City: **UPTON**
BROOKHAVEN NATIONAL LABORATORY (USDOE)

Site Information:

Site Name: BROOKHAVEN NATIONAL LABORATORY (USDOE)
Address: UPTON, NY

EPA ID: NY7890008975
EPA Region: 02

Record of Decision (ROD):

ROD Date: 03/25/1996
Operable Unit: 04
ROD ID: EPA/ROD/R02-96/285

Media: soil, groundwater

Contaminant: tank, wells, treatment, institutional controls, soil vapor extraction, vadose zone, fencing, sump, monitoring, air sparging, extraction, biodegradation, hot spot, underground storage 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.

Brookhaven National Laboratory (BNL)is a Federal facility owned by the Department of Energy (DOE) and operated by the Associated Universities, Inc. (AUI), a not-for-profit consortium of nine universities. The mission of BNL is to provide exceptional research facilities for training and research in the diverse fields of science, and to meet the appropriate needs and interests of the educational, governmental, and industrial research institutions. Brookhaven National Laboratory has three major functions. The first is design, construction, and operation of large research facilities, such as particle accelerators, nuclear reactors, and synchotron storage rings. The second major function is the support of the research staff in it its efforts to carry out long-term programs in the basic sciences which have potential long-term payoffs. The third major function involves the contribution by the staff to the technology base of the nation. To carry out this mission, BNL has been or is maintained by a full staff

of 3,300 to 4,000 research and support personnel. In addition, about 1,500 other personnel participate each year in research on short-term projects such as collaborators, consultants, or students.Located about 60 miles east of New York City, BNL is in Upton, New York, near the geographic center of Long Island. Distances to neighboring communities from BNL include Patchogue, Bellport, Center Moriches, Riverhead, Wading River, and Port Jefferson. The BNL site, formerly Camp Upton, was occupied by the U.S. Army during World Wars I and II. Between the wars, the site was operated by the Civilian Conservation Corps. The site was transferred to the Atomic Energy Commission in 1947, to the Energy Research and Development Administration in 1975, and to DOE in 1977.The BNL site consists of 5,321 acres. The developed portion includes the principal facilities located near the center of the site. These facilities are contained in an area of approximately 900 acres; of these, 500 were originally developed for Army use.

The remaining 400 acres are occupied mostly by various large research machine facilities. Outlying facilities occupy approximately 550 acres and include an apartment area, biology field, Hazardous Waste Management Area, Sewage Treatment Plant (STP), fire breaks, and the Landfill Area.The Central Steam Facility (CSF) supplies heating and cooling to all major BNL facilities. It consists of a network of 21 aboveground receiving and mixing fuel tanks, which are connected via aboveground and underground pipelines to the boiler building.In November 1977, approximately 23,000 to 25,000 gallons of waste oil and solvent were released from a ruptured pipe located southeast of the CSF and west of North Sixth Street. The mixture was composed of 60% Number 6 fuel oil and 40% mineral spirits. The pipe ruptured when a nearby empty 5,000 gallon underground storage tank (UST), which was enclosed in a concrete structure, rose off its mount as a result of water accumulating beneath the tank, shearing the connecting lines.The spill was contained with sand berms and free product was recovered with portable pumps. The total amount of the soil/solvent mixture that was recovered is unknown.In November 1989, excavation began at a location south of Building 610 to install a 1,000-gallon underground propane tank. During the digging, the backhoe encountered an 8-inch vitreous tile pipe. A review of drawings of the site showed that the pipe had been connected to a Leaching Pit. The pit had been installed in the 1950s or 60s to receive waste oil and washwater from equipment cleaned inside Building 610. Further excavation revealed that the tile pipe led to a sand trap, and then to Building 610. The Leaching Pit contained a thick, black, tar material similar in appearance to Number 6 fuel oil. Excavation proceeded by removing the oil-stained concrete blocks and surrounding soil, in addition to the sand filter and piping connecting the Leaching Pit to Building 610. Clean sand and soil were placed into the hole. The soil, construction material, and tarry residue excavated were classified as non-hazardous. In May 1990, an abandoned 550-gallon underground gasoline tank was discovered under the asphalt on the west side of Building 610. BNL records show that the tank was in operation from 1948 until approximately 1963. Excavation and inspection of the tank revealed several large rusted-out holes. Soil from beneath the tank smelled of petroleum. The contaminated soil was excavated until the organic vapor content of the remaining soil was less than 50 parts per million (ppm). The hole was backfilled with clean soil.The CSF Fuel Unloading Areas are constructed of pavement, bluestone, and concrete. The secondary containments are concrete boxes. BNL has documented several small surface spills of fuel oil. On three separate occasions, surface spills of about 60 gallons of Number 6 fuel oil were reported.There are four receiving tanks located to the west of Building 610. The tanks have a combined capacity of 1.1 million gallons. The majority of the pipelines are aboveground, and have had no history of leaking. However, there are three sections of piping leading to Building 610 that are below ground. There are no documented releases from the pipes.In September 1977, a tank truck was unloading fuel at a fuel-transfer pipe station. Apparently the valve was in the closed position. As a result, approximately 250 to 500 gallons of fuel were spilled. The fuel caused excessive back pressure in the pipeline and ruptured it. The fuel spilled onto the ground and entered an adjacent catch basin, with an outlet in the woods east of Building 610. The oil reportedly flowed east along a small drainage ditch to a fence which marks the Gamma Field. The oil ponded in the low area, and was collected with recovery pumps. A bulldozer was used to limit the spread of the oil.The Reclamation Facility (Building 650) was constructed for decontamination of radiologically contaminated clothing and heavy equipment. At present, Building 650 is not used as a decontamination facility, but is still used by BNL as a laundry facility. Potentially radioactive laundry was segregated from routine laundry. Contaminated laundry was cleaned with dedicated equipment and the residual washwater remained in USTs until its radioactivity could be monitored. The liquid waste was emptied from the tanks about three times a year.Building 650 also served as a decontamination facility for equipment contaminated with radioactivity. Again, waste was stored in tanks and they were emptied about twice a year.The sanitary and storm sewer lines at BNL date back to 1917. There is approximately 1,300 feet of sanitary sewer line. This sewer line transports effluent.The last area of concern is the Basin HO, which is the largest of five recharge basins at BNL. It discharges 48 percent of all the water that BNL uses for non-contact cooling and related purposes.

Remedy: The remedy consists of a combination of treatment and institutional controls. The selected remedy consists of the following major components: treatment of chemically contaminated soil using a soil vapor extraction system to collect organic contaminants in the vadose zone of the 1977 oil/solvent spill area and a fuel unloading area at the CSF; fencing around the radiologically contaminated soil at the Building 650 Sump and the Sump Outfall area with institutional controls and monitoring; treatment of groundwater contaminated with organic compounds at the most contaminated portion or hot spot of the 1977 oil/solvent spill plume area using a combination of soil vapor extraction and air sparging technologies; and an engineering enhancement option for groundwater contaminated with organic constituents may be implemented if it is decided, based on the performance and monitoring data, that soil vapor extraction and air sparging alone will not achieve the desired performance levels. The engineering enhancement option consists of groundwater extraction, enhanced biodegradation, and re-injection of the groundwater and would be used in combination with soil vapor extraction and air sparging.

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

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U.S. DEPARTMENT OF ENERGY

BROOKHAVEN NATIONAL LABORATORY

OPERABLE UNIT IV

RECORD OF DECISION

March 14, 1996

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U.S. DEPARTMENT OF ENERGY

BROOKHAVEN NATIONAL LABORATORY

OPERABLE UNIT IV

I. DECLARATION OF THE RECORD OF DECISION

DECLARATION OF THE RECORD OF DECISION

OPERABLE UNIT IV
BROOKHAVEN NATIONAL LABORATORY
UPTON, NY

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for Operable Unit (OU) IV of the Brookhaven National Laboratory (BNL) site in Upton, New York. Operable Unit IV includes the Central Steam Facility (CSF), the Reclamation Facility Building 650 Sump and Sump Outfall, leaking sewer lines, Recharge Basin HO, and associated environmental media.

This remedial action was selected in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as amended by Superfund Amendments and Reauthorization Act of 1986 (SARA) (hereinafter jointly referred to as CERCLA), and is consistent, to the extent practicable, with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for the BNL site.

The U.S. Environmental Protection Agency (EPA) and the State of New York concur with the selected remedial action.

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 a potential threat to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

Operable Unit IV is the first of the five operable units at the site for which remedies will be selected in individual RODs. The purpose of this remedy is to address contamination associated with a 1977 oil/solvent spill and a fuel unloading area near BNL's CSF and with the Reclamation Facility Building 650 Sump and Sump Outfall area. The OU IV remedy consists of a combination of treatment and institutional controls.

The selected remedy consists of the following major components:

- Treatment of chemically contaminated soil using a soil vapor extraction system to collect organic contaminants in the vadose zone of the 1977 oil/solvent spill area and a fuel unloading area at the CSF.

- Fencing around the radiologically contaminated soil at the Building 650 Sump and the Sump Outfall area with institutional controls and monitoring.

- Treatment of groundwater contaminated with organic compounds at the most contaminated portion or "hot spot" of the 1977 oil/solvent spill plume area using a combination of soil vapor extraction and air sparging technologies.

- An engineering enhancement option for groundwater contaminated with organic constituents may be implemented if it is decided by the DOE, EPA, and NYSDEC, based on the performance and monitoring data, that soil vapor extraction and air sparging alone will not achieve the desired performance levels. The performance levels will be defined during the remedial design phase. The engineering enhancement option consists of groundwater extraction, enhanced biodegradation, and re-injection of the groundwater and would be used in combination with soil vapor extraction and air sparging.

The components of the selected remedy for contaminated groundwater, in combination with the engineering enhancement option, and for the chemically contaminated soils, are final response actions. The component of the selected remedy that addresses radiologically contaminated soil is considered an interim action. This interim action is necessary to reduce the risk posed by potential exposure to radiologically contaminated soil at OU IV. Final remediation of these soils will be evaluated in the OU I Feasibility Study (FS) and documented in the OU I ROD, based upon OU I FS conclusions, future land use, and public comment.

DECLARATION

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 final components of the selected remedy utilize permanent solutions and alternative treatment technologies to the maximum extent practicable, and satisfy the statutory preference for remedies that employ treatment that reduces contaminant toxicity, mobility, or volume as a principal element. The interim action component of the remedy does not and is not intended to address fully the statutory mandate for permanence and treatment to the maximum extent practicable. The statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element will be evaluated for the radiologically-contaminated soil in the OU I FS and ROD for the BNL site.

A five-year review of the remedial action pursuant to CERCLA §121(c), 42 U.S.C. §9621(C), will not be necessary, because this remedy will not result in hazardous substances remaining on-site above health-based levels.

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TABLES

FIGURES

LIST OF ACRONYMS

AGS	Alternating Gradient Synchrotron
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
AUI	Associated Universities, Inc.
BNL	Brookhaven National Laboratory
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CERCLA	Comprehensive Environmental Response Compensation & Liability Act
CSF	Central Steam Facility
DOE	United States Department of Energy
DOT	Department of Transportation
EPA	United States Environmental Protection Agency
FS	Feasibility Study
GPR	Ground Penetrating Radar
HEAST	Health Effects Assessment Summary Tables
HFBR	High Flux Beam Reactor
IAG	Interagency Agreement
IRIS	Integrated Risk Information System
LLW	Low Level Radioactive Waste
MCL	Maximum Contaminant Level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NPL	National Priorities List
NYSDEC	New York State Department of Environmental Conservation
OU	Operable Unit
PAH	Polynuclear Aromatic Hydrocarbon
pCi/gram	Picocuries per gram
ppb	Parts per billion
ppm	Parts per million
PRAP	Proposed Remedial Action Plan
PVC	Polyvinyl Chloride
RA	Risk Assessment
RAGS	Risk Assessment Guidance for Superfund
RESRAD	Residual Radioactive Material Guideline Computer Code
RfD	Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RI/RA	Remedial Investigation/Risk Assessment
ROD	Record of Decision
RSD	Response Strategy Document
SARA	Superfund Amendments and Reauthorization Act of 1986
SCDHS	Suffolk County Division of Health Services
SPDES	State Pollutant Discharge Elimination System
STP	Sewage Treatment Plant
SVE	Soil Vapor Extraction
SVOC	Semi-Volatile Organic Compound
TAGM	NYSDEC Technical Assistance Guidance Memorandum
TBC	To Be Considered
TIC	Tentatively Identified Compound
USGS	United States Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compound
WCF	Waste Concentration Facility

U.S. DEPARTMENT OF ENERGY

BROOKHAVEN NATIONAL LABORATORY

OPERABLE UNIT IV

II. DECISION SUMMARY

DECISION SUMMARY

1. SITE NAME, LOCATION, AND DESCRIPTION

Brookhaven National Laboratory is a federal facility owned by the Department of Energy (DOE) and operated by the Associated Universities, Inc. (AUI), a not-for-profit consortium of nine universities. The mission of BNL is to provide exceptional research facilities for training and research in the diverse fields of science, and to meet the appropriate needs and interests of the educational, governmental, and industrial research institutions. Brookhaven National Laboratory has three major functions. The first is the design, construction, and operation of large research facilities, such as particle accelerators, nuclear reactors, and synchrotron storage rings. The second major function is the support of the research staff in its efforts to carry out long-term programs in the basic sciences which have potential long-term payoffs. The third major function involves the contribution by the staff to the technology base of the nation. To carry out this mission, BNL has been or is maintained by a full staff of 3,300 to 4,000 research and support personnel. In addition, about 1,500 other personnel participate each year in research on short-term projects as collaborators, consultants, or students.

Located about 60 miles east of New York City, BNL is in Upton, Suffolk County, New York, near the geographic center of Long Island. Distances to neighboring communities from BNL are: Patchogue 10 miles WSW, Bellport 8 miles SW, Center Moriches 7 miles SE, Riverhead 13 miles due east, Wading River 7 miles NNE, and Port Jefferson 11 miles NW. The BNL site, formerly Camp Upton, was occupied by the U.S. Army during World Wars I and II. Between the wars, the site was operated by the Civilian Conservation Corps. The site was transferred to the Atomic Energy Commission in 1947, to the Energy Research and Development Administration in 1975, and to DOE in 1977.

The BNL property is an irregular polygon that is roughly square, and each side is approximately 2.5 miles long. A current land use map of the BNL site is provided as Figure 1.

The site consists of 5,321 acres. The developed portion includes the principal facilities located near the center of the site, on relatively high ground. These facilities are contained in an area of approximately 900 acres, 500 acres of which were originally developed for Army use. The remaining 400 acres are occupied for the most part by various large research machine facilities. Outlying facilities occupy approximately 550 acres and include an apartment area, biology field, Hazardous Waste Management Area, Sewage Treatment Plant (STP), fire breaks, and the Landfill Area. The site terrain is gently rolling, with elevations varying between 40 to 120 feet above sea level. The land lies on the western rim of the shallow Peconic River watershed, with a tributary of the river rising in marshy areas in the northern section of the tract. Table 1 provides a summary of the physical plant information, including population, physical data, and utilitities.

The aquifer beneath BNL is comprised of three water bearing units: the moraine and outwash deposits, the Magothy Formation, and the Lloyd Sand Member of the Raritan Formation. These units are hydraulically connected and make up a single zone of saturation with varying physical properties extending from a depth of 45 to 1,500 feet below the land surface. These three water bearing units are designated as a "sole source aquifer" by the EPA and serve as the primary drinking water source for Nassau and Suffolk Counties.

To allow effective management of the BNL site, the 28 Areas of Concern (AOCs) have been divided into discrete groups called Operable Units (OUs) and Removal Action AOCs. The criteria used for OU groupings are: relative proximity of AOCs, similarity of site problems, similar geology and hydrology, similar phases of action or sets of actions to be performed during Remedial Investigation/Feasibility Study (RI/FS), and the absence of interferences with future actions at other AOCs or OUs. The BNL site is divided into five OUs and eight Removal Actions. Operable Unit IV is one of the first OUs studied at the site.

Operable Unit IV is located on the east-central edge of the developed portion of the site (Figure 2). Figure 3 shows the extent of OU IV, which encompasses the CSF, otherwise known as AOC 5, Reclamation Facility Building 650 Sump and Reclamation Facility Building 650 Sump Outfall (AOC 6), Leaking Sewer Lines (AOC 21), and Recharge Basin HO (AOC 24-D). The CSF is located between North Sixth Street, Seventh Road, Brookhaven Avenue, and Cornell Street, and consists of approximately 13 acres, divided equally between developed and undeveloped land. The Building 650 Sump is approximately 100 feet north of Cornell Avenue. The Building 650 Sump Outfall area is located approximately 800 feet northeast of Building 650 and consists of a natural depression, approximately 90 feet x 90 feet, bounded by dirt roads. The leaking sewer lines are located south of Building 610; Recharge Basin HO is located approximately 250 feet to the northeast of the Building 650 Sump Outfall area.

2. SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 Site History

A brief history of each AOC within OU IV is provided below:

AOC 5 - Central Steam Facility

The CSF supplies heating and cooling to all major BNL facilities. It consists of a network of 21 aboveground receiving and mixing fuel tanks, which are connected via aboveground and underground pipelines to the boiler building (Building 610) located near the corner of Sixth Street and Cornell Avenue. The tanks are registered with the Suffolk County

Department of Health Services (SCDHS), and have a Major Petroleum Facility License from the NYSDEC Division of Water Resources.

AOC 5 has several subAOCs as described below:

1977 Oil/Solvent Spill

On November 25, 1977, approximately 23,000 to 25,000 gallons of waste oil and solvent were released from a ruptured pipe located southeast of the CSF and west of North Sixth Street. The mixture was composed of 60 percent Number 6 fuel oil and 40 percent mineral spirits. The pipe ruptured when a nearby empty 5,000 gallon underground storage tank (UST), which was enclosed in a concrete structure, rose off its mount as a result of water accumulating beneath the tank, shearing the connecting lines.

The spill, which covered an estimated area of 1.2 acres, was contained with sand berms and free product was recovered with portable pumps. The cleanup activities were coordinated with EPA and the steps taken were considered at that time to be appropriate by EPA. The total amount of the soil/solvent mixture that was recovered is unknown.

Former Leaching Pit

On November 6, 1989, excavation began at a location south of Building 610 to install a 1,000 gallon underground propane tank. Although the current utilities maps showed that there were no underground utility lines at this location, the backhoe encountered an eight inch vitreous tile pipe approximately 3 to 4 feet below grade. A review of design drawings of Building 610, dating back to the 1950s, showed that the pipe had been connected to a Leaching Pit.

The Leaching Pit was located approximately 100 feet south of the southwest corner of Building 610. The pit was installed sometime in the 1950s or 1960s to receive waste oil and washwater from equipment cleaned inside Building 610. Further excavation revealed that the vitreous tile pipe led to a sand trap, and eventually to Building 610.

The Leaching Pit had an outside diameter of approximately 9 feet and was about 11 feet deep. Its walls were constructed of concrete cinder blocks, and the cover was a 12 inch thick concrete slab. The cover was located approximately 1 foot below grade.

The Leaching Pit contained approximately 53 inches of a thick, black, tar material similar in appearance to Number 6 fuel oil. Excavation proceeded by removing the oil-stained concrete blocks and surrounding soil, in addition to the sand filter and piping connecting the Leaching Pit to Building 610. The estimated dimensions of the excavation were 20 feet deep by 20 feet in diameter. Clean sand and soil were placed into the hole. The soil, construction material, and tarry residue excavated from the Leaching Pit were classified as non-hazardous. Currently, an underground propane tank is located at the excavation site. The excavation and cleanup of the Leaching Pit was coordinated with the IAG agencies and was performed with oversight by the NYSDEC Region III Oil Spill Division.

Former Underground Gasoline Storage Tank

In May 1990, an abandoned 550-gallon underground gasoline tank was discovered under the asphalt on the west side of Building 610. Brookhaven National Laboratory records show that the tank was in operation from 1948 until approximately 1963. Excavation and inspection of the tank revealed several large rusted-out holes. Soil from beneath the tank smelled of petroleum.

The contaminated soil was excavated until the organic vapor content of the remaining soil was less than 50 ppm. The depth and lateral extent of the excavation were not documented; however, approximately 12 cubic yards of soil were excavated. The hole was backfilled with clean soil under authorization from SCDHS.

CSF Fuel Unloading Areas

Fuel is unloaded at eight places around the storage tanks. The unloading areas are approximately 4 square feet and are constructed of pavement, bluestone, and concrete. The secondary containments are concrete boxes. Brookhaven National Laboratory has documented several small (1 to 10 gallons) surface spills of fuel oil. On three seperate occasions, in 1988, 1990, and 1993, surface spills of about 60 gallons of Number 6 fuel oil were reported.

CSF Underground Piping

Four receiving tanks (1,2,3, and 4) are located to the west of Building 610. The tanks have a combined capacity of 1.1 million gallons. The majority of the pipelines are aboveground, and have had no history of leaking. However, there are three sections of piping leading to Building 610 that are below ground. One section is a 12 inch diameter pipe that carries Number 6 fuel oil from Tank 3 to Building 610, a distance of approximately 150 feet. Another section of pipe carries Number 6 fuel oil from Tank 1 to Building 610. The third section of underground piping connects Building 633 to both Building 610 and Tank 1. There are no documented releases from the pipes.

Drainage Area East of CSF

In Septenber 1977, a tank truck was unloading fuel at a fuel-transfer pipe station; apparently, the valve was in the "closed" position. As a result, approximately 250 to 500 gallons of fuel were spilled. The fuel, believed to be Number 6 "Bunker C oil," caused excessive back pressure in the pipeline and ruptured it. The fuel spilled onto the ground and entered an adjacent catch basin, with an outlet in the woods east of Building 610. The oil reportedly flowed east along a small drainage ditch to a fence which marks the "Gamma Field." The oil ponded in the low area, and subsequently was collected with recovery pumps. A bulldozer was used to limit the spread of the oil.

AOC 6 - Reclamation Facility Building 650 Sump and Sump Outfall Area

The Reclamation Facility (Building 650) was constructed for decontamination of radiologically contaminated clothing and heavy equipment. As a result, Building 650 was designed to perform wash operations both outside and inside the building. These operations date back to at least 1959, with the construction of USTs #650-1 and -2, in 1962 and Tanks 650-3 and -4 in 1972. The structural integrity of the tanks had never been tested. At present, Building 650 is not used as a decontamination facility, but is still used by BNL as a laundry facility.

In the past, all soiled laundry from BNL was delivered to Building 650, where potentially radioactive laundry was segregated from routine laundry. Contaminated laundry was cleaned with dedicated equipment and the residual washwater remained in two 2,000 gallon USTs (#650-1 and -2) until its radioactivity could be monitored. These tanks were located on the north side of the building. The contents of the tanks were classified as D-waste, defined by BNL as waste with a gross beta concentration greater than 90 pico Curies/milliliter (pCi/ml). The liquid waste was emptied from the tanks about three times a year and taken to the Waste Concentration Facility (WCF) by a tank truck. Approximately six drums of sludge were removed from the tanks in 1983.

Building 650 also served as a decontamination facility for equipment contaminated with radioactivity. Equipment was steam-cleaned on a 30 foot by 30 foot concrete pad behind the north side of the building. This decontamination pad was in use by 1959, but the date of its initial operation is not known. Contaminated water ran down into a drum in the middle of a sloping pad, known as the Building 650 Sump. It was presumed that the effluent was piped into the sanitary sewer system or into holding tanks. Rinse water that was deemed to be excessively contaminated was supposed to be routed to two 2,000 gallon USTs (#650-1 and -2), designated for D-waste. Typically, however, the water was deemed clean enough to be routed to two 3,000 gallon USTs (#650-3 and -4), adjacent to Tanks 1 and 2, and designed for F-waste containment. Brookhaven National Laboratory defines F-waste as waste with a gross beta concentration less than 90 pCi/ml. The contents of these tanks were emptied about twice a year; the waste was discharged to the STP. The laundry facility and the decontamination pad area are the only known sources of D and F waste delivered to the four tanks at Building 650.

The USTs (#650-1,-2,-3, and -4) are included under AOC 12 and were removed under Removal Action II, the UST Removal Action, during the summer of 1994.

