Nickel-63		100 y	1.01E-12	5.50E-13	0.00E+00	6.29E-06	5.77E-07	0.00E+00
Plutonium-238		87.8 y	2.74E-08	2.95E-10	1.94E-11	2.88E-01	3.20E-03	9.75E-04
Plutonium-239/240	b		2.78E-08	3.16E-10	1.87E-11	5.10E-01	3.54E-03	9.25E-04
Plutonium-239		2.41+04 y	2.78E-08	3.16E-10	1.26E-11	5.10E-01	3.54E-03	5.09E-04
Plutonium-240		6.570 y	2.78E-08	3.15E-10	1.87E-11	5.10E-01	3.54E-03	9.25E-04
Promethium-147		2.62 y	7.49E-12	1.41E-12	6.35E-12	3.40E-05	9.50E-07	9.20E-06
Radium-226	+D	1.600 y	2.75E-09	2.96E-10	6.74E-06	8.58E-03	1.32E-03	9.69E+00
Radium-228	+D	5.76 y	9.94E-10	2.48E-10	3.28E-06	4.50E-03	1.20E-03	5.11E+00
Sodium-22		2.6 y	4.88E-12	8.02E-12	8.18E-06	7.66E-06	1.15E-05	9.62E-01
Stronium-90	+D	28.6 y	6.93E-11	5.59E-11	0.00E+00	1.30E-03	1.42E-04	0.00E+00
Technetium-99		2.13E+05 y	2.89E-12	1.40E-12	6.19E-13	8.33E-06	1.46E-06	1.05E-06
Thorium-228	+D	1.91 y	9.45E-08	2.31E-10	6.20E-06	3.10E-01	7.50E-04	8.31E+00
Thorium-230		7.70E+04 y	1.72E-08	3.75E-11	4.40E-11	2.60E-01	5.30E-04	1.32E-03
Thorium-232		1.41E+10 y	1.93E-08	3.28E-11	1.97E-11	1.64E+00	2.80E-03	8.35E-04
Thorium-232	d	1.41E+10 y	1.15E-07	5.12E-10	9.48E-06	1.95E+00	4.75E-03	1.34E+01
Thorium-234	c	24.1 d	1.90E-11	1.93E-11	3.50E-09	3.50E-05	1.37E-05	
Tritium		12.3 y	9.59E-14	7.15E-14	0.00E+00	6.40E-08	6.40E-08	0.00E+00
Uranium-233/234	b		1.41E-08	4.48E-11	3.52E-11	1.35E-01	2.89E-04	9.63E-04
Uranium-233		1.59E+05 y	1.41E-08	4.48E-11	3.52E-11	1.35E-01	2.89E-04	8.75E-04
Uranium-234		2.45E+05 y	1.40E-08	4.44E-11	2.14E-11	1.35E-01	2.60E-04	9.63E-04
Uranium-235		7.04E+08 y	1.30E-08	4.70E-11	2.65E-07	1.23E-01	2.66E-04	5.59E-01
Uranium-238	+D	4.47E+09 y	1.24E-08	6.20E-11	6.57E-08	1.18E-01	2.55E-04	7.94E-02

[a] Cancer slope factors and nuclear half-lives are provided in *Health Effects Assessment Summary Tables (FY-1995)* (EPA, 1995a)
[b] Where there are dual designations for cancer slope factors (e.g., curium-243/244), the most restrictive value for each exposure route was used in the calculation of the RTV.
+D includes short-lived daughters (half-lives less than or equal to 6 months)
[c] Included as daughter in decay chain of parent
[d] entire Th-232 decay chain aggregated, based on secular equilibrium in approximately 30 years.

Table E-2. Human Health Remedial Goals for Radionuclides

Isotope		Remedial Goal Option Industrial Worker 25 mrem/yr (pCi/g coil)	Remedial Goal Industrial Worker 1×10^{-6} (pCi/g soil)	SRS Background (95th %) (mg/kg)
Actinium-228	c			2.00
Americium-241		3.30E+02	7.67E+00	
Americium-243	+D	3.42E+01	7.62E-01	
Carbon-14		9.58E+05	3.11E+03	0.12
Cesium-137	+D	7.96E+00	1.06E-01	0.17
Cobalt-60		1.76E+00	2.27E-02	
Curium-243/244	b			
Curium-243		5.10E+01	1.17E+00	
Curium-244		8.37E+02	1.42E+01	
curium-245/246	b			
Curium-245		6.26E+01	2.77E+00	
Curium-246		4.35E+02	8.93E+00	
Europium-152		4.04E+00	5.42E-02	
Europium-154		3.63E+00	4.76E-02	
Iodine-129		1.05E+03	1.44+01	13.66
Lead-212	c	4.39E+04	7.34E-01	2.19
Neptunium-237	+D	2.36E+01	4.57E-01	
Neptunium-239	c		9.13E-01	
Nickel-63		3.46E+06	5.81E+03	
Plutonium-238		6.08E+02	1.03E+01	
Plutonium-239/240	b			1.14
Plutonium-239		5.55E+02	9.62E+00	
Plutonium-240		5.50E+02	9.65E+00	
Promethium-147		1.19E+06	2.12E+03	
Radium-226	+D	2.58E+00	3.27E-02	1.48
Radium-228	+D	4.88E+00	6.71E-02	2.42
Sodium-22		2.60E+01	2.70E-02	
Strontium-90	+D	1.40E+04	5.72E+01	2.08
Technetium-99		1.29E+06	2.27E+03	3.02
Thorium-228	+D	3.00E+00	3.56E-02	3.90
Thorium-230		3.09E+03	6.63E+01	1.64
Thorium-232		6.79E+02	7.20E+01	2.07
Thorium-232	d	1.85E+00	2.32E-02	
Thorium-234	c	1.46E+05	4.57E+01	
Tritium		3.12E+07	4.47E+04	
Uranium-233/234	b			
Uranium-233		5.47E+03	5.97E+01	
Uranium-234		5.82E+03	6.04E+01	
Uranium-235		4.45E+01	8.23E-01	0.09
Uranium-238	+D	3.02E+02	3.14E+00	1.34

[a] Cancer slope factors and nuclear half-lives arc provided in *Health Effects Assessment Summary Tables (FY-1995)* (EPA. 1995a).
[b] Where there are dual designations lot cancer slope factors (e.g.. curium-243/244), the most restrictive value for each exposure route was used in the calculation of the RTV.
+D includes short-lived daughters (half-lives less than or equal to 6 months)
[c] Included as daughter in decay chain of parent
[d] entire Th-232 decay chain aggregated, based on secular equilibrium in approximately 30 years.