Building 650 and the Sump Outfall Area were identified during aerial radiological surveys of BNL conducted in 1980, 1983, and 1990. Thus, Building 650 is also included as subAOC 16 under the Aerial Radioactive Monitoring System Results and was inadvertently included under OU II/VII. The investigations under OU IV satisfy all IAG activities for this AOC.

In late 1969, five curies of tritium were accidentally released into the sanitary sewer system, via the building 650 Sump. However, this tritium was not detected at the STP. An investigation into the incident revealed that the drainage pipe from the outdoor concrete pad behind Building 650 led to a natural depression in a wooded area about 800 feet northeast of Building 650, rather than to either the sanitary sewer system or to a waste holding tank, as had been assumed. The practice of washing radioactive equipment on the concrete pad was discontinued after the 1969 incident. The natural wooded depression is referred to as the Building 650 Sump Outfall Area; the area of radiological soil contamination is approximately 90 feet by 90 feet.

AOC 21 - Sanitary and Storm Sewer Lines

The sanitary and storm sewer lines at BNL date back as far as 1917. Major repairs were made in 1940. Additional modifications have extended the sewer system to 31 miles. Many of the sewer and storm lines are composed of vitrified clay tile pipe and have undoubtedly developed cracks. In the region containing the 1977 Oil/Solvent Spill and Leaching Pit, there are approximately 1,300 feet of sanitary sewer line.

The sanitary sewer main (a 20 inch diameter tile line) transports effluent to the STP located to the north of OU IV. Lines carrying storm water in the vicinity of the CSF (south of Temple Place) discharge into a wooded area east of the CSF. The main 20 inch sanitary sewer line divides into two lines approximately 80 feet south of Tank 3. The 20 inch tile sewer line connects with Building 610, passing beneath the valve house and pumping house and then continues east along the south side of Building 610. A large 21 inch diameter line, constructed of polyvinylchloride (PVC), runs east for approximately 100 feet off the sewer main, and then continues to the northeast, passing between the locations of the Former Leaching Pit and the 1977 Oil/Solvent Spill. A third line, 6 inches in diameter, is connected to the main line at the point of division and serves Building 529.

A single sewer line runs east-west between Cornell Avenue and Building 650; it is an 8 inch line, constructed of tile. It connects to the 20 inch main east of the CSF near Building

528.

Storm water from Cornell Avenue and water from several outlets at Building 650, as well as the Building 650 decontamination pad, are directed to the Building 650 Sump Outfall area, via a 15-inch line. The structural integrity of the sanitary sewer lines is known to be compromised by fractures and slippage along joints in portions of the line beneath OU IV. To address the type and extent of damage, a video camera survey of the sanitary sewer main was made in 1988. The structural integrity of the 15-inch diameter storm sewer line connecting the Building 650 Sump to the Building 650 Sump Outfall Area was not known before the remedial investigation for OU IV.

Sub-AOC 24D - Basin HO

Basin HO is located approximately 250 feet northeast of the Reclamation Building 650 Sump Outfall. Basin HO is the largest of five recharge basins at BNL, discharging to the water table aquifer approximately 48 percent or 1,530,000 gallons daily of all of the water that BNL uses for non-contact cooling and related purposes. Basin HO actually is two adjacent basins constructed of native material (sand and gravel) on 3.9 acres.

Since 1958, most of the water discharged to Basin HO, approximately 1,374,000 gallons per day, is single-use, non-contact cooling and process water from the Alternating Gradient Synchrotron (AGS). Water from the High Flux Beam Reactor (HFBR) also has been discharged to Basin HO since 1978. The remainder of the water (approximately 156,000 gallons per day) is multi-cycle blowdown water from the HFBR's secondary cooling system. These discharges are permitted by NYSDEC under BNL's State Pollutant Discharge Elimination System (SPDES) permit.

Water used for cooling and related processes is derived from process/potable supply wells for the entire operation of Basin HO. Poly-electrolytes and dispersant is added to the AGS cooling and process water to keep the ambient iron in solution. To control corrosion and deposition of precipitant, water at the HFBR towers was treated with inorganic polyphosphate (PO4) and benzotriazole before 1982. Since then, the HFBR water has been treated with mercaptobenzothiozene.

Environmental monitoring at Basin HO consisted of sampling the surface water at the Basin HO Outfall 003 from 1985 to 1989. No sediment, soil, or groundwater samples were ever collected in Basin HO before the remedial investigation for OU IV.

2.2 Enforcement Activities

In 1980, the BNL site was placed on NYSDEC's Inactive Hazardous Waste Sites. On December 21, 1989, the BNL site was included on the EPA's National Priorities List (NPL). Inclusion on the NPL reflects the relative importance placed by the federal government on ensuring the expedient completion of environmental investigations and resulting cleanup activities.
Subsequently, the EPA, NYSDEC, and DOE entered into a Federal Facilities Agreement (herein referred to as the IAG) that became effective in May 1992 (Administrative Docket Number: II-CERCLA-FFA-00201). The IAG identified AOCs that were grouped into the five OUs to be evaluated for response actions at the BNL site. The IAG also requires the conduct of cleanup actions to address identified concerns.

In accordance with the June 1994 DOE Secretarial policy on National Environmental Policy Act (NEPA), this CERCLA document incorporates NEPA values such as analysis of cumulative, off-site and ecological impacts to the maximum extent practicable. In particular, the IAG is intended to ensure that environmental impacts associated with past and present activities at

BNL are thoroughly and adequately investigated so that appropriate response actions can be formulated, assessed, and implemented.

The IAG identified AOC 5, CSF, for a RI/FS and provided a schedule for near-term work. A BNL Response Strategy Document (RSD) was written pursuant to the IAG which grouped AOC 5 with AOCs 6, 15, 21, and 24-D and prioritized OU IV as the first OU for RI/FS.

Remediation at the BNL site will be conducted under CERCLA, as amended by the SARA, and the NCP, 40 CFR Part 300.

Following the issuance of the ROD for the last of the five OUs, the necessity of a final assessment from a site-wide perspective will be determined to ensure that ongoing or planned remedial actions identified in the ROD for the five OUs will provide a comprehensive remedy for the BNL site which is protective of human health and the environment.

3. HIGHLIGHTS OF COMMUNITY PARTICIPATION

A Community Relations Plan was finalized for the BNL site in September 1991. In accordance with this plan and CERCLA Section 113(k)(2)(B)(I-v) and 117, the community relations program focused on public information and involvement. A variety of activities were used to provide information and to seek public participation. The activities included: compilation of a stakeholders mailing list, community meetings, availability sessions, site tours and the development of fact sheets. An Administrative Record, documenting the basis for the selection of removal and remedial actions at the BNL site, has been established and is maintaied at the local libraries listed below. The libraries also maintain site reports, press releases, and fact sheets. The libraries are:

Longwood Public Library
800 Middle Country Road
Middle Island, NY 11953

Mastic-Moriches-Shirley Library
301 William Floyd Parkway
Shirley, NY 11967

Brookhaven National Laboratory
Research Library
Bldg. 477A
Upton, NY 11973

The Administrative Record is also maintained at the EPA's Region II Administrative Records Room at 290 Broadway, New York, New York, 10001-1866.

A chronological summary of the significant community participation activities to date for OU IV is provided below:

September 26, 1991: A Site Specific Plan and 5-Year Plan informational meeting was held at BNL where the OU IV draft RI/FS Work Plan was also presented to the public. Presentation handouts on the draft Work Plan were provided to community members at that time. Although the community was informed by a press release to the local newspapers, attendance at this meeting was low. A question and answer period was held at the end of the meeting.

February 17, 1992: A public notice was published in two local newspapers (Newsday and

Suffolk Life) announcing the availability of the OU IV RI/FS Work Plan at local repositories. The comment period began on February 17, 1992 and concluded on March 17, 1992. One community member commented by letter in April and was responded to by BNL.

August 3, 1994: A public notice was published in two local newspapers (Newsday and Suffolk Life) announcing availability of an Engineering Evaluation Report and Action Memorandum at local repositories for an OU IV soil interim removal action. An informational letter, with public notice attached, was sent to the community mailing list. Two phone calls from community members were received concerning the disposal of soils.

January 17, 1995: A public notice was featured in local newspapers announcing the availability of OU IV Remedial Investigation/Risk Assessment (RI/RA) Report at local repositories. The comment period began on January 18, 1995 and concluded on February 20, 1995.

January 25, 1995: An informational letter was sent to community members on the mailing list concerning the OU RI/RA Report. A civic association requested an extension to the comment period. Comments were received in April 1995, which focused primarily on groundwater concerns. A meeting to discuss these concerns with the civic association was held on June 5, 1995. A written response to the civic association comments was provided by DOE.

November 18, 1995: An informational letter was sent to community members on the mailing list announcing the OU IV FS/Proposed Remedial Action Plan (PRAP) public meeting. A public notice, meeting invitation/PRAP fact sheet, and site tour invitation was attached.

November 22, 1995: A public notice was published in Newsday and Suffolk Life (on November 29, 1995) announcing the availability of the FS/PRAP at local repositories for review and comment. A 30-day public comment period was held beginning November 22, 1995.

December 6, 1995: A public meeting was held at BNL for the OU IV FS/PRAP along with an afternoon site tour of OU IV. At this meeting, representatives from EPA, NYSDEC, BNL, and DOE answered questions and accepted comments on the remedial alternatives under consideration for OU IV. A response to comments received during the public comment period is included in the Responsiveness Summary, which is part of this ROD. This decision document presents the selected remedial action for OU IV at the BNL site in Upton, New York, chosen in accordance with CERCLA, and to the extent practicable, the NCP.

December 22, 1995: Seven community members provided written comments.

In addition to traditional public involvement activities at CERCLA sites, DOE worked with stakeholders in identifying a range of future use options for the BNL site. Final Draft of the Future Land Use Report was presented to the public in August, 1995. The Final Report was prepared in September, 1995. Stakeholder preferred future uses identified in this report will assist with the establishment of acceptable risk and remediation levels for the entire BNL site.

4. SCOPE AND ROLE OF OPERABLE UNIT AND RESPONSE ACTION

In order to adequately evaluate BNL's existing and potential environmental problems, and to group these problems for such a large site into workable units that could be properly scheduled and funded, the 28 AOCs have been grouped into five OUs and eight Removal Actions. This grouping was performed under an RSD based on the six criteria: (1) relative proximity of AOCs, (2) similar site problems, (3) similar phase of action or sets of actions, (4) simultaneous actions, (5) absence of interference with future actions, and (6) similar geology and hydrology.

The RSD assigned OU IV the first priority based on a preliminary risk assessment and since an OU IV RI/FS was already underway. Operable Unit IV is the first OU to undergo a RI/FS. Pursuant to the findings documented in the RI/RA Report, FS Report, and the PRAP, OU IV addresses remediation of soil contaminated with Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs) at AOC 5(1977 oil/solvent spill area), soil contaminated with radionuclides at AOC 6, and groundwater contaminated with VOCs and SVOCs from AOC 5 (1977 oil/solvent spill). Conducting this remedial action under OU IV is part of the overall BNL response strategy and is expected to be consistent with any planned future actions.

The other OUs are currently in different phases of RI/FS. The nature, magnitude, and extent of contamination as well as associated risks will be evaluated and the appropriate response actions will be implemented under the respective OU.

5. SUMMARY OF SITE CHARACTERISTICS

The RI was conducted in accordance with the approved OU IV RI/FS Project Plans. The main purposes of the RI were to determine the nature, magnitude, and extent of contamination due to the AOCs included in OU IV, and to characterize the potential health risks and environmental impacts of any contaminants present. The RI included: (1) video camera survey of a pipeline from Building 650 to the Sump Outfall area, (2) geophysical survey, including magnetic and Ground Penetrating Radar (GPR) around several buildings within OU IV, (3) soil-vapor survey of the CSF area, (4) soil borings/soil sampling, (5) monitoring well installation and two rounds of groundwater sampling, (6) sediment sampling in the Recharge Basin HO, (7) aquifer testing in the form of slug tests, (8) analysis of soil and groundwater samples for various chemical and radiological constituents, and (9) additional radiological surface soil sampling and survey (1994) of AOC 6. The video camera survey and geophysical surveys were conducted in July 1992. Fifty-seven soil borings and 23 monitoring wells were installed during the RI for OU IV.

Classification of the nature and extent of soil and groundwater contamination was based on the following Applicable or Relevant and Appropriate Requirements (ARARs), such as those for groundwater, or guidance/criteria To Be Considered (TBC), such as cleanup goals for soils:

(1) Since the groundwater is a federally designated sole source aquifer and is classified as a source of potable water by New York State, the most restrictive of the state and federal Maximum Contaminant Levels (MCLs) were selected as ARARs.

(2) The soil cleanup goals for protection of groundwater contained in the NYSDEC Technical Assistance Guidance Memorandum (TAGM) HWR-92-4046 entitled "NYSDEC Soil Cleanup Objectives and Cleanup Levels," November 1992, were selected for organic compounds found in groundwater.

(3) The cleanup goal selected for radiologically contaminated soils, with the exception of Radium-226, is the annual dose rate of 10 millirem above background, contained in the NYSDEC TAGM 4003 entitled "NYSDEC Soil Cleanup Guidelines for Radioactive Materials", September 1993. This goal, along with the assumption of a future industrial land use and an institutional control period of 50 years, was used to develop soil cleanup guidelines using the DOE Residual Radioactivity (RESRAD) computer model.

(4) Radium-226 concentrations were compared to the 5 pCi/gram generic cleanup guideline contained in DOE Order 5400.5.

Tables 2, 3, and 4 show the selected ARARs or cleanup goals and the maximum concentrations of VOCs and SVOCs in soil, radionuclides in soil, and VOCs and SVOCs in groundwater, respectively.

5.1 Soil Investigations

The findings of RI and Risk Assessment (RA) are detailed in the RI/RA Report. A summary of the findings of the soil investigations and determinations on remedial actions are discussed next.

AOC 5 - Central Steam Facility:

1977 Oil/Solvent Spill

Elevated levels of VOCs and SVOCs are present in the soils in the area adjacent to the Oil/Solvent UST, down gradient of the UST, and in the area known to be covered by the 1977 Oil/Solvent spill. Figure 4 shows the areal extent of soils contaminated with VOCs and SVOCs. VOC levels are highest near the Oil/Solvent UST. The VOCs and SVOCs were detected throughout the vadose zone, and are present at elevated concentrations at the water table. The most common VOCs detected include tetrachloroethylene and petroleum-related compounds, such as toluene, ethylbenzene, benzene, and xylenes. The most common SVOCs detected include a variety of Polynuclear Aromatic Hydrocarbons (PAHs) and phthalates.

As an interim action, and with the concurrence of the IAG agencies, the Oil/Solvent UST and associated piping were removed in October 1993, along with visibly contaminated soil. The excavated soil was stockpiled near the UST location, and soil samples from the piles were analyzed in February 1994 to determine disposal options. The results showed that while numerous VOCs and SVOCs were present in the stockpiled soil above the cleanup goals, the soil was non-hazardous. On June 10, 1994, BNL disposed of the excavated soils at the Town of Brookhaven Landfill after having obtained permission from both the town and the regional NYSDEC office. Thirty-four truckloads of contaminated soil and debris totaling 1,413 tons were transported to the Town Landfill. Each truckload was screened through BNL's radiological vehicle monitor before leaving the site and no radioactivity was detected.

The vadose zone in the Oil/Solvent UST and spill area will require further remediation due to the presence of VOCs and SVOCs above cleanup goals.

Former Leaching Pit

Low levels of VOCs and SVOCs are present in the soils adjacent to the Former Leaching Pit. They most likely represent residual materials discharged into the pit from Building 610. The low levels of tetrachloroethylene may have resulted from the 1977 Oil/Solvent Spill, since that compound is commonly associated with the spill. The Former Leaching Pit and the Sand Filter Trap area do not require further remediation since concentrations are below cleanup goals.

Former Gasoline UST Location

Low levels of petroleum-related VOCs and SVOCs are present in the soils at approximately the subsurface level, i.e., 8 to 10 feet deep, of the Former UST. They represent residual compounds from the UST. When the UST was removed, approximately 12 cubic yards of soil were excavated, until the organic-vapor content was less than 50 parts per million. No VOCs or SVOCs were detected in soil samples collected from below 16 feet, indicating that the small amount of residual organics in the subsurface soil is not migrating deeper into the vadose zone. The Former Gasoline UST will not require further remediation since concentrations are below cleanup goals.

CSF Fuel Unloading Areas

The VOCs and SVOCs are present in soils adjacent to six of the eight CSF Fuel Unloading areas, generally in the shallower portion of the vadose zone. The presence of these compounds indicates that minor spills occurred as the fuel was transferred from tank trucks to the CSF tanks. Most of these compounds are in the upper portion of the vadose zone, indicating that such spills probably were small and have not penetrated far through the unsaturated zone into the water table and groundwater. Elevated levels of VOCs and/or SVOCs above soil cleanup goals were detected near one of the eight Fuel Unloading areas. Contaminated soils will need to be remediated at this Fuel Unloading Area (see Figure 4).

Underground Pipes

Very low levels of VOCs in soil samples at the bottom invert of the fuel pipelines indicate that leakage from the pipes adjacent to the boring locations is minimal; note of the organic compounds exceed cleanup goals. The analyses show that the soils adjacent to the pipes will not require remediation.

Drainage Area

Acetone was the only VOC and phthalate was the only SVOC detected in soil samples from the Drainage Area; both were below cleanup goals. The vadose-zone soils along the pipeline and downgradient of the concrete headwall will not require remediation.

AOC 6 - Reclamation Facility Building 650 and Sump Outfall

Reclamation Building 650 Sump

Acetone was the primary VOC detected in the soil samples in the Sump/Decontamination Pad area behind Building 650. The concentrations are below the cleanup goals. Several chlorinated solvents were detected in soil borings SB38, located on the west side of the decontamination pad. Polynuclear Aromatic Hydrocarbons were the primary SVOCs detected in the soil samples below cleanup goals. Inorganic contamination was found above background levels, primarily in surface soil samples. No remediation will be required for inorganics based on the risk assessment, as described in Section 6 of this report. While the 0 to 2 foot composite samples did not show radionuclide contamination above the cleanup goals, the 0 to 6 inch surface soil samples in this area indicate that there is shallow radiological surface soil contamination. The contaminant concentrations in this area exceed the soil cleanup goals for Cesium-137, Europium-152, and Europium-154. Therefore, radiologically contaminated surface soils will need to be evaluated further.

Reclamation Building 650 Sump Outfall

Acetone was the only VOC detected in soil samples at the Sump Outfall and was below the soil cleanup goal. A wide variety of PAHs were the primary SVOCs detected; they were present primarily in the surface soil. Inorganic contamination was found above background levels, primarily in surface soil samples. No remediation will be required for inorganics based on the risk assessment. Two borings (SB48 and SB49) closest to the pipe headwall, had the highest levels in surface samples from the Outfall Area. Gross alpha, and gross beta radiation was detected in many samples from the Sump Outfall area; both were present in all five surface-soil samples. Cesium-137, Strontium-90, Europium- 152 and 154, Radium-226, and Plutonium-239 and -240, were found at levels above the RESRAD cleanup guidelines. In addition, the gamma radiation level within the sump produces a potential risk that exceeds EPA's target risk level; therefore, the vadose soils in the sump outfall also require remediation. Figure 5 shows the areal extent of radiologically contaminated soils in the Sump Outfall area.

Because the Storm Sewer connecting Building 650 and the Sump Outfall was leaking (video camera survey), the pipeline and the surrounding soil will require remediation.

AOC 21 Leaking Sewer Line

Low levels of chloroform and SVOCs were detected in soil samples adjacent to the sewer line (SB53). This boring is located at the western end of the sewer line and close to the 1977 Oil/Solvent UST Spill. It is likely that this contamination is related to the spill. Since levels are below cleanup goals and groundwater has not been impacted, the soils around SB53 will not be remediated.

SUB-AOC 24D Recharge Basin HO

No VOCs, SVOCs, Tentatively Identified Compounds (TICs), or Pesticides/PCBs were detected in the sediment samples from Basin HO, and no inorganic analytes exceeded cleanup goals. No remediation will be required.

5.2 Groundwater Investigations

The findings of RI and RA are detailed in the RI/RA Report. A summary of the findings of the groundwater investigations and determination of remedial actions is discussed next.

Data from two rounds of groundwater sampling indicates that there were two primary sources of VOCs: the 1977 Oil/Solvent Spill and UST, and the decontamination pad behind Building 650. The VOC plume emanating from the northern side of Building 650 is composed primarily of 1,1,1-trichloroethane at 5.10 ppb and 8.5 (estimated) ppb in the second round of sampling, only slightly above the NYSDEC MCL of 5 ppb. The plume associated with the 1977 Oil/Solvent Spill and UST is composed of numerous VOCs and SVOCs which are predominantly hydrocarbon-related, such as benzene, toluene, ethylbenzene, xylene (BTEX) compounds, chlorinated VOCs, and PAHs. The center of the plume is near the UST, with the highest levels of VOCs and SVOCs in monitoring wells immediately downgradient. The contaminants that exceed the selected cleanup goals are listed in Table 4. The highest levels were observed in the vicinity of the UST. The farthest downgradient wells in the ballfields contained only 4 ug/l of tetrachloroethylene in the second round of sampling, which is below the MCL. Several of these wells contained low levels of TICs, indicating either that the plume is very diluted and degraded at the downgradient end of OU IV, or that the plume travels preferentially between the monitoring well clusters at the southern end of OU IV. Tentatively Identified Compounds were identified at all levels of the Upper Glacial aquifer, suggesting that there are no hydraulic barriers or clay layers within the glacial aquifer in OU IV. Based on site-specific flow, it is estimated that it would take about 7.8 years for 1,2 dichloroethane (the most mobile of the organic contaminants) to reach the downgradient wells, located at approximately 1,800 feet, while the duration for tetrachloroethylene to travel this distance is calculated as 11.2 years. Using the hydraulic conductivity value estimated by the U.S. Geological Survey (USGS), travel times for tetrachloroethylene and 1,2-dichloroethane are 2.1 years and 3 years, respectively.

The results of inorganic analyses show that no primary MCLs were exceeded for inorganic compounds in groundwater beneath OU IV. Two radiological parameters exceeded MCLs for groundwater. In the first round, the monitoring action level for gross beta of 50 pCi/l was exceeded in monitoring wells 76-091 (88pCi/l) and 76-20S (120 pCi/l); neither exceeded 50 pCi/l in the second round. In the second round, Strontium-90 exceeded the federal MCL of 8 pCi/l in Well 66-19S (53 pCi/l). In the first round, the Strontium-90 value of 5.2 pCi/l did not exceed the MCL. The monitoring action level for gross beta was exceeded in the second round in Monitoring Well 66-20S (110 pCi/l).

While isolated spots of radionuclide contamination in groundwater have been observed, the data for two rounds of sampling and analysis do not indicate any consistent MCL violations, and therefore, no groundwater remediation for radiological contamination will be required under OU IV. In addition, there were localized exceedances of secondary MCLs for iron, manganese, sodium, and aluminum. The inorganic contamination appears to be localized and stationary. The contamination is primarily due to VOCs and SVOCs. Groundwater cleanup will be required for VOCs and SVOCs for the most contaminated portion of the 1977 oil/solvent spill plume shown in Figure 6. Groundwater monitoring for radionuclides, organics, and inorganics will be required.

The following is a summary of findings of the OU IV RI described in Sections 5.1 and 5.2.

	Area of Concern	Soil Remediation Required	Groundwater Remediation Required
AOC-5:	Central Steam Facility		
	- 1977 Oil/Solvent Spill	Yes	Yes
	- Former Leaching Pit	No	No
	- Former Gasoline UST Location	No	No
	- CSF Fuel Unloading Areas	Yes*	No
	- Underground Pipes	No	No
	- Drainage Area	No	No
AOC-6:	Reclamation Facility Building 650 and Sump Outfall		
	- Building 650 Sump Area	**	**
	- Sump Outfall Area	**	**
AOC-21:	Leaking Sewer Lines	No	No
AOC-24D:	Recharge Basin HO	No	No

*Only one of the eight fuel unloading areas will require soil remediation.
**Further evaluation is required.

Tables 2, 3, and 4 provide a summary of the types of contaminants, their maximum concentration, and their locations. Figures 4 and 5 show the areal extent of chemical and radiological contamination, respectively, above soil cleanup goals.

6. SUMMARY OF SITE RISKS

As part of the OU IV RI, an analysis was conducted to estimate the human health risks that could result from exposure to OU IV areas if no remediation is performed beyond that accomplished to date. This analysis is referred to as a baseline risk assessment. The human health risk assessment evaluated both present and future potential exposures to contaminants. Findings of the risk assessment are documented in the OU IV RI/RA Report (Volume II), dated December 7, 1994.

6.1 Human Health Risks

The reasonable maximum human exposure was evaluated. A four-step process was used for assessing OU IV-related human-health risks for a reasonable maximum-exposure scenario: Hazard Identification - identifies the contaminants of concern at the site based oon several factors such as toxicity, frequency of occurrence, and concentration. Exposure Assessment - estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g., contaminated well water) by which humans potentially are exposed. Toxicity Assessment - determines the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response). Risk Characterization - combines the outputs of the exposure and toxicity assessments to provide a quantitative (e.g., one-in-one-million excess cancer risk) assessment of OU IV-related risks.

The EPA uses a reference dose (RfD) and a slope factor, respectively, to calculate the non-carinogenic and carcinogenic risk attributable to a particular contaminant. An RfD is an estimate of a daily exposure level that is unlikely to cause any appreciable risk from deleterious effects during a person's lifetime. A slope factor establishes the relationship between the dose of a chemical and the response, and is commonly expressed as a probability of a response per unit intake of a chemical over a human life span.

To assess the overall potential for carcinogenic effects, EPA calculates excess cancer risk. Excess cancer risk is the incremental probability of an individual developing cancer over a lifetime from exposure to the potential carcinogen. Current federal guidelines for acceptable exposure are an excess carcinogenic risk ranging from approximately one-in-ten-thousand to one-in-one-million (1E-04 to 1E-06).

6.1.1 Identification of Contaminants of Concern

Chemicals of potential concern were selected based on procedures specified in EPA's Risk Assessment Guidance for Superfund (RAGS), Part A and professional judgment, where appropriate. The primary consideration for selection or elimination were frequency of detection in analyzed medium, historical site information/activities, chemical concentration, sample chemical detections relative to blank chemical detections, chemical toxicity (potential carcinogenic and non-carcinogenic effects), chemical properties, and significant exposure routes. Table 5 provides a summary of chemicals of potential concern at this site by AOC.

6.1.2 Exposure Assessment

As part of the risk assessment, present and potential future-use scenarios were quantitatively evaluated for the following receptor populations:

- Area residents (trespassers)
- Residents
- Site Workers
- Construction workers.

The AOCs evaluated included:

- Sump Outfall
- Drainage area
- Central Steam Facility
- Building 650 area.

The environmental matrices evaluated in the risk assessment included:

- Surface soil
- Subsurface soil
- Groundwater

Present-use scenarios: Under present conditions, area residents (trespassers) in the Sump Outfall, site workers in the CSF, and Building 650 area, and construction workers at the CSF were quantitatively evaluated for surface soil exposure. The exposure routes selected for evaluation included ingestion, dermal contact, and inhalation of suspended particulates.

Additional present-use scenarios included site worker (employee) and construction worker exposures to subsurface soil exposure. The exposure routes selected for evaluation included ingestion, dermal contact, and inhalation of suspended particulates.

No groundwater scenarios were selected for quantitative evaluation under present site conditions since the water supply is obtained from the potable water system.

Future-use scenarios: Under potential future site conditions, residents in the Sump Outfall, Drainage area, CSF, and Buiding 650 area were quantitatively evaluated for surface soil and subsurface soil exposures. The exposure routes selected for evaluation included ingestion, dermal contact, and inhalation of suspended particulates. Site workers and construction workers in the CSF and Building 650 area were quantitatively evaluated for surface soil and subsurface soil exposures. The ingestion, dermal contact, and inhalation of suspended particulate routes of exposure were selected for evaluation. The only groundwater scenarios quantitatively evaluated included residential ingestion and inhalation of VOCs exposure.

Only Sump Outfall surface soil and CSF subsurface soil could be quantitatively evaluated for dermal contact exposure in the risk assessment. These AOCs/matrices included PCBs and cadmium as chemicals of potential concern, the only chemicals within OU IV with established dermal absorption factors.

6.1.3 Toxicity Assessment

The toxicity assessment consisted of presenting toxicological properties of the selected chemicals of potential concern using the most current toxicolgical human health effects data. Toxicity profiles for each of the chemicals of potential concern are presented in Appendix I-2 of the RI/RA Report. Many carcinogenic slope factors and reference doses used in this assessment were obtained from EPA's Integrated Risk Information System (IRIS) data base. Slope factors and reference doses/concentrations not available on IRIS were obtained from EPA's second most current source of toxicity information, Health Effects Assessment Summary Tables (HEAST). The determination of the potential health hazards associated with exposure to non-carcinogens was made by comparing the estimated chronic or subchronic daily intake of a chemical with the RfD. Numerous VOCs, SVOCs, pesticides, and inorganics could not be quantitatively evaluated in this risk assessment due to the lack of established toxicity values. These were qualitatively evaluated. Uncertainty related to the chemical toxicity data was addressed.

6.1.4 Risk Characterization

Chemical Risks

Present and/or potential future area residents (trespassers) in the Sump Outfall Area, residents (adults and children) in the Sump Outfall, Drainage Area, CSF, and Building 650 area, and site workers (employees) and construction workers in the CSF and Building 650 area were evaluated for their exposure to surface soil via ingestion, dermal contact, and inhalation. All estimates of carcinogenic risk fell within or outside and below the EPA target risk ranges of one-in-ten-thousand to one-in-one-million (1E-04 to 1E-06). All non-carcinogenic hazard-index values fell below the target level of one.

Present and/or potential future area residents (adults and children) in the Sump Outfall, Drainage Area, CSF, and Building 650 area, and site workers (employees) and construction workers in the CSF and Building 650 area were quantitatively evaluated for exposure to surface soil via ingestion, dermal contact, and inhalation routes. All estimates of carcinogenic risk fell within or outside and below the EPA target risk ranges of one-in-ten-thousand to one-in-one-million (1E-04 to 1E-06). All non-carcinogenic hazard-index values fell below the target level of one.

Potential future exposures of residents to groundwater ingestion and inhalation of VOCs (shower model) were quantitatively evaluated for OU IV as a whole, assuming that a residential well could be installed in any AOC in the future. All estimates of carcinogenic risk fell within or outside and below the EPA target risk range of one-in-ten-thousand to one-in-one-million (1E-04 to 1E-06). Only the hazard-index value of 1.3 for children exposed by drinking the groundwater slightly exceeded EPA's target level of one. The exceedance were almost entirely due to manganese. While potential future exposure due to manganese contamination in groundwater only slightly exceeds the hazard index target level, groundwater data show that the manganese contamination is localized and stationary, therefore, no remediation will be required.

Radiological Risks

Present area residents (trespassers) and potential future residents in the Sump Outfall and potential future residents, present and future site workers (employees) and potential future construction workers in the Building 650 area were quantitatively evaluated for exposures to surface soil. The risk estimates for potential future residents in both areas exceeded the EPA target risk level. The highest risks were for the future residents in the Sump Outfall Area with a total combined (adult and child) carcinogenic risk of 1 in 10 to 1 in 100, when the results from the 1994 sampling are included. The major contributor to the risk was from the external gamma-radiation pathway. The risk estimate for present site workers in the Building 650 area also exceeds the EPA target risk level with a risk of 4 in 1,000. However, the exposures are within the occupational exposure standards. All other carcinogenic risk estimates fell within the EPA target risk range of one-in-ten-thousand to one-in-one-million (1E-04 to 1E-06).

Potential future residents in the Sump Outfall and Building 650 areas and present and potential future site workers (employees) and construction workers in the Building 650 area were quantitatively evaluated for exposure to subsurface soil via the ingestion, inhalation, and external gamma-radiation pathways. All carcinogenic risk estimates fell within or below the EPA target risk range of one-in-ten-thousand to one-in-one-million (1E-04 to 1E-06). The highest risk, 8 in 100,000 or 1 in 10,000 occurred for future residents in the Sump Outfall Area. Again, the external gamma-radiation exposure was the pathway with the predominant radiological risk, and the major contributor was Cesium-137.

Potential future residents sitewide were quantitatively evaluated for exposure to groundwater via ingestion. The carcinogenic risk estimate was within the EPA target risk range of one-in-ten-thousand to one-in-one-million (1E-04 to 1E-06).

6.2 Ecological Risk Assessment

The reasonable maximum environmental exposure was evaluated. A four-step process was used for assessing OU IV-related ecological risks for a reasonable maximum exposure scenario: Problem Formulation - a qualitative evaluation of a contaminant's release, migration, and fate; identification of contaminants of concern, receptors, exposure pathways, and known ecological effects of the contaminants; and selection of endpoints for further study. Exposure Assessment - a quantitative evaluation of the release, migration, and fate of the contaminant; characterization of exposure pathwaays and receptors; and measurement or estimation of exposure point concentrations. Ecological Effects Assessment - literature reviews, field studies, and toxicity tests, linking contaminant concentrations to effects on ecological receptors. Risk Characterization - measurement or estimation of both current and future adverse effects. Unlike assessments of human-health risk, assessments of ecological risk focus on the wildlife population and ecosystem levels. Because there is little toxicity data relevant to wildlife, it is difficult to draw inferences at the population and ecosystems level. Thus, this ecological assessment is largely qualitative.

The ecological risk assessment indicated that there are no natural wetlands, threatened, protected or endangered species, or habitats of special concern within the boundaries of OU IV. Although wetlands and areas which may support species of concern occur within the two-mile radius of OU IV, these areas are not affected by contamination confined within the OU IV area. The preliminary toxicological screening suggests that contamination in OU IV is not having a significant adverse impact on receptors identified during the site surveys. During the four site visits, no visible signs of adverse ecological effects were observed.

6.3 Basis for Response/Remedial Action Objectives

Actual or threatened releases of hazardous substances from OU IV, if not addressed by implementing the response actions selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment. The following is a summary of the remedial action objectives:

The objectives of remedial action are specific goals that protect human health and the environment; they specify the contaminants of concern, the exposure routes, receptors, and acceptable levels of contaminant for each exposure route. These objectives are based on available information and standards, such as ARARs and TBCs established in the risk assessment.

As indicated by the RI/RA, there is no risk posed by the surface and subsurface soil contamination due to organics and inorganics within OU IV above the acceptable range. Since the primary concern is the protection of the sole source aquifer which underlies OU IV, soil remediation of VOCs and SVOCs will be addressed using the Cleanup Goals contained in NYSDEC Soil Cleanup Objectives and Cleanup Levels, NYSDEC TAGM HWR-92-4046,

November 1992, which are designed to be protective of groundwater. NYSDEC TAGMs are not promulgated standards but are TBCs.

The radiological risk is primarily from possible direct exposure to gamma-radionuclides emitting in soil of Building 650 and Sump Outfall areas. Cleanup goals are contained in the NYSDEC TAGM 4003 (TBC), NYSDEC Soil Cleanup Guidelines for Radioactive Materials, September 1993.

There are no current unacceptable risks due to groundwater contamination at OU IV because the groundwater is not being used. However, the aquifer is designated as a sole source aquifer under the Safe Drinking Water Act and classified by the New York State as GA, i.e., groundwater whose best use is as a potable water supply. The overall objective of the groundwater remediation is to preserve the aquifer as a future drinking water resource and prevent exposures due to future use. As such, the goals selected for groundwater remediation are the most restrictive of the federal and state MCLs. The proposed remediation will focus on the "hot spot," i.e., the most heavily contaminated portion of the groundwater associated with the 1977 oil/solvent spill.

The following objectives for remedial action were established for OU IV:

- Prevent/minimize the leaching of chemical and radiological contaminants from the vadose zone soils into the underlying sole-source aquifer (Upper Glacial aquifer) due to the infiltration of precipitation.
- Restore the water quality of the part of the Upper Glacial aquifer at the most contaminated portion of the AOC 5 plume within the OU IV boundaries to MCLs or background levels, as appropriate.
- Prevent/minimize the volatilization of chemical and radiological contaminants from surface soils into the ambient air.
- Prevent/minimize the migration of chemical and radiological contaminants from the surface soils via surface runoff and windblown dusts.
- Prevent/minimize human exposure, including ingestion, inhalation, and dermal contact for present and future residents (trespassers), site workers (employees), and construction workers, and environmental exposure to chemical and radiological contaminants in the surface and subsurface soils and groundwater.
- Prevent/minimize the uptake by plants and animals of chemical and radiological contamiants present in the soils and/or groundwater.

Comprehensive Environmental Response Compensation & Liability Act requires that each selected site remedy protects human health and the environment, is cost effective, complies with other statutory laws, and uses permanent solutions, alternative treatment technologies, and resource recovery alternatives as fully as practicable.

7. DESCRIPTION OF ALTERNATIVES

A detailed description of soil cleanup alternatives and groundwater cleanup alternatives is provided in the OU IV FS Report. The following is a summary of these alternatives.

Section 121 of CERCLA requires that each selected site remedy protects human health and the environment, is cost effective, complies with other statutory laws, and uses permanent solutions, alternative treatment technologies, and resource recovery alternatives as fully as practicable. In addition, the statute includes a preference for treatment as a principal element for reducing the toxicity, mobility, or volume of the hazardous substances.

The OU IV FS Report evaluates, in detail, five remedial alternatives for addressing the chemical contamination in soil, four radiological soil cleanup alternatives for the soil, and six OU IV cleanup alternatives for groundwater. The numbering of alternatives in this ROD corresponds to the numbering in the FS Report.

Alternatives retained for comparative analysis in the OU IV FS Report are:

7.1 Soil Cleanup Alternatives (Chemical)

The alternatives discussed below were developed to address the leaching of contaminants from the vadose zone soils into the underlying sole-source aquifer due to infiltration by rainwater. The present cost includes the 5-Year review cost for all alternatives.

Alternative S-1: No Further Action:

Estimated Capital Cost:	$0
Estimated Annual O&M Costs	$46,400
Estimated 5-Year Review Cost:	$15,000
Estimated Present Worth Cost:	$36,400
Estimated Construction Time:	N/A

The CERCLA and NCP require the evaluation of a "No Action" alternative to compare with other remedial-action alternatives. The "No Action" alternative for the OU IV chemically contaminated soil consists of a single sampling event which includes soil-vapor survey and groundwater sampling and analysis for TCL compounds and a review of site conditions at the end of five years to determine whether the contamination in the vadose zone has spread horizontally and vertically.

Alternative S-2: Limited Action

Estimated Capital Cost:	$0
Estimated Annual O&M Costs:	$ 33,200
Estimated 5-Year Review Cost:	$ 15,000
Estimated Present Worth Cost:	$511,000
Estimated Construction Time:	1 month

This alternative includes an annual sampling consisting of a soil-vapor survey and groundwater sampling to conduct a monitoring program which would track the migration of the contaminant into the aquifer for at least 30 years. The samples would be collected annually at the same locations as in Alternative S-1. Groundwater samples would be collected from four shallow monitoring wells within or immediately downgradient of the contaminated soil. All samples would be analyzed for TCL organics.

Alternative S-3: No Excavation - Soil Vapor Extraction

Estimated Capital Cost:	$373,700
Estimated Annual O&M Costs:	$141,900

Estimated 5-Year Review Cost: $ 15,000
Estimated Present Worth Cost: $638,000
Estimated Construction Time: 3 months

This remedial alternative consists of installation and operation of a soil-vapor extraction (SVE) system. The SVE component is expected to operate for approximately two years. The SVE would remove most of the volatile organics present in the soil.

Alternative S-4: Total Excavation - On-Site Treatment or On-Site/Off-Site Disposal of Excavated Soils

Estimated Capital Cost:	
Option S-4A:	$2,574,500
Option S-4D:	$4,864,600
Estimated Annual O&M Costs: (Options A&D)	$0
Estimated 5-Year Review Cost:	$0
Estimated Present Worth Cost:	
Option S-4A:	$2,570,000
Option S-4D:	$4,860,000
Estimated Construction Time: (Options A&D)	6 Months

The major features of this remedial alternative are the complete excavation of 6,770 cubic yards of contaminated vadose-zone soils, followed by on-site treatment or off-site disposal of those soils. On-site treatment consists of low-temperature thermal desorption in Option S-4A. Option S-4D consists of disposal of non-hazardous soils at the off-site landfill, such as the Town of Brookhaven.

Alternative S-5: Partial Excavation/Soil Vapor Extraction

Estimated Capital Cost:	
Option S-5A:	$1,798,600
Option S-5D:	$2,757,400
Estimated Annual O&M Costs: (Options A&D)	$ 70,000
Estimated 5-year Review Cost:	$ 9,000
Estimated Present Worth Cost:	
Option S-5A:	$1,930,000
Option S-5D:	$2,890,000
Estimated Construction Time:	6 months

The major features of this remedial alternative include the partial excavation of 3,290 cubic yards of contaminated vadose-zone soils down to a maximum depth of 16 feet, followed by their on-site treatment or off-site disposal. The unexcavated deeper soils will undergo treatment with SVE. The SVE system will be similar to the one in Alternative S-3 but considerably smaller. The excavated soils are either treated on site or disposed of off site, exactly as in Alternative S-4. On-site treatment for Alternative S-5 consists of low-temperature thermal desorption in Option S-5A. Option S-5D consists of disposal of non-hazardous soils at the off-site landfill such as the Town of Brookhaven.

7.2 Soil Cleanup Alternatives (Radiologicaal)

The alternatives described below are developed to prevent and minimize radiological exposure from surface and subsurface soils contaminated with radionuclides within AOC 6.

Alternative R-1: No Further Action

Estimated Capital Cost:	$39,215
Estimated Annual O&M Costs:	$49,500
Estimated 5-Year Review Cost:	$15,000
Estimated Present Worth Cost:	$78,000
Estimated Construction Time:	N/A

Under the "No Action" alternative, no remedial action would be taken and AOC 6 would continue in its current state. A single sampling and a review of site conditions would be made after five years to determiine whether contamination has spread. The sampling event would

consist of alpha, beta/gamma, and gamma radiation survey, and groundwater sampling. Groundwater monitoring would be conducted for radiological parameters.

Alternative R-2: Limited Action

Estimated Capital Cost:	$ 76,300
Estimated Annual O&M Costs:	$ 37,950
Estimated 5-Year Review Cost:	$ 15,000
Estimated Present Worth Cost:	$769,000
Estimated Construction Time:	1 month

This alternative includes installing a fence to prevent access to the sites, and annual sampling (same as Alternative R-1) to determine whether radiation levels have decreased with time and to track migration of the contaminant into the groundwater. Institutional controls consisting of restrictions on construction and personnel access at the sites would be instituted.
Eight existing and two new monitoring wells from and downgradient of the Sump Outfall will be monitored semi-annually for radiological parameters. The natural decay fo radionuclides and migration of contaminants would be assessed and reports would be written every five years using the data collected during annual monitoring.

Alternative R-3: Total Excavation - On-Site Storage/Off-Site Disposal of Excavated Soils

Estimated Capital Cost:	
Option R-3A:	$ 3,205,630
Option R-3B:	$33,632,850
Estimated Annual O&M Costs:	$ 33,600
Estimated 5-Year Review Cost:	$ 15,000
Estimated Present Worth Cost:	
Option R-3A:	$ 3,820,000
Option R-3B:	$34,200,000
Estimated Construction Time:	6 months

The major features of this remedial alternative include the excavation of 6,510 cubic yards of soil in AOC 6 with radionuclides above the selected action levels, followed by on-site storage/off-site disposal of this contaminated soil. This alternative also includes excavating contaminated debris, including the concrete decontamination pad at Building 650, the Storm Sewer pipe, and the concrete Storm Sewer pipe headwall at the outfall area. For the on-site storage option (Option R-3A), soil and debris contaminated with radionuclides excavated from these areas would be placed into a temporary storage structure consisting of a steel frame and a concrete base. The structure would store contaminated soil and debris pending the selection of remedial alternatives for the other OUs at BNL. The purpose of storing these soils on site is to combine all radiologically contaminated soils at BNL into one sitewide remedial action. The off-

site disposal option (Option R-3B) consists of transporting excavated soils in approved containers
to the DOE Hanford facility for disposal as low-level radioactive waste (LLW).

Groundwater monitoring of 10 wells would be conducted semi-annually for the first 20 years and every 5 years thereafter. Radiological surveys would be conducted on the same schedule. The data would be summarized in a report every five years.

Alternative R-4: Partial Excavation - On-Site Storage/Off-Site Disposal Excavated Soils and Capping

Estimated Capital Cost:	
Option R-4A:	$ 2,737,900
Option R-4B:	$18,210,370
Estimated Annual O&M Costs: (Options A&B)	$ 37,354
Estimated 5-Year Review Cost:	$ 15,000
Estimated Present Worth Cost:	
Option R-3A:	$ 3,420,000
Option R-3B:	$18,900,000
Estimated Construction Time:	6 months

The major features of this alternative include the excavation of 3,320 cubic yards of the most significantly radiologically contaminated soil, followed by on-site storage/off-site disposal.
This alternative also includes excavating contaminated debris, including the concrete decontamination pad at Building 650, the Storm Sewer pipe, and the concrete Storm Sewer pipe headwall at the outfall area. The soils would be excavated from the Building 650 area and the Storm Sewer Outfall to a depth of 2 feet, and from the Storm Sewer at the elevation of the buried
pipe down to 4 feet below the bottom of the pipe. The excavated areas would be filled with clean
soil to grade, and a single layer cap would be constructed for Building 650 and Storm Sewer Outfall area. Run-on/run-off water from the Storm Sewer Outfall cap would be diverted to a concrete pipe that would be connected to the sewer line at Cornell Avenue and North Sixth Street. Control of runon/runoff will not be necessary at the Building 650 area since there already
is an adequate stormwater diversion system. A cap would not be placed over the excavated Storm Sewer pipe because the area is too narrow.

Options R-4A with on-site storage and R-4B with disposal at the Hanford facility conceptually are the same as Options R-3A andd R-3B.

7.3 Groundwater Alternatives

The alternatives described below are developed to meet the remedial objectives described
above with a focus on hot spot remediation of the most contaminated portion of the AOC 5 plume.

Alternative GW-1: No Further Action

Estimated Capital Cost:	$0
Estimated Annual O&M Costs:	$52,100

Estimated 5-Year Review Cosst: $15,000
Estimated Present Worth Cost: $40,900
Estimated Construction Time: N/A

This alternative includes a single sampling event and a review of site conditions at the end of five years to determine whether the contamination has spread. For the Former Oil/Solvent UST area, samples would be collected from monitoring wells. All samples would be analyzed for TCL organics.

Alternative GW-2: Limited Action

Estimated Capital Cost: $ 59,500
Estimated Annual O&M Coasts: $ 39,500
Estimated 5-Year Review Cost: $ 15,000
Estimated Present Worth Cost: $667,000
Estimated Construction Time: N/A

This alternative includes an annual long-term groundwater monitoring program which would track the migration of the contamination in the aquifer for at least 30 years. Every five years a report would be prepared to assess the migration and contaminant concentrations in the plume.

Alternative GW-3A: Chemical Precipitation, Air Stripping, and Polishing with Activated Carbon - Infiltration Through Recharge Basins

Estimated Capital Cost:
Option GW-3A: $2,074,500
Estimated Annual O&M Costs:
Option GW-3A: $ 541,950
Estimated 5-Year Review Cost: $ 15,000
Estimated Present Worth Cost:
Option GW-3A: $6,070,000
Estimated Construction Time: 1 year

The major features of this remedial alternative include extracting the groundwater from the AOC 5 plume, pretreatment to remove metals from groundwater, treating it to MCLs or natural background as appropriate discharging the treated water, and undertaking a performance-monitoring program which would include the AOC 6 plume. It is expected that a series of pumping tests will be conducted during the remedial design stage to verify withdrawl and recharge rates prior to actual engineering design of the extraction system.

Treating the extracted groundwater would consist of chemical precipitation to remove inorganics; this would be followed by air-stripping to remove VOCs. The final treatment step includes polishing with activated carbon to remove SVOCs. Treated groundwater would be discharged to a new recharge basin (Option GW-3A).

Alternative GW-4A: Chemical Precipitation and Chemical Oxidation Enhanced with UV Photolysis - Infiltration Through Recharge Basins

Estimated Capital Cost: $2,264,470
Estimated Annual O&M Costs: $ 599,450
Estimated 5-Year Review Cost: $ 15,000
Estimated Present Worth Cost:
Option GW-4A: $6,670,000
Estimated Construction Time 1 year

The major features of this remedial alternative include extracting groundwater from the AOC 5 plume, treating the groundwater to MCLs or natural background, as appropriate, discharging the treated water, and setting up a performance-monitoring program which would include the AOC 6 plume.

Treating the extracted groundwater would consist of chemical precipitation to remove inorganics, followed by chemical oxidation enhanced with UV photolysis to remove VOCs and SVOCs. Treated groundwater would be discharged to a new recharge basin (Option GW4A).

Alternative GW-5A: Chemical Precipitation and Carbon Adsorption - Infiltration Through Recharge Basins

Estimated Capital Cost:	
Option GW-5A:	$2,028,200
Estimated Annual O&M Costs:	$ 558,000
Estimated 5-Year Review Cost:	$ 15,000
Estimated Present Worth Cost:	
Option GW-5A:	$6,140,000
Estimated Construction Time:	1 year

The major features of this remedial alternative include extracting the groundwater (pumping and collection) from the AOC 5 plume, treating it to MCLs or natural background, as appropriate, and discharging the treated water, and a performance-monitoring program would be adopted which would include the AOC 6 plume.

Treating the extracted groundwater would consist of chemical precipitation to remove inorganics, followed by carbon adsorption to remove VOCs and SVOCs. The discharge of treated groundwater would be infiltration through a new recharge basin (GW-5A).

Alternative GW-6: Air Sparging (AS) and Soil Vapor Extraction (SVE)

Estimated Capital Cost:	$ 886,000
Estimated Annual O&M Costs:	$ 427,000
Estimated 5-Year Review Cost:	$ 15,000
Estimated Present Worth Cost:	$1,062,000
Estimated Construction Time:	1 year

The major features of this alternative include in-situ groundwater treatment using a combination of AS and SVE.

The VOCs in the groundwater plume would be transferred into the vadose zone using air sparging, where they would be captured by the SVE wells and treated as appropriate before discharge to air.

Upon review of the performance and monitoring data, if it is decided by DOE, EPA and NYSDEC, that SVE and air sparging alone will not achieve desired performance levels, Enhanced Biodegradation may be implemented along with the SVE/AS system as an engineering enhancement option. The desired performance levels will be defined during the remedial design phase. The engineering enhancement option consists of: groundwater extraction using extraction wells located downgradient of the VOC plume, addition of nutrients, and reinjection into the saturated zone using injection wells and/or recharge basins located upgradient of the Oil/Solvent Spill area. This option would promote the in-situ biodegradation of organic compounds. The present worth cost of SVE/AS with the engineering enhancement option is $3,110,000.

8. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The CERCLA guidance requires that each remedial alternative be compared according to nine criteria. Those criteria are subdivided into three categories: (a) threshold criteria that relate directly to statutory findings and must be satisfied by each chosen alternative; (B) primary balancing criteria that include long- and short-term effectiveness, implementability, reduction of toxicity, mobility, volume, and cost; and (c) modifying criteria that measure the acceptability of the alternatives to state agencies and the community. The following sections summarize the evaluation of the candidate remedial alternatives according to these criteria.

A detailed comparative analysis of all alternatives is provided in Chapter 5 of the FS Report. Tables 6, 7, and 8 provide a summary of comparative alternative analysis for soil and groundwater alternatives. A summary of comparative analysis of alternatives, based upon the evaluation criteria noted above, is given below.

8.1 Threshold Criteria

The remedial alternatives were evaluated in relation to the threshold criteria: overall protection of human health and the environment and compliance with ARARs. The threshold criteria must be met by the remedial alternatives for further consideration as potential remedies for the ROD.

8.1.1 Overall Protection of Human Health and the Environment

Alternatives S-1 and S-2 rely on natural processes of biological reactions and washing by infiltration of rainwater to restore quality. In the long term, there is potential risk of exposure to future residents from the groundwater which has a potential to be contaminated by the chemically contaminated soils. Alternatives S-3, S-4, and S-5 would eliminate the toxicity and the exposure pathways from excavation/treatment of soils. Since Alternatives S-4 and S-5 rely on land disposal of untreated soils, they could adversely affect the environment.

Alternative R-1 relies on natural dispersion and decay processes to improve soil contamination levels, does not meet cleanup goals and would not be effective in reducing potential risks to human health and the environment since the contaminated soil would continue to be a source of groundwater contamination. Alternative R-2 reduces risks to the public health by eliminating access and exposure to the contaminated soils. However, Alternative R-2 is less certain in the longer term since the contaminated soils would remain in place. Alternatives R-3 and R-4 are protective of human health and the environment.

Alternatives GW-1 and GW-2 rely on natural processes of dilution and biological reactions to restore groundwater quality, therefore, have a longer restoration time frame than the other alternatives. All of the groundwater alternatives fully protect human health and the environment because the groundwater quality is restored to MCLs.

8.1.2 Compliance with ARARs

There are no federal or state ARARs that contain specific soil cleanup levels for chemical and radiological contaminants. The NYSDEC TAGM cleanup goals are not promulgated standards and are classified as TBCs under CERCLA. These NYSDEC TAGMs are therefore utilized as cleanup goals for chemically and radiologically contaminated soil.

Alternatives S-1 and S-2 would not meet the organic, chemical-specific TAGM cleanup goals for the soils over a very long time and would continue to be a source of groundwater contamination. Alternative S-4 would achieve the organic chemical-specific, state cleanup goals in months. Alternatives S-3 and S-5 are expected to achieve the organic chemical-specific state cleanup goals in about two years. Alternatives S-4 and S-5 would comply with ARARs and TBCs for disposal of contaminated soils.

Alternative R-1 would not meet the soil cleanup goal of NYSDEC TAGM (TBC). Alternative R-2 would meet the cleanup goal by restricting access to the soil by fencing and institutional control. Alternative R-3 would meet the soil cleanup goal and allow industrial use of the area after 50 years. Alternative R-4 would meet the cleanup goal by a combination of soil removal, capping, and institutional controls.

Alternatives GW-1 and GW-2 have a longer restoration timeframe. All other groundwater alternatives are expected to achieve the federal and state MCLs. Alternatives GW-3, GW-4, and GW-5 would comply with ARARs for disposal of filter-cake wastes from the treatment processes.

8.2 Balancing Criteria

Once an alternative satisfies the threshold criteria, five balancing criteria are used to evaluate other aspects of the potential remedial alternatives. Each alternative is evaluated using each of the balancing criteria. The balancing criteria are used in refining the selection of the candidate alternatives for the site. The five balancing criteria are: (1) long-term effectiveness and permanence; (2) reduction of toxicity, mobility, or volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost.

8.2.1 Long Term Effectiveness

Alternatives S-1 and S-2 provide the fewest controls for protection of humean health and the environment, and no physical control of the contaminated soils, including any type of land-use restrictions. Alternatives S-3, S-4, and S-5 would restore the soils to organic chemical-specific state cleanup goals and eliminate the long-term risks to future residents from contaminants leaching into the groundwater from the soils.

Alternative R-1, "No Action", would not be protective in the long term, since the baseline risk assessment indicates that the no action for radiologically contaminated soil under current site conditions would not, in the long term, be protective of human health and the environment. Alternative R-2 provides protection to site workers and public health by fencing and implementing institutional controls. Alternative R-3 relies on removal of radiologically contaminated soil above the radiological cleanup goals and would be effective in the long-term. Alternative R-4 relies on a combination of soil removal, capping and institutional controls which also would be reliable in the long term.

Short-term risk for R-3B and R-4B would be higher for the off-site disposal component due to the increased risk of transportation accidents.

All of the groundwater alternatives would ensure long-term protectiveness to human health and the environment through restoration of groundwater quality.

8.2.2 Reduction of Toxicity, Mobility, or Volume

Alternatives S-1 and S-2 rely on biological processes and washing of the soils by infiltration of rainwater to reduce their toxicity; they do not reduce the mobility of the contaminants. Neither alternative reduces the volume of the contaminated soil. Alternatives S-3 and S-5 would reduce mobility by removing organic contaminants from the soil, thereby reducing migration of contaminants to the sole source aquifer. Alternative S-4 provides the most assurance of eliminating toxicity, and organic contaminants; however, Alternatives S-3 and S-5 also achieve the organic, chemical-specific state cleanup goals.

None of the alternatives for the radiologically contaminated soil reduce the toxicity, mobility, or volume since they do not include treatment. Alternatives R-3 and R-4 would isolate the contaminated soil from the environment through excavation and disposal at an off-site location.

Alternatives GW-1 and GW-2 rely on biological processes and dilution to reduce the toxicity of the groundwater; they do not reduce the mobility of the contaminants. Neither alternative reduces the volume of the contaminated groundwater. Alternatives GW-3, GW-4, GW-5, and GW-6 eliminate the toxicity and volume of contamination from the organic compounds when remediation is completed. The mobility of the contaminants is controlled by Alternatives GW-3, GW-4, and GW-5.

8.2.3 Short-Term Effectiveness

Alternatives S-1 and S-2 do not pose risk during implementation. Alternatives S-2, S-4, and S-5 pose a low-level risk of exposure to site workers during construction; however, this risk can be managed by appropriate health and safety measures.

Alternatives R-1 and R-2 offer no short-term risks to the community remedial action and minimal risks to workers during remedial action. Alternatives R-3 and R-4 offer minimal risk to the community and workers during the remedial action. The risks to workers during implementation can be managed by appropriate health and safety measures.

All the alternatives are effective in the short term in protecting site workers and neighboring communities. Alternatives GW-3, GW-4, and GW-5 pose a low-level risk to site workers during construction; however, this risk can be managed by appropriate health and safety measures. Alternative GW-6 uses an innovative technology (air sparging) which is being used at several sites.

8.2.4 Implementability

Alternatives S-1 through S-5 are technically and administratively feasible and all services needed to implement the alternatives are available.

Alternatives R1 and R-2 are technically feasible and all services needed to implement the alternatives are available. Administratively, R-3 and R-4 would require additional coordination with and approval from federal, state, and local agencies. Alternatives R-3B and R-4B may not be implementable due to the potential unavailability of the off-site facility for soil disposal.

All groundwater alternatives are technically and administratively feasible and all the services needed to implement the alternatives are available. However, alternatives GW-3, GW-4, and GW-5 contain a metals-recovery system that makes them more complex than alternative GW-6 which does not require metals treatment. Alternatives GW-3, GW-4, and GW-5 require the most services since they involve operating a recovery unit for the metals and arranging to dispose of the filter cake. Alternative GW-6 is readily implementable, however, pilot tests are necessary to determine effectiveness and design parameters.

8.2.5 Cost

A summary of estimated capital, O&M, 5-year review, and present worth costs is provided in the Summary of Remedial Alternatives Section of this ROD. Table 9 provides a summary of the capital, O&M, and present worth costs. A detailed cost breakdown for each alternative is provided in Chapter 4 of the FS Report.

The present worth costs associated with groundwater alternatives range from $40,900 for Alternative GW-1 to $6,670,000 for Alternative GW-4A. For chemically contaminated soil, the present worth cost range from $36,400 for Alternative S-1 to $4,860,000 associated with Alternative S-4. For the radiologically contaminated soil, the costs range from $78,000 for Alternative R-1 to a cost of $34,200,000 for excavation and disposal in Alternative R-3. There is a high cost associated with excavation and storage of radiologically contaminated soil from OU IV and uncertainty in disposal options.

Alternatives S-3, R-2, and GW-6 are the most cost-effective remedies for soil and groundwater, while also meeting the remediation objectives.

8.3 Modifying Criteria

The modifying criteria are used in the final evaluation of remedial alternatives. The two modifying criteria are state and community acceptance. For both of these criteria, the factors that are considered include the elements of the alternatives that are supported, the elements of the alternatives that are not supported, and the elements of the alternatives that have strong opposition.

8.3.1 State Acceptance

New York State, based on its review of the FS and Proposed Plan, has concurred with the preferred alternatives.

8.3.2 Community Acceptance

Written and verbal comments received from the community during the public comment period and at the public meeting held on December 6, 1996 have been evaluated. The Responsiveness Summary Section of the ROD contains the comments from the community and the appropriate responses.

9. SELECTED REMEDY

The selected remedy consists of three major components: a final action for the soils contaminated with chemicals (S-3), an interim action (R-2) for radiologically contaminated soils, and a final remedy with a contingency option (GW-6) for groundwater contaminated with VOCs and SVOCs. Alternative R-2 is an interim action because the radiologically contaminated soils will be evaluated in a BNL-wide context as part of OU I. The following is a brief description of the selected remedy:

For Soils:

For dealing with organic chemical contamination in soils, an SVE system will be installed to collect VOCs and some SVOCs in the vadose zone soils in two areas: (1) the 1977 Oil/Solvent Spill Area, particularly in the vicinity of the UST location, and (2) one fuel unloading area. The SVE wells will be located in the hatched areas shown in Figure 4. After operating for about one year, the concentration of the organic contaminants in the vapor extracted from the vadose zone would be expected to stabilize at a very low value.

To address the radiological contamination of soils at Building 650 and the Sump Outfall area, as an interim remedy, fencing, institutional control, radiological surveys, and groundwater monitoring will be performed. Fencing of radiologically contaminated soil areas around Building 650 and at the Sump Outfall area has been completed in the Summer of 1995 due to risk from external gamma radiation. Fencing will not be required for the storm sewer pipe. Figure 5 shows the extent of old and new fencing.

The selected remedy R-2 proposes a potential groundwater monitoring program. However, radiological groundwater contamination from the Sump Outfall area will further be characterized using geoprobe in FY-96 under OU I. The final monitoring program will be designed by DOE in consultation with EPA and NYSDEC, using all data.

The volume of radiologically contaminated soils to be managed under OU IV is relatively small when compared to estimated soil volumes from OU I at BNL. To be cost effective, final remedy for these soils will be evaluated in the OU I FS and ROD, which concerns large volumes of radiologically contaminated soils. In the interim, fencing, institutional controls, and monitoring (R-2) will be implemented and will be protective of human health.

Figure 6 shows the maximum areal extent of soil remediation for VOCs.

For Groundwater:

To deal with the volatile contaminants in groundwater, SVE, and air sparging would be used. Air sparging would strip volatile and some semi-volatile contaminants from the groundwater into their vapor phase. The SVE will collect both the sparged air and volatile organics from the vadose zone.

Upon review of the performance and monitoring data, if it is decided by DOE, EPA, and NYSDEC, that SVE and air sparging alone will not achieve desired performance levels, Enhanced Biodegradation may be implemented along with the SVE/AS system as an engineering enhancement option. The desired performance levels will be defined during the remedial design phase. The engineering enhancement option consists of: groundwater extraction using extraction wells located downgradient of the VOC plume, addition of nutrients, and reinjection into the saturated zone using injection wells and/or recharge basins located upgradient of the Oil/Solvent Spill area. This option would promote the in-situ biodegradation of organic compounds.

Figure 6 shows the maximum areal extent of groundwater remediation for volatile organic compounds. Figure 7 shows the approximate locations of AS and SVE wells. Extraction and reinjection wells shown in Figure 7 will not be installed unless required as an engineering enhancement to the AS/SVE system. The final number and locations of AS/SVE wells will be specified in the OU IV remedial design.

If monitoring indicates that continued operation of the components of the selected remedy is not producing significant further reductions in the concentrations of contaminants in soils and groundwater, in accordance with the NCP, DOE, NYSDEC, and EPA will evaluate whether discontinuance of the remedy is warranted. The criteria for discontinuation will include an evaluation of the operating conditions and parameters as well as a determination that the remedy has attained the feasible limit of contaminant reduction and that further reductions would be impracticable.

10. STATUTORY DETERMINATIONS

Remedy selection is based on CERCLA, as amended by SARA, and the regulations contained in the NCP. All remedies must meet the threshold criteria established in the NCP:

protection of human health and the environment, and compliance with ARARs. The CERCLA also requires that the remedy use permanent solutions and alternative treatment technologies to the maximum extent practicable and that the implemented action must be cost effective. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as their principaal element. The following sections discuss how the selected remedy meets these statutory requirements.

10.1 Protection of Human Health and the Environment

The selected remedy satisfies the criterion of overall protection of human health and the environment by preventing/minimizing the risk of potential contaminant migration. As determined by the RA, there is no risk posed by the surface and subsurface soil contamination due to organics and inorganics within OU IV above the acceptable range. The NYSDEC TAGM cleanup goals which are designed to be protective of groundwater will be met in AOC 5 by extraction of VOCs from the soil by a SVE system (S-3). The interim remedy of fencing, institutional controls, and monitoring (R-2) will be effective in reducing risks to humans and environmental receptors by controlling the significant direct exposure and ingestion/inhalation pathways. The remediation of radiologically contaminated soils will be evaluated as part of OU I ROD. Potential future risks to human health and the environment due to contaminated groundwater will be eliminated through air sparging of the groundwater and extraction of the volatile organics by SVE.

No unacceptable short term risks or cross-media impacts will be caused by implementation of the remedy.

10.2 Compliance with ARARs

The NCP Section 300.430(P)(5)(ii)(B) requires that the selected remedy attains the federal and state ARARs or obtain a waiver of an ARAR.

10.2.1 Chemical-Specific ARARs

The chemical-specific ARARs that the selected remedy will meet are listed below:

1. Groundwater:

   A. Safe Drinking Water Act, Public Law 95-523, as amended by Public Law 96502, 22 USC 300 et. seq. This requirement is applicable to the component GW-6 of the selected remedy. This ARAR sets limits to the MCLs.

   B. New York Water Quality Standards, 6 NYCRR Part 703. This applicable requirement establishes standards of quality and purity for groundwaters of the state.

2. Air

   C. 6 NYCRR Part 212, General Process Emission Sources. This state regulation will be used to establish the need for air emission control equipment for the SVE (S-3) and air sparging (GW-6) portions of the selected remedy.

10.2.2 Location-Specific ARARs

No location-specific ARARs have been identified.

10.2.3 Action-Specific ARARs

10 CFR 835. This regulation establishes requirements for controlling and managing radiologically contaminated areas. Compliance with this regulation is required as of January 1996.

10.2.4 To Be Considered Guidance

In implementing the selected remedy, the following significant guidances which are not promulgated, therefore not legally binding, will be considered:

1. NYSDEC Soil Cleanup Objectives and Cleanup Levels, NYSDEC TAGM HWR-92-4046. The soil cleanup goals based on groundwater protection contained in this TAGM were selected for organic compounds that were found in the groundwater for the SVE (S-3) component of the selected remedy.

2. NYSDEC Soil Cleanup Guidelines for Radioactive Materials, NYSDEC TAGM 4003. The institutional controls and access restrictions contained in component R-2 of the selected remedy will meet this guidance by eliminating exposure pathways to the radiologically contaminated soil.

3. NYSDEC Division of Air Guidelines for Control of Toxic Ambient Air Contaminants, Air Guide 1. This guide will be used to evaluate the impacts of air emissions from the SVE (S-3) and air sparging (GW-6) portions of the selected remedy and to assist wiht the evaluation of the need for air emissions control equipment.

10.3 Cost

Based on the expected performance standards, the selected remedy (S-3, R-2, and GW-6) has been determined to be most cost-effective because it would provide overall protection of human health and the environment, long- and short-term effectiveness, and compliance with ARARs, at the least cost.

Table 9 provides a comparison of capital, O&M, and present worth costs for all soil and groundwater alternatives.

10.4 Use of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The NCP prefers a permanent solution whenever possible. Components S-3 and GW-6 of the selected remedy are final actions which utilize permanent solutions to the maximum extent practicable for OU IV. Component R-2 is an interim action and is not designed or expected to be a final action. These components, however, provide the best balance of tradeoffs with respect to this criteria, given the limited scope of these actions. Because of the large volume of low concentration VOCs and SVOCs in soil and groundwater that can be treated in place, in-situ remedies (air sparging, SVE) and alternative treatment technologies (air sparging) are selected. Final remedial decisions for the radiologically contaminated soil will be addressed in the final decision document for OU I.

10.5 Preference for Treatment as a Principal Element

Components S-3 and GW-6 of the selected remedy are final actions and satisfy the statutory preference for treatment as a principal element. Soil in the 1977 Oil/Solvent Spill Area near the UST location and a fuel unloading area contaminated with VOCs and SVOCs will be treated with SVE. Groundwater at the most contaminated portion of the oil/solvent spill plume area will be remediated using a combination of soil vapor extraction and air sparging

technologies.
component R-2 is an interim action. For the interim action component of the selected remedy, the preference for treatment as a principal element will be addressed in the final decision document for OU I.

10.6 Five Year Review

The selected remedy for the radiologically contaminated soils is an interim remedy. The final remedy for these soils will be selected under the OU I ROD. Therefore, the need for a five-year review will depend on the selected remedy and will be addressed in the OU I ROD.

The selected remedial actions for VOCs in soil and groundwater will meet the desired performance levels within five years from the initiation of the selected remedy under OU IV. Therefore, a five-year review is not required because the remedy will not leave hazardous substances on-site above health-based levels.

U.S. DEPARTMENT OF ENERGY

BROOKHAVEN NATIONAL LABORATORY

OPERABLE UNIT IV

III. RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY
OPERABLE UNIT IV
BROOKHAVEN NATIONAL LABORATORY SITE
UPTON, NEW YORK

A. INTRODUCTION:

The Responsiveness Summary Section of the Record of Decision (ROD) summarizes the public comments and concerns and the Department of Energy's (DOE) responses to comments/concerns which address the Feasibility Study Report (FS) and the Proposed Remedial Action Plan (PRAP) for Operable Unit (OU) IV.

The DOE's preferred remedial alternatives for OU IV are as follows:

For Soils:

(1) Treatment of organic contamination in sub-surface soils using soil vapor extraction/treatment.

(2) As an interim measure, use of fencing and institutional controls to prevent exposure to radiologically contaminated soil until such time as a final remedy is evaluated and implemented under OU I. As a preventive action, the U.S. Department of Energy (DOE) has completed fencing and posting of the radiologically contaminated soil areas in July, 1995. Groundwater monitoring will also be performed during this interim period.

For Groundwater:

(3) To address volatile and semi-volatile contaminants in groundwater, Air Sparging (AS) and Soil Vapor Extraction (SVE) treatment will be used. Air sparging would strip volatile and some semi-volatile contaminants from the groundwater into their vapor phase, further promoting bioremediation.

An engineering enhancement system consisting of groundwater extraction, nutrient addition, and reinjection may also be implemented, if it is determined by the DOE, U.S. Environmental Protection Agency (EPA), and New York State Department of Environmental Conservation (NYSDEC), based on system performance and groundwater monitoring data, that AS/SVE alone would not achieve the cleanup goals.

A public comment period for the review of OU IV PRAP and the FS Report began on November 22, 1995 and ended on January 10, 1996. A public meeting was held on December 6, 1995 at 7:30 p.m. in the Hamilton Conference Room located in Brookhaven National Laboratory's (BNL's) Chemistry Building. Approximately 140 people attended the meeting. The DOE distributed copies of the PRAP and other related informational material. Copies of the PRAP were provided at the following locations for public review:

Administrative Record/Information Repositories:

(1) USEPA - Region II, Administrative Records Room
(2) Longwood Public Library, Middle Island
(3) BNL Research Library, Upton
(4) Mastic-Moriches-Shirley Library, Shirley

Based on the comments received during the public meeting and comment period, the DOE believes that the EPA, NYSDEC, BNL, local government officials, and the residents were responsive to the PRAP and generally support DOE's preferred remedial alternatives. At the public meeting, some citizens commented that contaminated soils should be excavated. One letter received during the public comment period recommended that a clay or a concrete cap be installed at the Sump Outfall Area during the interim period, before the fate of the radiologically contaminated soils is decided in Operable Unit I. The interim measure of fencing, institutional controls, and groundwater monitoring is protective of human health. No other major objections to the DOE's preferred alternatives were raised by the attendees. Responses to all comments that pertained to OU IV PRAP have been summarized in Section III of this Responsiveness Summary.

Citizens asked several other questions at the public meeting which were not related to the OU IV PRAP. These questions were related to: disposal of radiological wastes generated under other removal action projects; the reasons for delay in cleanup under CERCLA; extent of fencing around the BNL site boundary; pollution prevention and waste minimization measures that have been taken to avoid recurrences of environmental releases; releases of biological contaminants at the BNL site; nature and extent of groundwater contamination off-site, rate of groundwater flow, horizontal and vertical extent of known groundwater contamination farthest from BNL, off-site groundwater sampling and analysis, off-site public health risks, and DOE's remedy for off-site groundwater contamination; and affiliation of personnel who served on the panel at the public meeting. The panel members provided responses to these questions. A transcript of the December 6, 1995 public meeting is available for review in the Administrative Record and the information repositories.

The NYSDEC, based on its review of the FS and the PRAP, has concurred with the preferred alternatives.

The Responsiveness Summary is divided into the following sections:

B. RESPONSIVENESS SUMMARY OVERVIEW: This section briefly describes the site background and DOE's preferred remedial alternatives.

C. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS: This section provides the history of community concerns and describes community involvement in the process of selecting a remedy for Operable Unit IV.

D. COMPREHENSIVE SUMMARY OF MAJOR QUESTIONS, COMMENTS, CONCERNS AND RESPONSES: This section summarizes the comments DOE received during the public comment period. Oral comments received at the public meeting and written comments received during the public meeting and public comment period, are included with the appropriate DOE responses. A transcript of the proceedings of the public meeting is available in the Administrative Record and the information repositories.

B. RESPONSIVENESS SUMMARY OVERVIEW:

Site History

Brookhaven National Laboratory (BNL) is a federal facility operated for the DOE by Associated Universities, Inc. (AUI), a not-for-profit consortium of nine universities. The mission of BNL is to provide research facilities for training and research in the diverse fields of science and to meet the appropriate needs and interests of the educational, governmentaal, and industrial research institutions. Brookhaven National Laboratory has three major functions. The first is the design, construction, and operation of large research facilities, such as particle accelerators, nuclear reactors, and synchrotron storage rings. The second major function is the support of the research staff in its efforts to carry out long-term programs in the basic sciences which have potential longterm payoffs. The third major function involves the contribution by the staff to the technology base of the nation. To carry out this mission, BNL has a staff of 3,300 to 4,000 research and support personnel. In addition, about 1,500 other personnel participate each year in research on short-term projects as collaborators, consultants, or students.

Located about 60 miles east of New York City, BNL is in Upton, Suffolk County, New York, near the geographic center of Long Island. Distances to neighboring communities from BNL are:

Patchogue 10 miles WSW, Bellport 8 miles SW, Center Moriches 7 miles SE, Riverhead 13 miles due east, Wading River 7 miles NNE, and Port Jefferson 11 miles NW. The BNL site, formerly Camp Upton, was occupied by the U.S. Army during World Wars I and II. Between the wars, the site was operated by the Civilian Conservation Corps. The site was transferred to the Atomic Energy Commission in 1947, to the Energy Research and Development Administration in 1975, and to DOE in 1977.

The BNL property is an irregular polygon that is roughly square, and each side is approximately 2.5 miles long. The site consists of 5,321 acres. The developed portion includes the principal facilities located on relatively high ground near the site. These facilities are contained in an area of approximately 900 acres, 500 acres of which were originally developed for Army use. The remaining 400 acres are occupied for the most part by various large research machine facilities. Outlying facilities occupy approximately 550 acres and include an apartment area, biology field, Hazardous Waste Management Area, Sewage Treatment Plant (STP), fire breaks, and the Landfill Area. The site terrain is gently rolling, with elevations varying between 40 to 120 feet above sea level. The land lies on the western rim of the shallow Peconic River watershed, with a tributary of the river rising in marshy areas in the northern section of the tract.

The aquifer beneath BNL is comprised of three water bearing units: the moraine and outwash deposits, the Magothy Formation, and the Lloyd Sand Member of the Raritan Formation. These units are hydraulically connected and make up a single zone of saturation with varying physical properties extending from a depth of 45 feet to 1,500 feet below the land surface. These three water-bearing units are designated as a "sole source aquifer" by the EPA and serve as the primary drinking water source for Nassau and Suffolk Counties.

In 1980, the BNL site was placed on the NYSDEC's list of Inactive Hazardous Waste Sites. In 1989, it was included on the EPA's National Priorities List under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), otherwise known as the Superfund Law. Environmental restoration at the BNL site is being conducted under CERCLA in accordance with a May 1992 Interagency Agreement among DOE, EPA, and the NYSDEC.

To allow effective management of the BNL site, the 28 Areas of Concern (AOCs) have been divided into discrete groups called Operable Units (OUs) and Removal Actions. The criteria used for OU groupings are: relative proximity of AOCs, similarity in nature of contamination, similar geology and hydrology, similar phases of action or sets of actions to be performed during Remedial Investigation/Feasibility Study (RI/FS), and the absence of interferences with future actions at other AOCs or OUs. The BNL site is divided into five OUs and eight Removal Actions. Operable Unit IV is one of the first OUs studied at the site.

Operable Unit IV is located on the east-central edge of the developed portion of the site. OU IV encompasses the Central Steam Facility (CSF), otherwise known as AOC 5, Reclamation Facility Building 650 Sump and Reclamation Facility Building 650 Sump Outfall (AOC 6), Leaking Sewer Lines (AOC 21), and Recharge Basin HO (AOC 24-D). The CSF is located between North Sixth Street, Seventh Road, Brookhaven Avenue, and Cornell Street, and consists of approximately 13 acres, divided equally between developed and undeveloped land. The Building 650 Sump is approximately 100 feet north of Cornell Avenue. The Building 650 Sump Outfall area is located approximately 800 feet northeast of Building 650 and consists of a natural depression, approximately 90 feet x 90 feet, bounded by dirt roads. The leaking sewer lines are located south of Building 610; Recharge Basin HO is located approximately 250 feet to the northeast of the Building 650 Sump Outfall area.

Remediation of Operable Unit IV

The selected remedy consists of three major components: a final action for the soils contaminated with chemicals (S-3), an interim action (R-2) for radiologically contaminated soils, and a final remedy with a contingency option (GW-6) for groundwater contaminated with Volatile Organic Compounds (VOCs) and Semi-volatile Organic Compounds (SVOCs). Alternative R-2 is an interim action and the fate of radiologically contaminated soils will be evaluated under OU I. The following is a brief description of the selected remedy:

For Soils:

For dealing with organic chemical contamination in soils, an SVE system will be installed to collect VOCs and some SVOCs in the vadose zone soils in two areas: (1) the 1977 Oil/Solvent Spill Area, particularly in the vicinity of the Underground Storage Tank (UST) location, and (2) one fuel unloading area. After operating for about one year, the concentration of the organic contaminants in the vapor extracted from the vadose zone would be expected to stabilize at a very low value.

An interim measure of fencing and institutional controls, radiological surveys, and groundwater monitoring has been selected to address the radiological contamination of soils at Building 650 and the Sump Outfall Area. Fencing of Building 650 and Sump Outfall areas was completed in the Summer of 1995 to mitigate the risk from external gamma radiation. Fencing will not be required for the storm sewer pipe.

The selected remedy R-2 proposes a potential groundwater program. However, radiological groundwater contamination from the Sump Outfall area will be further characterized using geoprobe in FY-96 under OU I. The final monitoring program will be designed by DOE in consultation with EPA and NYSDEC, using all data.

The volume of radiologically contaminated soils to be managed under OU IV is relatively small when compared to estimated soil volumes from OU I. To be cost effective, final remediation of these soils will be evaluated in the OU I FS and ROD. In the interim, fencing, institutional controls, and monitoring (R-2) will be implemented. This interim action will be protective of human health.

For Groundwater:

To deal with the volatile and semi-volatile contaminants in groundwater, SVE, and AS will be used. Air Sparging will strip volatile and some semi-volatile contaminants from the groundwater into their vapor phase. Soil Vapor Extraction will collect both the sparged air and volatile organics from the vadose zone.

The desired performance levels will be defined during the remedial design phase. Upon review of the performance and monitoring data, if it is decided by the DOE, EPA, and NYSDEC that SVE and AS alone will not achieve desired performance levels, Enhanced Biodegradation may be implemented along with the SVE/AS system as an engineering enhancement option. The engineering enhancement option consists of: groundwater extraction using extraction wells located downgradient of the VOC plume; addition of nutrients; and reinjection into the saturated zone using injection wells and/or recharge basins located upgradient of the Oil/Solvent Spill area. This option would promote the in situ biodegradation of organic compounds.

When monitoring indicates that continued operation of the components of the selected remedy is not producing significant further reductions in the concentrations of contaminants in soils and groundwater, in accordance with the National Contingency Plan (NCP), DOE, and the EPA will evaluate whether discontinuance of the remedy is warranted. The criteria for discontinuation will include an evaluation of the operating conditions and parameters as well as a determination that the remedy has attained the feasible limit of contaminant reduction and that further reductions would be impracticable.

C. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS

Community Profile:

Brookhaven National Laboratory is located in Brookhaven Town at the geographic center of Suffolk County, which encompasses the central and eastern part of Long Island. Brookhaven Town accounts for almost a third of Long Island's 1.3 million residents with a population of 408,000.

Suffolk County is operated by a County Executive and an 18-member legislature, while the town employs a Town Council and a Supervisor. Both county and town governments maintain professional planning, development and environment departments, in addition to planning boards.

Many hamlets dot Brookhaven Town's 428 square kilometers (260 square miles). Located within a 5-mile radius of BNL are the unincorporated communities of Yaphank, Middle Island, Ridge, East Shoreham, Wading River, Calverton, Manorville, Center Moriches, Moriches, Mastic, and Shirley. Most of these villages or hamlets have citizen-run civic or taxpayers organizations with large and active memberships. Their goal is to benefit their community. Most organizations join one or both of the area's two umbrella civic groups, Affiliated Brookhaven Civic Organizations and the Longwood Alliance. These same communities support Rotary and other service clubs, which represent the business people and other aligned interests within the community.

The town of Riverhead is another Suffolk County town where BNL activities generate interest. The town of Riverhead, located to the east of BNL beyond the Town of Brookhaven, has a population of about 23,457 and an area of just over 108 square kilometers (about 60 square miles of which 62 percent is farmed). Riverhead employs a supervisor-town council government which maintains professional planning, development and environment departments, plus a planning board.

History of Community Involvement

Historically, public involvment in BNL's environmental restoration activities has been low, but after the establishment of a Community Relations program in 1991, public interest and contact with BNL has increased. Community attendance at public meetings has increased from a handful in 1991 to over 100 attendees at the OU IV meeting in December 1995. Each week, more than 50 calls from civic leaders, school officials, or citizens are received, each wanting to know something about environmental restoration activities. The focus of the Community Relations program for the last four years has been the following:

- To develop relationships with on-site personnel, community members and leaders, and community health-safety activists.

- To expand the mailing list.

- To attend regular monthly civic meetings to gain awareness of citizen issues and concerns.

- To increase communication with interested individuals by newsletters, public meetings, home page on the Internet, and maintaining the Administrative Record at local libraries.

A Community Relations Plan was finalized for the BNL site in September 1991. In accordance with this plan and CERCLA Section 113 (k) (2)(B)(I-v) and 117, the community relations program focused on public information and involvement. A variey of activities were used to provide information and to seek public participation. The activities included: compilation of a stakeholders mailing list, community meetings availability sessions, site tours and the development of fact sheets. An Administrative Record, documenting the basis for the selection of removal and remedial actions at the BNL site, has been established and is maintained at the local libraries listed below. The libraries also maintain site reports, press releases, and fact sheets. The libraries are:

Longwood Public Library
800 Middle Country Road
Middle Island, NY 11953

Mastic-Moriches-Shirley Library
301 William Floyd Parkway
Shirley, NY 11967

Brookhaven National Laboratory
Research Library
Bldg. 477A
Upton, NY 11973

The Administrative Record is also maintained at the EPA's Region II Administrative Records Room at 290 Broadway, New York, New York, 10001-1866.

Summary of Community Participation Activities for OU IV

A chronological summary of the significant community participation activities to date for OU IV is provided below:

September 26, 1991: A Site Specific Plan and 5-Year Plan informational meeting was held at BNL where the OU IV draft RI/FS Work Plan was also presented to the public. Presentation handouts on the draft Work Plan were provided to community members at that time. Although the community was informed by a press release to the local newspapers, attendance at this meeting was low. A question and answer period was held at the end of the meeting.

February 17, 1992: A public notice was published in two local newspapers (Newsday and Suffolk Life) announcing the availability of the OU IV RI/FS Work Plan at local repositories. The comment period began on February 17, 1992 and concluded on March 17, 1992. One community member commented by letter in April and was responded to by BNL.

August 3, 1994: A public notice was published in two local newspapers (Newsday and Suffolk Life) announcing the availability of an Engineering Evaluation Report and Action Memorandum at local repositories for an OU IV soil interim removal action. An informational letter, with public notice attached, was sent to the community mailing list. Two phone calls from community members were received concerning the disposal of soils.

January 17, 1995: A public notice was featured in local newspapers announcing the availability of the OU IV Remedial Investigation/Risk Assessment (RI/RA) Report at local repositories. The comment period began on January 18, 1995 and concluded on February 20, 1995.

January 25, 1995: An informational letter was sent to community members on the mailing list concerning the OU RI/RA Report. A civic association requested and was granted an extension to the comment period. Comments were received from the civic association in April 1995, which focused primarily on groundwater concerns. A meeting to discuss these concerns with the civic association was held on June 5, 1995 and DOE provided a written response thereafter.

November 18, 1995: An informational letter was sent to community members on the mailing list announcing the OU IV FS/PRAP public meeting. A public notice, meeting invitation/PRAP fact sheet, and site tour invitation was attached.

November 22, 1995: A public notice was published in Newsday and Suffolk Life (on November 29, 1995) announcing the availability of the FS/PRAP at local repositories for review and comment. A 30-day public comment period was initiated on November 22, 1995.

December 6, 1995: A public meeting was held at BNL for the OU IV FS/PRAP along with an afternoon-site tour of OU IV. The public meeting was attended by over 100 people. At this meeting, representatives from the EPA, NYSDEC, BNL, and DOE answered questions and accepted comments on the remedial alternatives under consideration for OU IV. A response to comments received during the public comment period is included in Section III of this Responsiveness Summary.

January 10, 1996: Community members provided written comments.

In addition to traditional public involvement activities at CERCLA sites, the DOE worked with stakeholders in identifying a range of future use options for the BNL site. The Final Draft of the Future Land Use Report was presented to the public in August, 1995. The Final Report was

prepared in September, 1995. Preferred future uses identified in this report will help determine the acceptable risk and remediation levels for the entire BNL site.

Highlights of other significant community relations activities are attached at the end of this Responsiveness Summary.

D. COMPREHENSIVE SUMMARY OF MAJOR QUESTIONS, COMMENTS CONCERNS AND RESPONSES

Public comments on the FS and Proposed Plan submitted during the public comment period are summarized and addressed below. These comments are presented in the following three categories:

1. Summary of Questions and Responses from the Public Meeting Concerning Operable Unit IV: Oral questions and comments received during the public meeting held

on December 6, 1995 are summarized in this section by the following topics:

- Site History
- Flow of Groundwater at BNL
- Extent of Contamination
- Site Risks
- Comparative Analysis of Alternatives
- Preferred Remedy
- Compliance with ARARs
- Community Participation and Acceptance

Similar comments and responses on a topic were consolidated to avoid redundancies.

2. Responses to Written Public Comments Received on Comment Cards at the Public Meeting: The DOE responses to the written public comments received at the public Meeting on December 6, 1995 are provided in this section.

3. Responses to Written Comments Received During the Public Comment Period: The DOE responses to written comments from the community are provided in this section.

1. SUMMARY OF QUESTIONS AND RESPONSES FROM THE PUBLIC MEETING CONCERNING OPERABLE UNIT IV

SITE HISTORY

A citizen asked whether BNL has found any contamination in the clean backfill material which was placed in the area where contaminated soil was removed.

Responses: Historically, when contaminated soil was excavated at OU IV spill sites, BNL/DOE, with concurrence from the regulatory agency (NYSDEC), ensured that the soil at the bottom of an excavation was determined to be "clean" based on the prevailing standards. After this determination was made, the pit was backfilled with clean sand.

The results of subsequent soil investigations did not indicate contamination of the clean backfill material from the original spill.

A citizen inquired about the source of the cooling water discharged to the Recharge Basin HO.

Response: The cooling water that is discharged to the Recharge Basin HO is primarily non-contact cooling water that is used to cool large research facilities and equipment at BNL.

Citizens inquired about the OU IV interim soil removal action, requested documentation, and expressed concern over disposal of the soil at the Town of Brookhaven Landfill.

DOE Response: In 1993, during the remedial investigation, the undergound storage tank which was the subject of the 1977 oil/solvent spill was found abandoned in the ground. Evidence of soil contamination from the 1977 oil/solvent spill was also observed. The tank was removed. Visually stained soil underneath the tank and around the associated piping was also removed. Treatment/disposal alternatives for the excavated soil including incineration and on-site thermal treatment, were studied in the Engineering Evaluation of Soil Piles Near Former Oil/Solvent UST. This study report and an Action

Memorandum, which are part of the Administrative Record, were made available for public comments. The NYSDEC and the Town of Brookhaven were also provided the study report and the analytical data. Upon receipt of written concurrence from the Town of Brookhaven and NYSDEC in 1994, 1,413 tons of soil and debris were disposed of at the Town of Brookhaven Landfill. A written response was provided to the commenter with regard to the request for documentation.

FLOW OF GROUNDWATER AT BNL

A citizen inquired whether the Suffolk County had groundwater flow maps around the BNL site and whether such a map could be obtained.

Response: Groundwater contour maps are available. They vary in detail. Some are limited to the BNL site, and others are regional groundwater flow maps. The Suffolk County Water Authority clarified that the Suffolk County Division of Health Services (SCDHS) produces groundwater contour maps on an annual basis based on its network of monitoring wells. These maps are available to the public. Brookhaven National Laboratory has produced more detailed maps which are based on several BNL monitoring wells on-site and outside the BNL site boundary. These maps can be obtained by the public from the DOE or BNL.

EXTENT OF CONTAMINATION

A citizen asked about the impact of remedial actions, such as installation of wells and air sparging, on increasing the extent of groundwater contamination.

Response: The contamination is not likely to spread during the implementation of the remedial action due to the nature of the given aquifer media, sand and gravel. During air sparging, localized mounding and the potential for creation of preferential pathways due to improper design or operation of the air injection system exists, but will be avoided. Necessary design and operational monitoring measures will be taken to ensure that this will not occur.

A citizen asked exactly what is being done to determine the extent of off-site contamination from the 1977 oil/solvent spill.

Response: Additional groundwater modeling is being performed to determine the areal extent of groundwater contamination and to guide placement of additional monitoring wells as part of Operable Unit I. These wells will also be used to track the 1977 plume. Off-site residential wells are also being sampled south and east of BNL in cooperation with the Suffolk County Department of Health Services.

SITE RISKS

A citizen asked what would happen to the chemically and radiologically contaminated soil in the event of a major flood; would it be displaced off-site.

Response: It is not likely that the residual contaminated soil from OU IV will be transported off-site in the event of a major flood, since the runoff is minimal on-site, even after a major storm event.

The interim measure of fencing, institutional controls, and groundwater monitoring for the radiologically contaminated soil is currently protective of human health. A final remedy for these radiologically contaminated soils is expected within a year.

A citizen inquired about the impact of future potential wildfires on the spread of radiological contamination from the Building 650 Sump Outfall Area. The citizen recommended that such a contingency be included in the safety planning during the implementation of the interim measure for this area.

Response: There are several trees in the Building 650 Sump Outfall area. While the dust from a potential fire may contain small amounts of radiological activity, it would be in concentrations that will not be of concern from the standpoint of health impacts or risks.

However, the impacts of such a contingency will be evaluated, and appropriate preventive measures will be taken during the implementation of the interim measure.

COMPARATIVE ANALYSIS OF ALTERNATIVES

A citizen asked for assistance in visualizing 7,000 cubic yards of soil.

DOE Response: It is approximately a large 10 foot high room, 150 feet long, and 125 feet wide. Alternately, it is the quantity of soil that would fill about 700 ten-wheeler dump trucks.

PREFERRED REMEDY

A. Preferred Alternatives for Soil

A citizen inquired about how long it will take for the Soil Vapor Extraction system to meet the soil cleanup standards and for that area to become safe.

Response: The SVE is expected to take about two years before the OU IV area is restored to the New York State standards.

A citizen asked how the interim measure (of fencing) for radiologically contaminated soils will prevent runoff from the Sump Outfall Area to become safe. a flood, to reach the Recharge Basin HO which is designed to recharge to the aquifer.

Response: The layout of the Sump Outfall area is such that the runoff from this area will not contaminate the Recharge Basin HO. Also, due to the localized mounding of the groundwater at the Recharge Basin, the ground water flow is radially away from and eventually downgradient of the Basin HO.

A citizen inquired about the frequency of groundwater monitoring of the Building 650 Sump Outfall Area.

Response: Groundwater will be monitored semi-annually during the interim action period. A final remedy for the radiologically contaminated soils is being studied and a proposed remedy is expected within a year. This final remedy will address long-term monitoring at the Building 650 Sump Outfall Area.

B. Cost of Preferred Alternatives for Soil

A citizen inquired about how the costs for the preferred alternatives for chemically contaminated soils and groundwater were computed.

Response: These costs reflect the present worth of the remedial action costs. A rate of 5% has been used for the 30-year life of the proposed remedy. Costs of long-term monitoring are also reflected in these costs.

C. Cost Effectiveness

Citizens inquired if there is actually a limitation under the Superfund Law or has DOE set any restrictions in terms of money that can be spent for cleanup. Citizens also asked why not excavate all contaminated soils, regardless of the price, in the interest of long-term safety.

Response: Cost is one of nine criteria that is used in the detailed evaluation of remedial alternatives. Eight other criteria are used in the remedy selection process.

Cost alone is not an index of protectiveness of human health and the environment. The cleanup is performed with the use of taxpayer money. Therefore, efficient use of these funds in the cleanup process is warranted. A remedy which meets the cleanup objectives at the lowest cost is preferred. A table at the end of the PRAP was cited to illustrate that the cheapest remedy is not necessarily proposed as DOE's preferred remedy.

From both a technical and cost effectiveness point of view, the SVE would be effective in the remediation of the chemically contaminated soils. This technology has been tested at numerous sites across New York State and has been determined to be effective. It is a proven technology and will remediate this site to the cleanup standards.

A citizen requested that someone on the panel compare the 1977 oil/solvent spill with the gasoline spill at the Northville gasoline spill site in Long Island.

Response: The Northville spill was significantly larger in volume and extent, and was all gasoline. None of the Northville spill was recovered by soil excavation. More than a million gallons of gasoline went into the ground and contaminated the groundwater.

The OU IV spill was closer to the surface. Soil contaminated with the oil was excavated. Air Sparging is now a proven technology, it is being used around the country, and is effective in cleanup of such spills.

COMPLIANCE WITH ARARs

A citizen inquired about how the cleanup standards are derived.

Response: Cleanup standards are selected based upon a review of federal and state regulations and guidance. The groundwater cleanup standards are selected based on a comparison of Federal and State Drinking Water Standards. The most stringent of the Federal and State standards are selected. Guidance on soil cleanup goals has been developed by the NYSDEC and is based upon an analysis of potential exposure routes, i.e., ingestion, inhalation, or impacts on groundwater that might one day be consumed.

A citizen expressed concern over applicability of the drinking water standard set about 10 years ago.

Response: Drinking water quality standards are established based on known health effects and other technical data obtained over time. These standards are reviewed regularly by the EPA and updated as new information becomes available.

COMMUNITY PARTICIPATION AND ACCEPTANCE

A citizen inquired if citizens could observe sampling of the wells and related field work being performed by BNL/DOE.

Response: It was stated that BNL/DOE has not received such requests in the past, but would be glad to show the citizens how this work is done. However, there are safety protocols associated with each field activity which need to be followed. Citizens can call BNL's Community Relations Coordinator to set up an appointment.

2. Responses to Written Comments Received on Comment Cards at the Public Meeting

Comment: Specifically, what authority does the County have over this [cleanup program]?

Response: Environmental restoration work at BNL is performed under an Interagency Agreement (IAG) among the DOE, EPA, and NYSDEC. The DOE is required by the IAG to consult with and obtain the review of the EPA and NYSDEC during various stages of the clean-up, with EPA having the final decision regarding the cleanup remedy in case of disagreement. Suffolk County has the right to participate in the process of determining the appropriate action to be taken regarding remediation and is provided the opportunity to review and comment on reports. Suffolk County representatives also inspect work and obtain split samples for anaysis at their own laboratories. The County is cooperating with DOE and BNL regarding groundwater sampling and public water supply, and other aspects of the environmental restoration program.

Comment: When you sent contaminants to Hanford did they go through:

(A) Manhattan?

Response: No.

(B) On the Orient Ferry?

Response: No.

(C) Across the Triboro Bridge?

Response: No.

We believe that you are referring to the low level radioactive waste shipments. Applicable Department of Transportation routing, shipping and packaging requirements were followed when these low level radioactive wastes were transported to Hanford.

Comment:

(A) Whose wells have you sampled?

Response: Only on-site monitoring wells were sampled during the OU IV remedial investigation. Off-site wells were sampled as a part of Operable Unit V, Removal Action V, and Operable Unit III.

(B) How far from BNL property have you sampled?

Response: To the North-East: Residential wells as far as David Terry Street to the North-East of BNL have been sampled.

To the South-East: Residental wells as far as Wading River Road to the South-East of BNL have been sampled.

To the South: Residential wells as far as Flower Hill Drive to the South of BNL have been sampled.

To the South-West: Residential wells as far as River Road on the South-West of BNL have been sampled.

Comment: How much "Superfund" money do you have?

Response: Environmental Restoration work under CERCLA (Superfund Law) is being performed with funds provided by the U.S. Department of Energy to BNL. The EPA's "Superfund money" is generally not available for use by federal facilities such as BNL.

Comment: How can you, with a straight face, make such a big fuss about a plan to build an ordinary fence?

Response: Based on the results of remedial investigation and risk assessment, it has been determined that the primary pathway of exposure is via direct exposure. To prevent exposure from this, the most significant pathway, and as an interim measure, fences have been installed. Radiological surveys and groundwater monitoring will also be performed in the interim period until the final remedy for the radiologically contaminated soil areas is selected under the Operable Unit I FS.

Comment: It seems that the responsibility for this radiological contamination of the soil and the chemical contamination of the groundwater is Brookhaven Labs. I feel you're taking the cheapest way out. A fence can't control all routes of exposure - example - inhalation, and what about direct contact by animals who leave the area? This is unacceptable. Also, doesn't groundwater need to be cleaned or removed? Groundwater travels and so do these dangerous chemicals. The Mastic Shirley areas have been through enough pollution of their drinking water and hopefully will fight this pollution once again.

I don't feel you have done enough on the local level to make people aware of this meeting or these problems and proposals. I myself only found out from an article in Suffolk Life that was delivered today. Thank you.

Response: The fence was installed only as an interim measure. The fence is, as an interim measure, effective in preventing exposure to humans and animals. The primary route of exposure is from direct exposure, not from ingestion or inhalation. The final remedy for the radiologically contaminated soil areas will be further studied and addressed by a Feasibility Study being conducted under OU I. The final proposal for this area will be available for your comments by February, 1997.

Cost is one of the nine criteria that is used in the detailed evaluation of remedial alternatives. Eight other criteria are used in the remedy selection process. Cost is not an index of protectiveness of human health and the environment. To be cost effective, a remedy which meets the cleanup objectives at a lower cost is preferred.

Any contaminated groundwater which may potentially be migrating off-site is being addressed under other BNL projects (OU I, III, and V).

Efforts to better inform the community of the environmental restoration activities at BNL, such as, expanding mailing list and newsletters, are being initiated.

3. Responses to Written Comments Received During the Public Comment Period:

Letter from Cancers Cure

Questions/Comments Regarding the 1977 Oil/Solvent Spill:

Comment: The tank floated and ruptured, giving reason to believe that groundwater contamination was occurrig with each rainfall (specially record rainfall early nineties), what was stopping soil from 1977 to 1993 from being contaminated (see Question 4A)? How did you come up with the 25,000 gallon amount?

Response: In November 1977, BNL's Plant Engineering (PE) used sand berms to contain the spread of oil and used portable pumps to retrieve the oil. Test borings performed at that time at several locations within the spill area revealed a heavy clay layer approximately 0.25 to 0.3 meters below the topsoil. Sampling of the soil at different depths conducted by BNL's Safety and Environmental Protection Division (S&EP) indicated that the oil had not reached the clay layer but was confined to the top 0.3 meters. Some oil soaked soil was removed, but the location or amount of the soil was not documented. Clean top soil was added to this area, followed by fertilization and tilling. In a Decembeer 1977 meeting with EPA, EPA expressed satisfaction that the steps taken were appropriate. Thus, the soil contamination was thought to be confined.

As a condition of the New York State Major Petroleum Storage Facility Permit and CSF expansion, BNL installed soil borings in the spill area. The results of soil borings indicated presence of chemical odor. Following this finding, a soil and groundwater investigation was initiated by BNL. Monitoring wells were installed in the spill area and were sampled. Residual oil/solvent contamination from the 1977 spill was found in the soil at the spill area, and an oil sheen was observed on a water table soil sample. Based on these follow-up studies, it was determined that soil contamination was not confined to the top 0.3 meters below the topsoil.

The 25,000 gallon spill amount was estimated from observations made before and after the spill on the level gauges on the large storage Tank #4 which was feeding the 5,000 gallon underground storage tank.

Comment: Are there photographs of the spill which covered 1.2 acres (before and after sand berms)?

Response: Photographs taken by BNL personnel at the time of the spill are available and were sent to the commenter.

Comment: In cleanup coordinated with EPA, who else participated with the cleanup (other agencies such as DEC and other companies such as Marine Pollution Control)?

Response: BNL Divisions performed the cleanup with the approval of EPA. The New York State Department of Transportation (NYSDOT) also was informed, since they administered the oil spill program for the New York State in 1977.

Comment: Why is the amount of oil and solvent recovered by portable pumps unknown?

Response: The recovered amount is unknown because there is conflicting documentation of recovery. One document indicated that about 2,900 gallons were recovered and the other indicated that about 20,000 gallons were recovered.

Comment: In the interim action taken by DOE with the EPA and NYSDEC approval:

A. Why did DOE wait until October 1993 to remove visibly-contaminated soil?

Response: Until 1987, it was believed that the oil had not reached the clay layer but was confined to the top 0.3 meters above the clay layer (See Response to first comment). It was not visible at the surface. As of 1987, further investigations were required to determine the extent of contamination prior to initiation of any further response actions. In 1987, at the request of BNL, IT Corporation (ITC) conducted an investigation of the extent of soil and groundwater contamination. IT Corporation developed a conceptual remediation plan in 1989. On December 21, 1989, the BNL site was placed on the National Priority List under Section 120 of CERCLA (Superfund Law).

Subsequently, an IAG addressing the environmental contamination and restoration at BNL was negotiated by the DOE, EPA, and NYSDEC. The IAG was finalized in February 1992 and became effective in May 1992. The IAG established that the OU IV, which contains the subject spill, be subject to a RI/FS process. Planning for the OU IV RI/FS was initiated in 1991. Only during the excavation of the 5,000 gallon UST, an interim removal action, and associated piping in 1993, visibly stained soils were found around the tank and associated piping. These soils were excavated with the approval of the IAG agencies.

B. Where was the soil until June 1994, when after sampling and analysis and with approval of DEC and Brookhaven Town, the soil was disposed of in the Town of Brookhaven Landfill.

Response: The excavated soils and debris were stored on-site in piles. The piles were placed on top of a liner and were securely covered with tarpulins just west of North Sixth Street. The soil piles remained in place until June of 1994. Alternate treatment/disposal options were studied by Camp Dresser & McGee (CDM), at the request of BNL. Upon written concurrence from NYSDEC and the Town of Brookhaven, a total of 1,413 tons of excavated soil and debris were disposed of at the Town of Brookhaven Landfill.

C. Where in the Landfill was soil deposited and how much was deposited?

Response: Brookhaven National Laboratory hired a NYSDEC licensed contractor to transport the soil/debris to the Town of Brookhaven Landfill. Disposal was performed by the contractor per direction from the Town of Brookhaven Landfill officials. We are not aware of the exact location in the Landfill where this soil is deposited. The exact location may be obtained from the Town of Brookhaven. The amount deposited was 1,413 tons of soil and debris.

D. I would also like to know who performed the excavation process, and who performed the anaalysis of the above mentioned soil.

Response: The excavation was performed by BNL personnel. The sampling was conducted by CDM and the analysis was performed by PACE Laboratories, under a contract with CDM.

Questions/Comments Regarding the Former Leaching Pit:

Comment: For how long was wastewater and waste oil from equipment cleaned inside Building 610 sent into this leaching pit?

Response: The leaching pit received wastewater from equipment cleaning operations inside Building 610 from 1948 to 1980.

Comment: Was the entire pit covered with 53 inches of tar-like substance?

Response: The bottom of the pit was covered with 53 inches of tarry sludge material.

Comment: Where was this waste and surrounding soil taken? (DEC Region 1 Oil Division documentation would be sufficient).

Response: Approximately 100 cubic yards of soil and debris was excavated from the pit, was transported, and disposed of at the Town of Brookhaven Landfill. Clean sand was placed into the excavated area.

Questions/Comments Regarding Former Underground Gasoline Storage Tank:

Comment: Who from SCDHS gave authorization for removal?

Response: Both the NYSDEC Spill Unit in Stony Brook and the SCDHS in Farmingville were notified of the discovery of the abandoned underground storage tank by BNL personnel on April 9, 1990. A representative of SCDHS, Mr. D. Obrig, came to BNL to inspect the tank and examine the excavation on April 11,1990. SCDHS authorization was not required for removal of the tank.

Comment: Where can documentation regarding the soil and tank be retrieved for viewing or photocopying?

Response: The abandoned tank and surrounding area were remediated using the services of a local contractor. A representative sample was collected from the excavated soil and analyzed for the hazardous waste characteristic test of ignitability and the extraction procedure toxicity test for lead. The analytical results indicate that the soils were not hazardous for the parameters tested. The documentation can be obtained from the Administrative Record and information repositories. Based on these results, approval was obtained from the Town of Brookhaven and the NYSDEC to dispose of the soils at the Town of Brookhaven Landfill. This was performed by the contractor in May, 1990. The tank was removed from BNL and disposed as scrap by the contractor.

Questions/Comments Regarding Fuel Unloading Areas:

Comment: I would like to obtain documentation of spills, what action was taken, what agency documented these spills, and what action has been taken as far as groundwater contamination.

Response: Several spills have occurred during the unloading of fuel at the CSF. The spills documented on BNL's Chemical and Oil Spill Reporting Forms, prior to the remedial investigation, indicate that six spills have occurred during the delivery of fuel. The spills range in size from 2 to 60 gallons and were, in the most part, No. 6 fuel oil, with one instance of No. 2 fuel oil and incident of gasoline spillage. All of the spills were remediated using absorbents and where the volume was sufficient, fuel was recovered by pumping into storage tanks.

Reportable spills that occurred after the NYSDEC started administering the oil spill program are documented with the NYSDEC Spill Unit in Stony Brook.

During the RI, one soil boring was installed at each of the eight unloading areas. The purpose of the borings was to determine if soil contamination was present in the vadose zone. Additional monitoring wells were also installed south of the CSF tank farm area to detect any groundwater contamination from this area.

Questions/Comments Regarding Drainage Area:

Comment: Where was oil (No. 6 fuel oil, 250-500 gallons) taken after collection and by whom was it collected?

Response: The spill amount was estimated to be 250-500 gallons. The oil ponded in the low area was collected by BNL with recovery pumps. A BNL bulldozer was used to limit the spread of the oil. The recovered oil was placed back in an oil storage tank.

Questions/Comments Regarding Reclamation Facility Building 650 Sump and Outfall Area:

Comment: Wastewater drained into two of four underground storage tanks. What was the purpose of the two remaining tanks?

Response: Wastewater from the laundry operation inside Building 650 was contained in two 2,000 gallon underground storage tanks (#650, 1 and 2) until it could be monitored for radioactivity. Rinse water from the decontamination pad that was deemed excessively contaminated (liquid with gross beta concentration greater than 90 picoCuries per milliliter, otherwise called "D" waste) was also supposed to be routed to these tanks with the use of appropriate valves.

Tanks 3 and 4, designated as "F" waste tanks, were used to contain liquids from the decontamination pad operation having gross beta concentration less than 90 pCi/ml. Typically, rinse water from the decontamination pad, was deemed clean enough to be routed to these two 3,000 gallon underground storage tanks (#650, 3 and 4), located adjacent to Tanks 1 and 2.

Comment: Contents of clothing decontamination tanks were regularly transferred by truck to BNL's Waste Concentration Facility.

A. What was done with contaminated clothes? (Please provide information as to who wore these clothes, in writing if possible. If Freedom of Information needed for this, please inform me).

Response: Clothing received at this facility was first washed. After washing, clothes were monitored for contamination. If it was determined that the clothes were contaminated, they were sent back for a rewash. If these clothes after rewash were determined to still be contaminated, they were disposed of as low level radioactive waste. The clean clothes were reused by personnel working in radiologically controlled areas. It would be inappropriate to identify such personnel by name.

B. What is BNL's Waste Concentration Facility (WCF)? Where is it located? What else is brought there from BNL and any other waste from anywhere else.

Response: Aqueous radioactive wastes are received and were processed at the WCF, located at Building 811 for volume reduction prior to disposal off-site. Above ground holding Tanks D-1, D-2, and D-3 were used to store the waste between 1952 and 1987. Since 1987, generated "D" Waste (define previously) is stored in two new tanks located north of the "D" waste tanks. Only BNL waste is received and processed at this facility.

C. Are contents discharged from Building 650 to the Sewage Treatment Plant, and then discharged into the Peconic River?

Response: Contents of the "F" waste tanks (Tanks 3 and 4) described previously were emptied about twice a year and were discharged to the Sewage Treatment Plant.

D. In 1969, five curies of tritium were released, supposedly, in BNL's sanitary sewer system. However, an investigation followed and revealed that the drainage pipe from Building 650 Sump discharged into a natural depression into a wooded area 800 feet northeast of Building 650. (I'm lead to believe that this discharge was into the ground, not into four tanks, is this true?)

Response: The discharge was into a natural depression, an area called the "Sump Outfall Area" which was addressed in the remedial investigation for OU IV. A valve, if correctly operated, would have directed the liquids to the "F" waste tanks. The valve was positioned, at the time of this release, to direct the liquids to a storm sewer line which discharged into the Sump Outfall Area.

E. In the Summer of 1994, Building 650 Sump's four underground storage tanks were removed and determined to have not leaked. What was done with these radioactive tanks? Who disposed of them?

Response: The underground storage tanks (#650-1, -2, -3, and -4) were no longer in use. In the Summer of 1994, as part of the UST Removal Action, the tanks and associated piping were removed, and upon determining that the tanks had not leaked, the holes were filled with clean sand. The tanks were cut up as a part of Removal

Action I ("D" Tanks Removal Action), packaged in approved containers, and disposed of by DOE at its facility in Hanford, WA.

Questions/Comments Regarding Leaking Sewer Lines:

Comment: All decontamination of contents of the equipment decontamination tanks were discharged into these sewer lines. This was radioactive material. Are there any tests from the leaky sewer lines? Please send any material you can send me (Please send separate comments not references in catalog of data. References would be appreciated from specific people responsible for each area).

Response: The liquids from the Building 650 decontamination pad area which discharged via a storm sewer line to the Sump Outfall Area. During the Remedial Investigation, a video camera survey of this storm sewer line was performed. The survey results were utilized to locate four soil borings along the pipeline. Soil boring samples collected along this storm sewer pipeline indicated no contamination above the cleanup goals.

Soil borings were also installed along the section of the sanitary sewer line included in OU IV which was known to have leaked. The results of soil testing indicated that there was no contamination above the New York State standards.

The requested material was provided to the commenter.

Questions/Comments Regarding Recharge Basin HO:

Comment: Why was sediment not tested? All contamination would presumably settle to bottom sediment. I don't understand why, if you are looking for contamination, why you would not test where the final product of contamination would be?

Response: Primarily, non-contact cooling water was discharged to the basin and the water was sampled periodically. Since there was no testing done on the sediment previously, six sediment samples were collected during the 1993 Remedial Investigation in the Recharge Basin HO (two basins). A composite sediment sample was analyzed for organics, inorganic pesticides/PCBs, and radionuclides.

Results of the soil analysis indicate that the soil cleanup goals for the respective compounds were not exceeded.

Letter From Suffolk County Water Authority

Comment: The SCWA made the following comment on the preferred alternative of fencing and using institutional controls to monitor access to the radiologically contaminated soil areas, identified in the Proposed Remedial Action Plan

(PRAP). "Recognizing the nature of the contamination in the area of concern, we recommend that in addition to fencing in the area, a layer of solid clay or concrete be placed over the area. This will act as a cap and minimize the potential for water percolationg through the area from becoming contaminated and reaching the aquifers underlying the site. This interim action is a cost effective method of reducing the risk this area poses to the aquifer and allows you time to formulate a more complete course of remedial action as part of the final action to be implemented under Operable Unit I remediation (as noted on Page 12 of the PRAP)."

Response: As an alternative, installation of a solid clay or concrete cap over the radiologically contaminated areas, in addition to the fencing, is being studied under the OU I FS. The Proposed Plan for this area is expected to be available for public comment by February, 1997. Considering that a final remedy for this area is in process, that the human health and environmental risks from direct exposure are, in the interim, eliminated by installation of the fence, and that groundwater contamination from this source area is further being evaluated, we believe that these steps are responsive and will be protective of human health.

Should a clay or concrete cap be installed within the next few months, and should the final remedy selected under Operable Unit I be excavation and treatment/ disposal, the cost of installation and dismantlement of the cap as well as characterization and treatment/disposal of additional radiological wastes would not be justified.

Letter From Ridge Civic Association

Comment: "Considering potential costs and risks, the preferred alternatives for the cleanup operations that are specified on Page 12 and 13 of the PRAP seem reasonable over the short term. It is important, however, that serious consideration be given to eventual removal of radiologically contaminated soil, as is mentioned on Page 12.

In addition, it should be taken into account that a substantial number of homes to the north, the south, and the west of BNL receive their water through private wells. There remains the risk that contaminants that have already escaped into the groundwater system will have an impact upon these wells. The area to the west of BNL will soon be receiving a HUD block grant that will provide access to public water. The recent proposal by DOE to provide public water hookups to the area south of BNL will help address concerns in that area. However, the residential area to the north of BNL and south of Middle Country Road also contains a number of homes with private wells. While groundwater issuing from OU IV is of the greatest concern to the community to the south of BNL, OU IV is considerably closer to the residential area to the north. Although the process of evaluating cleanup alternatives for OU IV has not yet officially commenced, the present might be an opportune time to consider providing public water to the area north of BNL.

While providing access to public water will address some of the concerns regarding contaminants released into the environment at BNL, the Ridge Civic Association is committed to the protection of the natural environment as well. Even after residential areas adjacent to BNL have been granted access to public water, proposals for preventive and remedial action should continue to consider the protection of the Peconic River, Peconic Bay, and other natural areas to be high priority".

Response: As recommended, excavation and removal of these soils is an alternative being evaluated as a part of a FS under OU I. The OU I FS Report will be prepared by BNL/DOE and reviewed by EPA and NYSDEC. Upon concurrence from these agencies, we expect to propose a final remedy for these soils by February, 1997 for public review.

The groundwater flow at BNL is generally from north to south. Ridge is located north of BNL site. There is no evidence or potential for any groundwater contamination in Ridge from BNL. Any potential groundwater contamination from BNL will travel towards the south. Therefore, providing public water to areas north of the BNL site could not be justified as part of this remediation project.

It is the intent of DOE to address both human health and environmental risks through environmental restoration activities that are being planned. Brookhaven National Laboratory & DOE are committed to seeking public involvement in the environmental restoration process and addressing community concerns.

Highlights of Other Community Relations Activities at the BNL Site

Specific community relations activities related to Operable Unit IV are detailed in the Record of Decision, Decision Summary Section 3 and in the Responsiveness Summary. The following is a list of other significant community relations activities under CERCLA conducted to date at the Brookhaven National Laboratory Site:

- 1991: The Administrative Reord and information repositories for the site were established. All documents referenced herein are a part of the Administrative Record.

- September 1991: a Community Relations Plan was prepared based on community and other stakeholder interviews to summarize public concerns and DOE's plan for addressing them. The document was finalized and was placed in the Administrative Record.

- September 1991: A public meeting was held and a fact sheet was distributed to receive public comments on BNLs Site Specific Plan for Environmental Restoration and Waste Management. Presentations were conducted on the status of BNLs environmental restoration activities. Public input was requested and comments on the draft Response Strategy Document, draft Site Community Relations Plan, and the draft Remedial Investigation/Feasibility Study (RI/FS) Work Plan for Operable Unit IV were requested. A 30-day public comment period was provided.

- April 1993: A public meeting was held and fact sheets were distributed to receive public comments on BNLs Site Specific Plan for Environmental Restoration and Waste Management. A presentation was conducted on the status of BNLs environmental restoration activities and upcoming public involvement milestones. A 30-day public comment period was provided.

- July 1993: A public notice of availability was issued to announce the availability of the Engineering Evaluation/Cost Analysis for the "D" Tanks Removal Action for public comment. A 30-day public comment period was provided.

- November 1993: A public meeting was held and fact sheet was distributed for the Operable Unit I RI/FS Work Plan, the Spray Aeration Field Investigation Sampling and Analysis Plan, and the Landfills Sampling and Analysis Plan to allow the public an opportunity for comment on the proposed activities. A 30-day public comment period was provided.

- February 1994: A public notice of availability was issued to announce the availability of the Engineering Evaluation/Cost Analysis for the Cesspools Removal Action as well as the Action Memorandum for the Bldg. 464 Mercury-contaminated Soil Removal Action for public comment. A 30-day public comment period was provided.

- October 1994: A public meeting was held and a fact sheet was distributed for the Operable Unit V RI/FS Work Plan to allow the public an opportunity for comments on the proposed activities. A 30-day public comment period was provided.

- May 1995: A publlic notice of availability was issued to announce the availability of the Engineering Evaluation/Cost Analysis for the Landfills Removal Action for public comment.

- January 1996: A Community Forum was established to provide a mechanism for community residents to express their views and concerns to BNL staff about BNL activities and plans for the future. The first meeting was held January 29, 1996.

- January 1996: Briefings to local elected officials and regulatory agencies on the status of residential public water hookups at the south boundary.

- January 1996: A public meeting was held for the Operable Unit I Groundwater Removal Action to discuss the findings of the Engineering Evaluation/Cost Analysis Report and to allow the public an opportunity to comment on the proposed cleanup activities. The document is part of the Administrative Record. A public notice of availability for the meeting was issued, along with the fact sheets, summary sheets, and a press release distributed to the public. Also presented at the meeting was an update of other BNL environmental restoration activities, including the on-going field investigation work for Operable Unit III. A 30-day public comment period was provided and an extension was provided.

- Other on-going community relations activities which were initiated in 1990 include holding meetings with local community civic associations and umbrella groups, meetings with BNL Departments, Divisions, and apartment area residents (the on-site community) to update them on the status of the Environmental Restoration activities, meetings with NYSDEC Hazardous Waste Advisory Group, area of concern tours, mailings, Brookhaven Bulletin articles, press releases, quarterly updates to the Administrative Record, presentations and tours for local colleges, elementary and high school presentations, and responding to community phone calls and correspondence.

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TABLES

<IMG SRC 0296285B>

Table 2

Operable Unit IV

Maximum Concentration of VOCs and SVOCs in Soil
(ug/Kg)

Compound	NYS Guideline (TAGM)	Cleanup Goal	Maximum Detected Level*	AOC-5 Location

Detected TCL VOCs				
Acetone	200	200	730	1977 Spill
Benzene	60	60	2,100	1977 Spill
Tetrachloroethene	1,400	1,400	4,300	1977 Spill
Toluene	1,500	1,500	180,000	1977 Spill
Ethylbenzene	5,500	5,500	64,000	1977 Spill
Xylenes (total)	1,200	1,200	330,000	1977 Spill
Detected TCL SVOCs				
Phenol	330**	330**	610	1977 Spill
Chrysene	400	400	2,200	1977 Spill
Benzo(b)fluoranthene	1,100	1,100	2,900	1977 Spill
Benzo(a)pyrene	330**	330**	1,800	1977 Spill

TAGM: New York State Technical and Administrative Guidance Memorandum, 1/24/94.

Given TAGM levels assume a soil organic carbon content of 1%.
*Maximum Detected Levels amoung all soil borings in this area.
**Contract Required Quantitation Limit (CRQL).

Table 3

Operable Unit IV

Maximum Concentrations
of Radionuclides in Soil
(pCi/g)

Compound	Selected Cleanup Guidelines*	Maximum Detected Level	AOC-6 Location
Plutonium 239/240	60	170	Sump Outfall
Strontium - 90	42	140	Sump Outfall
Cesium - 137	31	1,800	Sump Outfall
Europium - 152	70	580	Sump Outfall
Europium - 154	260	350	Sump Outfall
Radium - 226	5	63	Sump Outfall

*Above Background

Table 4

Operable Unit IV

Maximum Concentrations of VOCs and SVOCs in Groundwater
(ug/l)

Compound	Federal Standard or Guideline MCL	NYS Standard or Guideline MCL	Selected Cleanup Goal	Maximum* Detected Level	Well** No.
Detected TCL VOCs					
1,2 Dichloroethene	70(cis) 100(trans)	5	5	64	76-04
1,1,1-Trichloroethane	200	5	5	14	76-04
Trichloroethene	5	5	5		

				20	76-04
Tetrachloroethene	5	5	5	43	76-04
Toluene	1000	5	5	2700	76-04
Ethylbenzene	700	5	5	590	76-04
Xylenes (total)	10000	5	5	2200	76-04
Detected TCL SVOCs					
1,2-Dichlorobenzene	600	5	5	12	76-04

GA: Class GA Groundwater Quality Standard.
MCL: Maximum Contaminant Level.
*Maximum Detected Level amoung all sahllow wells which were monitored.
**Well locations are shown in Figure 7.

Table 5

Brookhaven National Laboratory

Operable Unit IV

Summary of Chemical of Potential Concern in Site Matrices by Area of Concern

Surface Soil
Subsurface Soil Groundwater

Sump Outfall Drainage Area Central Steam Facility
Bldg,. 6501 Sump Outfall Drainage Area Central Steam Facility
Bldg,. 650[2] Bldg,. 650 Site Wide
Pres
ent and Future
Present Future

VOCs VOCs VOCs VOCs
VOCs VOCs VOCs VOCs
VOCs VOCs

None Selected None Selected Ethylbenzene None
Selected None Selected None Selected None Selected
1,1-Dichloroethene None Selected 1,1-Dichoroethene
Tetrachloroethylene
Trichlroeothylene
Toluene
Bromodichloromethane
Xylenes(Total)
Tetrachloroethylene

SVOCs SVOCs SVOCs
SVOCs SVOCs SVOCs SVOCs
SVOCs SVOCs SVOCs

Benzo(a)anthracene None Selected Benzo(a)anthracene
Benzo(a)anthracene None Selected None Selected Benzo(a)anthracene
None Selected None Selected None Selected
Benzo(b)fluoroanthene Benzo(b)fluoranthene
Benzo(b)fluoranthene Benzo(b)fluoranthene

Benzo(a)pyrene Benzo(a)pyrene
Benzo(a)pyrene Benzo(a)pyrene
Indeno(1,2,3-co)pyrene
Indeno(1,2,3-co)pyrene

Pesticides/PCBs Pesticides/PCBs Pesticides/PCBs
Pesticides/PCBs Pesticides/PCBs Pesticides/PCBs Pesticides/PCBs
Pesticides/PCBs Pesticides/PCBs Pesticides/PCBs

None Selected None Selected 4,4-DDT None
Selected None Selected None Selected Arochlor 1248
None Selected None Selected None Selected

Inorganics Inorganics Inorganics
Inorganics Inorganics Inorganics Inorganics
Inorganics Inorganics Inorganics

Arsenic Arsenic Arsenic
Arsenic Arsenic Arsenic Arsenic
Arsenic Arsenic Arsenic
Barium Barium Barium
Barium Barium Barium Barium
Beryllium Barium Manganese
Beryllium Beryllium Beryllium
Beryllium Chromium VI Chromium VI Beryllium
Manganese Beryllium
Cadmium Chromium VI Chromuim VI
Manganese Managanese Manganese Chromium IV
Thallium Manganese
Chromium VI Manganese Manganese
Mercury Mercury Vandium Manganese
Vanadium Nickel
Manganese Nickel Mercury
Thallium Nickel Nickel
Thallium
Mercury Vanadium Nickel
Vanadium Thallium
Vanadium
Nickel Vanadium
Vanadium
Vanadium
Zinc

1 Surface soil exposure scenarios are different for present and potential future site workers in the Bldg,. 650 area. For both exposure scenarios, however, the same chemicals of potential concern were selected.
2 No present site or construction worker exposures to subsurface soil are occurring; therefore, the scenarios will only be qualitatively addressed.
3 Subsurface soil exposure scenaris are different and potential future site and construction workers in the Bldg,. 650 area. The future-use scenario wil be quantitively evaluated as construction and/or maintenance work involving excavation activity may occur. The chemicals of potential concern differ from those selected under the present-use scenario.

<IMG SRC 0296285C>

<IMG SRC 0296285D>

<IMG SRC 0296285E>

<IMG SRC 0296285F>

<IMG SRC 0296285G>

<IMG SRC 0296285H>

<IMG SRC 0296285I>

<IMG SRC 0296285J>

<IMG SRC 0296285K>

<IMG SRC 0296285L>

<IMG SRC 0296285M>

TABLE 9
COMPARATIVE COSTS FOR SOIL AND GROUNDWATER ALTERNATIVES

tive Alternative	Capital Cost ($)	Annual O&M Cost ($)	Net Person Worth @ 5% Rate
No Further Action	$0	$46,400	$36,400
Limited Action	$0	$33,200	$511,000
No Excavation - Soil Vapor Extraction	$373,700	$141,900	$638,000
Total Excavation - On Site Treatment (S-4A) or Off-Site Disposal of Excavated Soils (S-4D)	$2,574,500 S-4A $4,864,600 S-4D	$0 (A & D)	$2,570,000 S-4A $4,860,000 S-4D

Partial Excavation (S-5A)/Soil Vapor Extraction (S-5D)	$1,798,600 S-5A	$70,000(A&D)	$1,930,000 S-5A $2,890,000 S-5D
No Further Action	$39,215	$49,500	$78,000
Limited Action	$76,300	$37,950	$769,000
Total Excavation - On-Site Storage (R-3A)/Off-Site Disposal of Excavated Soils (R-3B)	$3,205,630 R-3A $33,632,850 R-3B	$33,600	$3,820,000 R-3A $34,200,000 R-3B
Partial Excavation - On-Site Storage (R-4A)/Off-Site Disposal Excavated Soils and Capping (R-4B)	$2,737,900 R-4A $18,210,370 R-4B	$37,354	$3,420,000 R-3A $18,900,000 R-3B
No Further Action	$ 0	$52,100	$40,900
Limited Action	$59,500	$39,500	$667,000
Chemical precipitaion, air stripping and polishing with activated carbon-infiltration through recharge basins.	$2,074,500	$541,950	$6,070,000
Chemical precipitation and chemical oxidation enhanced with UV photolysis - infiltration through recharge basins	$2,264,470	$599,450	$6,670,000
Chemical precipitation and carbon adsorption - Infiltration through recharge basins.	$2,028,200	$558,000	$6,140,000
Air sparging, soil vapor extraction and enhanced biodegradation.	$886,000	$427,000	$1,062,000

(Chemical), *R = Soil (Radiological), *GW = Groundwater

<IMG SRC 0296285N>

<IMG SRC 02962850>

<IMG SRC 0296285P>

<IMG SRC 0296285Q>

<IMG SRC 0296285R>

<IMG SRC 0296285S>

<IMG SRC 0296285T>

BROOKHAVEN NATIONAL LABORATORY (USDOE)

Site Information:

Site Name: BROOKHAVEN NATIONAL LABORATORY (USDOE)
Address: UPTON, NY

EPA ID: NY7890008975
EPA Region: 02

Record of Decision (ROD):

ROD Date: 09/16/1999
Operable Unit: 01
ROD ID: EPA/541/R-99/082

Media: Groundwater, Liquid Waste, Sediment, Soil, Surface Water

Contaminant: Metals, PCBs, 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 BNL site, formerly Camp Upton, was occupied by the U.S. Army during World Wars I and II. Between the wars, the site was operated by the Civilian Conservation Corps. The site was transferred to the Atomic Energy Commission in 1947, to the Energy Research and Development Administration in 1975, and to DOE in 1977.
A brief history of each Area of Concern (AOC) within Operable Unit 4 (OU 4) is provided below:
AOC 5 - CENTRAL STEAM FACILITY (CSF)
The CSF supplies heating and cooling to all major Brookhaven National Laboratory (BNL) facilities. It consists of a network of 21 aboveground receiving and mixing fuel tanks, which are connected via aboveground and underground pipelines to the boiler building (Building 610) located near the corner of Sixth Street and Cornell Avenue.

AOC 5 has several subAOCs as described below:

1977 Oil/Solvent Spill:
On November 25, 1977, approximately 23,000 to 25,000 gallons of waste oil and solvent were released from a ruptured pipe located southeast of the CSF and west of North Sixth Street. The mixture was composed of 60 percent Number 6 fuel oil and 40 percent mineral spirits. The pipe ruptured when a nearby empty 5,000 gallon underground storage tank (UST), which was enclosed in a concrete structure, rose off its mount as a result of water accumulating beneath the tank, shearing the connecting lines.
The spill, which covered an estimated 1.2 acres, was contained with sand berms and free product was recovered with portable pumps. The cleanup activities were coordinated with EPA and the steps taken were considered at that time to be appropriate by EPA. The total amount of the soil/solvent mixture that was recovered is unknown.

Former Leaching Pit:
The Leaching Pit was located approximately 100 feet south of the southwest corner of Building 610. The pit was installed sometime in the 1950s or 1960s to receive waste oil and washwater from equipment cleaned inside Building 610. Further excavation revealed that a vitreous tile pipe led to a sand trap, and eventually to Building 610.
The Leaching Pit had an outside diameter of approximately 9 feet and was about 11 feet deep. Its walls were constructed of concrete cinder blocks, and the cover was a 12-inch thick concrete slab. The cover was located approximately 1 foot below grade.
The Leaching Pit contained approximately 53 inches of a thick, black, tar material similar in appearance to Number 6 fuel oil. Excavation proceeded by removing the oil-stained concrete blocks and surrounding soil, in addition to the sand filter and piping connecting the Leaching Pit to Building 610. The estimated dimensions of the excavation were 20 feet deep by 20 feet in diameter. Clean sand and soil were placed into the hole. The soil, construction material and tarry residue excavated from the Leaching Pit were classified as non-hazardous. Currently, an underground propane tank is located at the excavation site. The excavation and cleanup of the Leaching Pit was coordinated with the Interagency Agreement (IAG) agencies and was performed with oversight by the New York State Department of Environmental Conservation (NYSDEC) Region III Oil Spill Division.
Former Underground Gasoline Storage Tank:
In May 1990, an abandoned 550-gallon underground gasoline tank was discovered under the asphalt on the west side of Building 610. BNL records show that the tank was in operation from 1948 until approximately 1963. Excavation and inspection of the tank revealed several large rusted-out holes. Soil from beneath the tank smelled of

petroleum. The contaminated soil was excavated until the organic vapor content of the remaining soil was less than 50 ppm. The depth and lateral extent of the excavation were not documented; however, approximately 12 cubic yards of soil were excavated. The hole was backfilled with clean soil under authorization from Suffolk County Division of Health Services (SCDHS).

CSF Fuel Unloading Areas:
Fuel isunloaded at eight places around the storage tanks. The unloading areas are approximately 4 square feet and are constructed of pavement, bluestone, and concrete. The secondary containments are concrete boxes. BNL has documented several small (1 to 10 gallons) surface spills of fuel oil. On three separate occasions, in 1988, 1990, and 1993, surface spills of about 60 gallons of Number 6 fuel oil were reported.

CSF Underground Piping:
Four receiving tanks (1, 2, 3, and 4) are located to the west of Building 610. The tanks have a combined capacity of 1.1 million gallons. The majority of the pipelines are aboveground, and have had no history of leaking. However, there are three sections of piping leading to Building 610 that are below ground. One section is a 12 inch diameter pipe that carries Number 6 fuel oil from Tank 3 to Building 610, a distance of approximately 150 feet. Another section of pipe carries Number 6 fuel oil from Tank 1 to Building 610. The third section of underground piping connects Building 633 to both Building 610 and Tank 1. There are no documented releases from the pipes.

Drainage Area East of CSF:
In September 1977, a tank truck was unloading fuel at a fuel-transfer pipe station; apparently, the valve was in the "closed" position. As a result, approximately 250 to 500 gallons of fuel were spilled. The fuel, believed to be Number 6 "Bunker C oil," caused excessive back pressure in the pipeline and ruptured it. The fuel spilled onto the ground and entered an adjacent catch basin, with an outlet in the woods east of Building 610. The oil reportedly flowed east along a small drainage ditch to a fence which marks the "Gamma Field." The oil ponded in the low area, and subsequently was collected with recovery pumps. A bulldozer was used to limit the spread of the oil.

AOC 6 - RECLAMATION FACILITY BUILDING 650 SUMP AND SUMP OUTFALL AREA
The Reclamation Facility (Building 650) was constructed for decontamination of radiologically contaminated clothing and heavy equipment. As a result, Building 650 was designed to perform wash

operations both outside and inside the building. These operations date back to at least 1959, with the construction of USTs #650-1 and -2, in 1962 and Tanks 650-3 and -4 in 1972. The structural integrity of the tanks had never been tested. At present, Building 650 is not used as a decontamination facility, but is still used by BNL as a laundry facility.

In the past, all soiled laundry from BNL was delivered to Building 650, where potentially radioactive laundry was segregated from routine laundry. Contaminated laundry was cleaned with dedicated equipment and the residual washwater remained in two 2,000 gallon USTs (650#-1 and -2) until its radioactivity could be monitored. These tanks were located on the north side of the building. The contents of the tanks are classified as D-waste, defined by BNL as waste with a gross beta concentration greater than 90 pico Curies/milliliter (pCi/ml). The liquid waste was emptied from the tanks about three times a year and taken to the Waste Concentration Facility (WCF) by a tank truck. Approximately six drums of sludge were removed from the tanks in 1983.

Building 650 also served as a decontamination facility for equipment contaminated with radioactivity. Equipment was steam-cleaned on a 30 foot by 30 foot concrete pad behind the north side of the building. This decontamination pad was in use by 1959, but the date of its initial operation is not known. Contaminated water ran down into a drum in the middle of a sloping pad, known as the Building 650 Sump. It was presumed that the effluent was piped into the sanitary sewer system or into holding tanks. Rinse water that was deemed to be excessively contaminated was supposed to be routed to two 2,000 gallon USTs (#650-1 and -2), designated for D-waste. Typically, however, the water was deemed clean enough to be routed to two 3,000 gallon USTs (#650-3 and -4), adjacent to Tanks 1 and 2, and designed for F-waste containment. BNL defines F-waste as waste with a gross beta concentration less than 90 pico Curies/milliliter (pCi/ml). The contents of these tanks were emptied about twice a year; the waste was discharged to the Sewage Treatment Plant (STP). The laundry facility and the decontamination pad area are the only known sources of D and F-waste delivered to the four tanks at Building 650.

The USTs (#650-1,-2,-3, and -4) are included under AOC 12 and were removed under Removal Action II, the UST Removal Action, during the summer of 1994.

Building 650 and the Sump Outfall Area were identified during aerial radiological surveys of BNL conducted in 1980, 1983, and 1990. Thus, Building 650 is also included as subAOC 16 under the Aerial Radioactive Monitoring System Results and was inadvertently included under OU 2/7. The investigations under OU 4 satisfy all IAG activities for this AOC.

In late 1969, five curies of tritium were accidentally released into the sanitary sewer system, via the Building 650 Sump. However, this tritium was not detected at the STP. An investigation into the incident revealed that the drainage pipe from the outdoor concrete pad behind Building 650 led to a natural depression in a wooded area about 800 feet northeast of Building 650, rather than to either the sanitary sewer system or to a waste holding tank, as had been assumed. The practice of washing radioactive equipment on the concrete pad was discontinued after the 1969 incident. The natural wooded depression is referred to as the Building 650 Sump Outfall Area; the area of radiological soil contamination is approximately 90 feet by 90 feet.

AOC 21 - SANITARY AND STORM SEWER LINES

The sanitary and storm sewer lines at BNL date back as far as 1917. Major repairs were made in 1940. Additional modifications have extended the sewer system to 31 miles. Many of the sewer and storm lines are composed of vitrified clay tile pipe and have undoubtedly developed cracks. In the region containing the 1977 Oil/Solvent Spill and Leaching Pit, there are approximately 1,300 feet of sanitary sewer line.

The sanitary sewer main (a 20 inch diameter tile line) transports effluent to the STP located to the north of OU 4. Lines carrying storm water in the vicinity of the CSF (south of Temple Place) discharge into a wooded area east of the CSF. The main 20 inch sanitary sewer line divides into two lines approximately 80 feet south of Tank 3. The 20 inch tile sewer line connects with Building 610, passing beneath the valve house and pumping house and then continues east along the south side of Building 610. A large 21 inch diameter line, constructed of polyvinylchloride (PVC), runs east for approximately 100 feet off the sewer main, and then continues to the northeast, passing between the locations of the Former Leaching Pit and the 1977 Oil/Solvent Spill. A third line, 6 inches in diameter, is connected to the main line at the point of division and serves Building 529.

A single sewer line runs east-west between Cornell Avenue and Building 650; it is an 8 inch line, constructed of tile. It connects to the 20 inch main east of the CSF near Building 528.

Storm water from Cornell Avenue and water from several outlets at Building 650, as well as the Building 650 decontamination pad, are directed to the Building 650 Sump Outfall area, via a 15-inch line.

The structural integrity of the sanitary sewer lines is known to be compromised by fractures and slippage along joints in portions of the line beneath OU 4. To address the type and extent of damage, a video camera survey of the sanitary sewer main was made in 1988. The structural integrity of the 15-inch diameter storm sewer line connecting the Building 650 Sump to the Building 650 Sump Outfall

Area was not known before the remedial investigation (RI) for OU 4.

Sub-AOC 24D - BASIN HO

Basin HO is located approximately 250 feet northeast of the Reclamation Building 650 Sump Outfall. Basin HO is the largest of five recharge basins at BNL, discharging to the water table aquifer approximately 48 percent or 1,530,000 gallons daily of all of the water that BNL uses for non-contact cooling and related purposes. Basin HO actually is two adjacent basins constructed of native material (sand and gravel) on 3.9 acres.

Since 1958, most of the water discharged to Basin HO, approximately 1,374,000 gallons per day, is single-use, non-contact cooling and process water from the Alternating Gradient Synchrotron (AGS). Water from the High Flux Beam Reactor (HFBR) also has been discharged to Basin HO since 1978. The remainder of the water (approximately 156,000 gallons per day) is multi-cycle blowdown water from the HFBR's secondary cooling system. These discharges are permitted by NYSDEC under BNL's State Pollutant Discharge Elimination System (SPDES) permit.

Water used for cooling and related processes is derived from process/potable supply wells for the entire operation of Basin HO. Poly-electrolytes and dispersant is added to the AGS cooling and process water to keep the ambient iron in solution. To control corrosion and deposition of precipitant, water at the HFBR towers was treated with inorganic polyphosphate (PO4) and benzotriazole before 1982. Since then, the HFBR water has been treated with mercaptobenzothiozene.

Environmental monitoring at Basin HO consisted of sampling the surface water at the Basin HO Outfall 003 from 1985 to 1989. No sediment, soil, or groundwater samples were ever collected in Basin Ho before the RI for OU 4.

Enforcement Activities

In 1980, the BNL site was placed on NYSDEC's Inactive Hazardous Waste Sites list. On December 21, 1989, the BNL site was included on the EPA's National Priorities List (NPL). Subsequently, the EPA, NYSDEC, and DOE entered into a Federal Facilities Agreement (herein referred to as the IAG) that became effective in May 1992 (Administrative Docket Number: II-CERCLA-FFA-00201). The IAG identified AOCs that were grouped into the five OUs to be evaluated for response actions at the BNL site. The IAG requires the conduct of a RI/FS for OU 4, pursuant to 42 U.S.C. 9601 et. seq., to meet Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) requirements. The IAG also requires the conduct of cleanup actions to address identified concerns. In accordance with June 1994 DOE Secretarial policy on National Environmental Policy Act (NEPA), this CERCLA document (ROD 3/25/96) incorporates NEPA values such as analysis of cumulative, off-site and ecological impacts to the maximum extent practicable. The IAG identified AOC 5, CSF, for a RI/FS and provided a schedule for near-term work. A BNL Response Strategy Document (RSD) was written pursuant to the IAG which grouped AOC 5 with AOCs 6, 15, 21, and 24-D and prioritized OU 4 as the first OU for RI/FS.

Remediation at the BNL site will be conducted under CERCLA, as amended by the Superfund Amendment and Reauthorization Act of 1986 (SARA), and the National Contingency Plan (NCP), 40 CFR Part 300.

Following the issuance of the ROD for the last of the five OUs, the necessity of a final assessment from a site-wide perspective will be determined to ensure that ongoing or planned remedial actions identified in the ROD for the five OUs will provide a comprehensive remedy for the BNL site which is protective of human health and the environment.

Community Participation

A Community Relations Plan was finalized for the BNL site in September 1991. An Administrative Record, documenting the basis for the selection of removal and remedial actions at the BNL site, has been established and is maintained at the local libraries and at EPA's Region II Administrative Records Room.

A public notice was published in "Newsday" and "Suffolk Life" announcing the availability of the OU 4 FS/Proposed Remedial Action Pland (PRAP) for review and comment. A 30-day public comment period was held beginning November 22, 1995. A public meetiing was held at BNL on December 6, 1995.Brookhaven National Laboratory (BNL) is a federal facility owned by the Department of Energy (DOE) and operated by the Associated Universities, Inc. (AUI), a not-for-profit consortium of nine universities. The mission of BNL is to provide exceptional research facilities for training and research in the diverse fields of science, and to meet the appropriate needs and interests of the educational, governmental, and industrial research institutions. Located about 60 miles east of New York City, BNL is in Upton, Suffolk County, New York, near the geographic center of Long Island.

The BNL property is an irregular polygon that is roughly square, and each side is approximately 2.5 miles long. The site consists of 5,321 acres. The developed portion includes the principal facilities located near the center of the site, on relatively high ground. These facilities are contained in an area of approximately 900 acres, 500 acres of which were originally developed for Army use. The remaining 400 acres are occupied for the most part by various large research machine facilities. Outlying facilities occupy approximately 550 acres and include an apartment area, biology field, Hazardous Waste Management Area, Sewage Treatment Plant (STP), fire breaks, and the Landfill Area.

The BNL site, formerly Camp Upton, was occupied by the United States Army during World Wars I and II. Between the wars, the Civilian Conservation Corps operated the site. It was transferred to the Atomic Energy Commission in 1947, to the Energy Research and Development Administration in 1975, and to the Department of Energy (DOE) in 1977.

In 1980 the BNL site was placed on New York State's Department of Environmental Conservation (NYSDEC) list of Inactive Hazardous Waste Sites. In December 1989, the BNL site was included on the Environmental Protection Agency's (EPA's) National Priorities List because of soil and groundwater contamination that resulted from BNL's past operations. Subsequently,the EPA, NYSDEC, and DOE entered into a Federal Facilities Agreement to coordinate cleanup activities.

The aquifer beneath BNL is comprised of three water bearing units. These three water-bearing units are designated as a "sole source aquifer" by the EPA and serve as the primary drinking water source for Nassau and Suffolk Counties.

To allow effective management of the BNL site, the 29 Areas of Concern (AOCs) have been divided into six Operable Units (OUs).

OU1:

Operable Unit (OU) 1:

OU1 is a relatively undeveloped 950-acre area in the southeastern part of the site. It includes historical waste handling areas, such as the Former and Current Landfills (Areas of Concern (AOCs) 2 and 3), and the Former Hazardous Waste Management Facility (AOC1). It also includes the Ash Pit (AOC 2F) and two recharge basins (AOCs 24E and 24F). OU1 contains six areas covered by accelerated removal actions: the Current and Former Landfills, Chemical/Animal Pits and Glass Holes, the Interim Landfill, the Slit Trench and Groundwater.

A Record of Decision (ROD) addressing OU1 was completed in September 1999.

OU2/7:

OU2/7 consists of several AOCs located in the developed central portion of the site. It includes contaminated soils and out-of-service underground storage tanks and pipelines proposed for removal at the Waste Concentration Facility (AOC 10), along with various isolated areas of contaminated surface soils (AOC 16, 17, 18). It also includes the BLIP facility (AOC16K).

OU3:

OU3 contains the south central and developed portions of the site.

This operable unit contains most of the site's contaminated groundwater.

OU 4:
OU4 is located on the east-central edge of the developed portion of the site. OU 4 encompasses the Central Steam Facility (CSF), otherwise known as AOC 5, Reclamation Facility Building 650 Sump and Reclamation Facility Building 650 Sump Outfall (AOC 6), Leaking Sewer Lines (AOC 21), and Recharge Basin HO (AOC 24-D). The CSF is located between North Sixth Street, Seventh Road, Brookhaven Avenue, and Cornell Street, and consists of approximately 13 acres, divided equally between developed and undeveloped land. The Building 650 Sump is approximately 100 feet north of Cornell Avenue. The Building 650 Sump Outfall is located approximately 800 feet northeast of Building 650 and consists of a natural depression, approximately 90 feet x 90 feet, bounded by dirt roads. The leaking sewer lines are located south of Building 610; Recharge Basin HO is located approximately 250 feet to the northeast of the Building 650 Sump Outfall area. A ROD addressing OU4 was completed in March 1996.

OU5:
OU5 is located in the northeast portion of the site and includes the Sewage Treatment Plant (AOC 4) and releases to the Peconic River.

OU6:
OU6 is located on the southeastern edge of the site. It is a largely wooded area which contains various agricultural research fields and human made experimental basins (AOC8). No contaminated soils of concern have been found in this operable unit, however, contaminated sediments in two of the human made basins pose an ecological risk to the Tiger Salamander. Ethylene dibromide, a pesticide, has been found in groundwater south of BNL's southern boundary.

Remedy: The selected remedy involves excavation and off-site disposal of soils above cleanup goals, institutional controls and long-term monitoring. Major components of the remedy are discussed below.

Radiologically and chemically contaminated soils and sediments above the cleanup goals will be excavated from Areas of Concern (AOCs) 1, 6, 10, 16, 17 and 18. Wetlands at the former hazardous waste management facility (AOC 1) will be reconstructed. Soils and sediments will be disposed of off-site at a permitted facility. Post remediation sampling and dose assessments will also be performed to ensure that the cleanup goals are met.

Out-of-service underground storage tanks and associated piping, the D Tanks pad area at the Waste Construction Facility (AOC 10), and out-of-service equipment and facilities at the former hazardous waste management facility (AOC 1) will be removed. Disposal options will be determined during design and will be in compliance with federal and state requirements.

Post remediation monitoring and institutional controls of residual contamination will also be performed in accordance with a Long-term Monitoring and Maintenance Plan. This Plan will ensure that land uses remain protective of public health and the environment.

A 12 inch soil cap will be installed at the Ash Pit (AOC 2F) to address metal contamination. Institutional controls, monitoring and maintenance of the soil cap will occur to limit access to the site and prevent erosion to the soil cap. Recreational and residential uses will be prohibited.

Chemically contaminated sediments from the two eastern basins at the Upland Recharge/Meadow Marsh Area (AOC 8) which serve as breeding grounds for the Tiger Salamander will be excavated, processed if needed to meet disposal facility waste acceptance criteria and disposed of off-site. The excavated wetland areas will be reconstructed. Ecological monitoring will also be performed.

Operation and monitoring of Recharge Basin HS and the Weaver Drive Recharge Basin HW (AOCs 24E and 24F) will continue in accordance with Brookhaven National Lab's State Pollutant Discharge Elimination System (SPDES) permit. A Tiger Salamander Habitat Management Plan will detail the routine maintenance required at the basins to reduce impacts to the Tiger Salamander. Annual monitoring of surface water and sediments will be conducted at the Wooded Wetland to ensure that the cap at the Current Landfill remains effective in preventing leachate from contaminating this wetland area.

In addition, several removal actions that have either been completed or are ongoing are being selected as final remedies.

Geomembrane caps were placed on the Current Landfill (AOC 3), Former Landfill (AOC 2A), Interim Landfill (AOC 2D) and Slit Trench (AOC 2E). Inspections, monitoring and maintenance are underway in accordance with approved Operations and Maintenance Manuals. Institutional controls will also be maintained to prevent activities that may compromise the geomembrane caps.

One drum of soil containing cesium-137 above cleanup goals from the National Weather Service soil stockpile (AOC 16S) was segregated and will be disposed of off-site. The remaining soil was used as grading material for the Former Landfill cap.

Buried chemical and radiological wastes and soils above cleanup goals were excavated from the Chemical/Animal Pits (AOC 2B) and Glass Holes (AOC 2C). Soil samples collected at each pit location demonstrated that cleanup goals were met. Off-site disposal of the excavated materials is underway.

A pump-and-treat system was installed at Brookhaven National Lab's southern boundary to treat on-site Volatile Organic Compounds in the groundwater from the Current Landfill (AOC 3) and the former hazardous waste management facility (AOC 1). In addition, institutional controls will be maintained to prevent the installation of drinking water wells into contaminated groundwater and to prevent the installation of supply or other pumping wells that may mobilize remaining contaminants or otherwise interfere with the cleanup.

Estimated Capital Cost: $50,461,000
Estimated Annual O&M Costs: Not Provided
Estimated Present Worth Costs: Not Provided

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

PB99-963805
EPA541-R99-082
1999

EPA Superfund
Record of Decision:

Brookhaven National Laboratory (USDOE)
OU 1
Upton, NY
9/16/1999

RECORD OF DECISION

OPERABLE UNIT I
AND RADIOLOGICALLY CONTAMINATED SOILS
(INCLUDING AREAS OF CONCERN 6, 8, 10, 16, 17, and 18)

U. S. DEPARTMENT OF ENERGY

BROOKHAVEN NATIONAL LABORATORY

AUGUST 25, 1999

Prepared by

Brookhaven National Laboratory
Environmental Restoration Division
Upton, NY 11973

for

U.S. Department of Energy
Brookhaven Group
Upton, NY 11973

U. S. DEPARTMENT OF ENERGY

BROOKHAVEN NATIONAL LABORATORY

RECORD OF DECISION

OPERABLE UNIT I
AND RADIOLOGICALLY CONTAMINATED SOILS
(INCLUDING AREAS OF CONCERN 6, 8, 10, 16, 17, and 18)

I. DECLARATION OF THE RECORD OF DECISION

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SITE NAME AND LOCATION

BROOKHAVEN NATIONAL LABORATORY
OPERABLE UNIT I
AND RADIOLOGICALLY CONTAMINATED SOILS
(INCLUDING AREAS OF CONCERN 6, 8, 10, 16, 17, and 18)

BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK 11973

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial actions for Operable Unit I, other Areas of Concern (AOCs) with radiologically contaminated soils and wetland areas with contaminated sediments at the Brookhaven National Laboratory (BNL) site in Upton, New York. It also serves as documentation for the final remedy for removal actions that either have been completed or are ongoing.

These remedial actions were selected in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (hereinafter jointly referred to as CERCLA), and is consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (National Contingency Plan), to the extent practicable. This decision is based on the Administrative Record for the BNL site. The State of New York concurs with the selected remedial actions.

ASSESSMENT OF THE SITE

Actual or potential releases of hazardous substances including chemical and radioactive materials from these areas may present a threat to public health, welfare, or the environment if they are not addressed by implementing the response actions selected in this Record of Decision.

DESCRIPTION OF THE SELECTED REMEDIES

Operable Unit I is one of the six Operable Units at the BNL site. Operable Unit I includes areas (AOCs 1,2,3, 24E and 24F) where waste was historically managed or disposed of at the site. The main remaining problem is radiologically contaminated soils and sediment. Remedies for other Operable Units are, or will be, selected in other Records of Decisions. This Record of Decision documents remedies which are consistent with the overall site cleanup strategy. Remedies have been identified for areas containing radiologically contaminated soils and sediments, and several other minor Areas of Concern. Removal actions for some Areas of Concern in Operable Unit I were taken to stabilize environmental problems and accelerate cleanup. These removal actions are adopted as final actions. The Record of Decision includes a description of principal contaminants and their representative risks. Cleanup goals have been established to meet regulatory standards and risk based objectives based on current and future land uses, and are included in this Record of Decision. The costs for each remedy have been estimated and are also included in this Record of Decision.

The major components of the selected remedies are:

- Excavation and off-site disposal of radioiogically and chemically contaminated soils and sediments above the selected cleanup goals at AOCs 1, 6, 10, 16, 17 and 18. This is Alternative 4 for radiologically contaminated soils. Wetlands at the Former Hazardous Waste Management Facility (AOC 1) will be reconstructed. An As-Low-As-Reasonably-Achievable (ALARA) analysis will be performed during the remedial design to identify cost effective measures for further inducing exposure to residual contamination below cleanup goals. Techniques which minimize waste volumes or further stabilize wastes to meet disposal facility waste acceptance criteria may also be identified during remedial design. Post remediation sampling and dose assessments will be performed to ensure that cleanup goals are met for any remaining contaminants.

- Removal of out-of-service facilities, tanks, piping and equipment from the Former Hazardous Waste Management Facility (AOC 1) and the Waste Concentration Facility (AOC 10).

- Installation of a soil cap in accordance with EPA guidance for lead contaminated soil to address metal contamination at the Ash Pit (AOC 2F). This is Alternative 2 for the Ash Pit.

- Excavation and off-site disposal of chemically contaminated sediments from the two eastern basins at the Upland Recharge/Meadow Marsh Area (AOC 8). The excavated wetland areas will be reconstructed and ecological monitoring will be performed. This is Alternative 3 for the Upland Recharge/Meadow Marsh area.

- Continued operation and monitoring of Recharge Basin HS and the Weaver Drive Recharge Basin HW (AOCs 24 E and 24F) in accordance with BNL's State Pollutant Discharge Elimination System (SPDES) permit. A Tiger Salamander Habitat Management Plan will detail the routine maintenance required at the basins to reduce impacts to the Tiger Salamanders. Annual monitoring of surface water and sediments will be conducted at the Wooded Wetland.

- Long-term institutional controls and monitoring will occur to ensure that planned uses are protective of public health. In addition, any sale or transfer of BNL property will meet the requirements of 120(h) of CERCLA to ensure that future users are not exposed to unacceptable levels of contamination.

In addition, several removal actions that either have been completed or are ongoing are being selected as final remedies. Each was selected in an Action Memorandum and subject to public participation.

- The Current Landfill (AOC3), Former Landfill (AOC 2A), Interim Landfill (AOC 2D) and Slit Trench (AOC 2E) were capped in accordance with New York State regulations. Institutional controls, inspections, monitoring and maintenance are underway.

- Buried chemical and radiological wastes and soils above cleanup goals were excavated from the Chemical/Animal Pits (AOC 2B) and Glass Holes (AOC 2C). Off-site disposal of the excavated materials is underway.

- A pump-and-treat system was installed at BNL's southern boundary to treat Volatile Organic Compounds in the groundwater from the Current Landfill and the Former Hazardous Waste Management Facility. This system became operational in December 1996 and will continue until performance objectives are met.

Groundwater contamination associated with the Former Landfill Area (AOC 2) and off-site groundwater associated with other Operable Unit I AOCs will be addressed in the Operable Unit III Record of Decision. An evaluation of remedial alternatives for contaminated soil and groundwater associated with the Brookhaven Linear Accelerator Isotope Producer (BLIP) facility (AOC 16K) is underway. The final remedy for this AOC will be documented in a subsequent Record of Decision.

DECLARATION

The selected remedies are protective of human health and the environment, comply with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and are cost-effective. These remedies use permanent solutions and alternative treatment technologies to the maximum extent practical for this site. However, because treatment of the principal threats of the site associated with radiologically contaminated soils was not found to be practical, these remedies do not satisfy the statutory preference for treatment as a principal element.

Since these remedies will result in hazardous substances remaining on-site above health-based levels for unrestricted use, a review will be conducted every five years after the commencement of remedial action to ensure that the remedies continue to provide adequate protection of human health and the environment.

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Manager, Brookhaven Group
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8/12/99
Date

Robert P. Gordon
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8-12-99
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9-16-99
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ALARA	As Low As Reasonably Achievable
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
BLIP	Brookhaven LINAC Isotope Producer
BNL	Brookhaven National Laboratory
CERCLA	Comprehensive Environmental Response Compensation & Liability Act
DOE	United States Department of Energy
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
HWMF	Hazardous Waste Management Facility
IAG	Interagency Agreement
MCL	Maximum Contaminant Level
mg/kg	Milligrams per kilogram
mrem/yr	Milli rem per year (rem is a measure of human exposure to radiation)
NEPA	National Environmental Policy Act
NYCRR	New York State Codes, Rules and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenols
PCE	Tetrachloroethene
pCi/g	Picocuries per gram
pCi/l	Picocuries per liter
RCRA	Resource Conservation and Recovery Act
RESRAD	Residual Radioactive Material Guideline Computer Code
SCDHS	Suffolk County Department of Health Services
SPDES	State Pollutant Discharge Elimination System
SVOC	Semi-Volatile Organic Compound
TAGM	NYSDEC Technical Assistance Guidance Memorandum
TBC	To Be Considered
TCA	1,1,1-trichloroethane
TCE	Trichloroethane
ug/l	Micrograms per liter
VOC	Volatile Organic Compound

U. S. DEPARTMENT OF ENERGY

BROOKHAVEN NATIONAL LABORATORY

RECORD OF DECISION

OPERABLE UNIT I
AND RADIOLOGICALLY CONTAMINATED SOILS
(INCLUDING AREAS OF CONCERN 6, 8, 10, 16, 17, and 18)

II. DECISION SUMMARY

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1. SITE NAME, LOCATION, AND DESCRIPTION

Brookhaven National Laboratory (BNL) is a federal facility owned by the U.S. Department of Energy (DOE). BNL-conducts research in physical, biomedical-and environmental-sciences, and energy technologies.

BNL is located in Upton, Suffolk County, New York, about 60 miles east of New York City, near the geographic center of Long Island (Figure 1). The following are the distances to neighboring communities from BNL: Patchogue 10 miles west-southwest, Bellport 8 miles southwest; Center Moriches 7 miles southeast; Riverhead, 13 miles east; Wading River, 7 miles north-northeast; and, Port Jefferson, 11 miles northwest.

The BNL property, consisting of 5,320 acres, is an irregular polygon, each side approximately 2.5 miles long. The developed portion includes the principal facilities located near the center of the site, on relatively high ground. These facilities are in an area of approximately 900 acres, 500 acres of which were originally developed for the Army's use. The remaining 400 acres are occupied, for the most part, by various large research machine facilities. Outlying facilities occupy approximately 550 acres and include an apartment area, Biology Field, Hazardous Waste Management Area, Sewage Treatment Plant, fire breaks, and the Landfill Area. The terrain is gently rolling, with elevations varying between 40 to 120 feet above sea level. The land lies on the western rim of the shallow Peconic River watershed, with a tributary of the river rising in marshy areas in the northern section of the tract.

The sole-source aquifer beneath BNL encompasses three water-bearing units: the glacial moraine and outwash deposits, the Magothy Formation, and the Lloyd Sand Member of the Raritan Formation. These units are hydraulically connected and make up a single zone of saturation with varying physical properties extending from a depth of 45-to 1,500-feet below the land surface. These three water-bearing units are designated as a "sole-source aquifer" by the U.S. Environmental Protection Agency (EPA), and serve as the primary source of drinking water for Nassau and Suffolk Counties.

To effectively manage remediation of the BNL site, 29 Areas of Concern (AOCs) were identified and divided into discrete groups called Operable Units (OUs), and Removal Action Areas of Concern. The BNL site is divided into six Operable Units (Table 1).

This Record of Decision addresses OU I and areas of concern 6, 8, 10, 16, 17, and 18 as shown in Figures 2 through 5. These areas contain radiologically contaminated soils; an ash pit, the Recharge Basin HS and the Weaver Drive Recharge Basin HW, the Upland Recharge/Meadow Marsh and the Wooded Wetland, and areas of concern that have been, or are being addressed as removal actions.

2. SITE HISTORY AND ENFORCEMENT ACTIONS

The BNL site, formerly Camp Upton, was occupied by the U.S. Army during World Wars I and II. Between the wars, the site was operated by the Civilian Conservation Corps. It was transferred to the Atomic Energy Commission in 1947, to the Energy Research and Development Administration in 1975, and to DOE in 1977.

In 1980, the BNL site was placed on New York State's Department of Environmental Conservation (NYSDEC) list of Inactive Hazardous Waste Sites. On December 21, 1989, the BNL site was included on EPA's National Priorities List because of soil and groundwater contamination that resulted from BNL's past operations. Subsequently, the EPA, NYSDEC, and DOE entered into a Federal Facilities Agreement (herein referred to as the IAG) that became effective in May, 1992 (Administrative Docket Number: II-CERCLA-FFA-00201) to coordinate cleanup activities. The IAG identified areas of concern that were subsequently grouped into Operable Units to be evaluated for response actions. The IAG requires a remedial investigation/feasibility study for OU 1, pursuant to 42 U.S.C. 9601 et. seq., to meet CERCLA requirements. The IAG also requires cleanup actions to address the identified concerns. Cleanup actions at the BNL site will be conducted pursuant to CERCLA, 40 CFR Part 300.

BNL's Response Strategy Document (SAIC, 1992) grouped the identified areas of concern into seven Operable Units. Several Operable Units were subsequently combined. Remedial investigations (CDM Federal 1996a; IT 1999) and risk assessments were conducted to evaluate the nature and extent of contamination, and the potential risks associated with the areas of concern addressed in this Record of Decision. A Feasibility Study (CDM Federal 1999) was prepared to evaluate the alternatives for remediating the radiologically contaminated soils and other areas of concern addressed in this Record of Decision. In addition, several accelerated cleanup actions were taken as discussed in Section 2.3, and an interim action was taken at the Building 650 Sump Outfall Area. The Sump Outfall Area was fenced off to prevent unnecessary access.

2.1 Radiological Contaminated Soil Sites

There are several areas throughout the BNL site where the soil has become contaminated with radionuclides from past waste handling operations, spills, or inadvertent use of contaminated soils for landscaping (Figure 4). The majority of the radioactively contaminated soils are located at the former Hazardous Waste Management Facility. These areas are discussed in Table 2.

2.2 Other Areas of Concern

There are five other areas of concern that are being addressed by this Record of Decision. They are the Upland Recharge/Meadow Marsh Area, Recharge Basin HS and the Weaver Drive Recharge Basin HW and Weaver Drive Recharge Basin, Ash Pit, and the Wooded Wetland. A discussion of these areas is presented in Table 2.

2.3 Removal Actions

DOE determined that accelerated cleanup actions, called removal actions, were required for several areas of concern. The potential removal actions were evaluated in Engineering Evaluation/Cost Analysis Reports that were prepared pursuant to CERCLA (CDM, 1995a; CDM, 1995b; and CDM, 1997a). These reports were made available for public review and were approved by the regulatory agencies. The removal actions selected, after considering public comments, were documented in Action Memoranda (BNL, 1994; BNL, 1996; BNL, 1997).

Several landfill areas of concern were capped to prevent the migration of contaminations. A geomembrane cap, constructed pursuant to 6 NYCRR Part 360, was placed over the Current Landfill, Former Landfill, Slit Trench and Interim Landfill. Construction of the cap was completed in November, 1995 at the Current Landfill; in October, 1996 at the Former Landfill and Slit Trench; and in November 1997 at the Interim Landfill. Details are documented in the construction certification reports (CDM, 1996b; Weston, 1997; and Grosser, 1997). The National Weather Service's soil stockpile was used as fill on the Former Landfill before placement of the cap. A 55-gallon drum containing soil with levels of radionuclides greater than cleanup levels is stored at the former HWMF awaiting off-site disposal.

Contaminated soil, debris, animal remains, laboratory equipment, and intact chemical bottles were excavated and segregated for treatment and/or disposal from the Chemical/Animals Pits and Glass Holes. Soil samples were taken at each pit to ensure that all hazardous materials were removed and cleanup levels were met.

Several actions are being taken to address groundwater contamination resulting from waste-disposal activities at the former HWMF and the Current Landfill. A groundwater pump- and-treat system was installed in December 1996 at BNL's southern boundary to extract and treat on-site groundwater contaminated with Volatile Organic Compounds (VOCs) downgradient of OU I source areas. The groundwater is recharged upgradient into a recharge basin. Groundwater in this area is being monitored. Institutional controls will prevent supply wells or other pumping wells being installed that may mobilize remaining contaminants or otherwise interfere with the remedial actions. Groundwater contamination associated with the Former Landfill, and contaminated groundwater that has migrated off-site will be addressed in the remedies for Operable Unit III.

These removal actions are being adopted as final actions in this Record of Decision. They will be monitored and maintained.

3. HIGHLIGHTS OF COMMUNITY PARTICIPATION

A Community Relations Plan was finalized for the BNL site in September, 1991. In accordance with this plan and CERCLA Sections 113 (k) (2)(B)(I-v) and 117, the community relations program focused on public information and involvement. A variety of activities provide information and seek public participation, including, a stakeholders' mailing list, community meetings, availability sessions, site tours, workshops, and fact sheets. An Administrative Record was established, documenting the basis for selecting the removal and remedial actions at the BNL site, and it is maintained at the local libraries listed below. These libraries also maintain current site-reports, press releases, and fact sheets.

Longwood Public Library
800 Middle Country Road
Middle Island, NY 11953

Mastics-Moriches-Shirley Community Library
301 William Floyd Parkway
Shirley, NY 11967

Brookhaven National Laboratory
Research Library
Bldg. 477A
Upton, NY 11973

The Administrative Record also is kept at EPA's Region II Administrative Records Room, 290 Broadway New York, NY, 10007-1866.

Consistent with CERCLA guidance and state requirements, community involvement and participation was solicited for all significant documents and decisions associated with this Record of Decision. The final scope of work, the work plan, quality assurance plan, the engineering evaluation/cost analysis documents for the removal actions, risk-assessment documents, remedial investigation reports, the proposed plan, and the feasibility study were made available for public review.

The latest community involvement activities included the review of the OU I Feasibility Study (CDM, 1999a) and Proposed Plan (BNL, 1999). In April 1999, a public notice was published in Newsday and Suffolk Life announcing the availability for review and comment of the OU I Feasibility Study and Proposed Plan, dates of information sessions, and a public meeting date. A Press Release also was issued. Public comment began April 1, 1999 and ended on April 30,1999. A mailing was sent to the Community Involvement mailing list (2300 homes) which included a fact sheet on the Feasibility Study and Proposed Plan and a copy of the public notice. Information sessions were held on April 13, 1999 and April 14, 1999, and a public meeting was held on April 22, 1999. An article about OU I was published in BNL's quarterly newsletter cleanupdate in December, 1999, and an article was published in the Brookhaven Bulletin in April 1999. Display advertisements listing the dates of the public comment period, information sessions, and the public meeting were placed in Suffolk Life and Newsday.

4. SCOPE AND ROLE OF OPERABLE UNIT AND RESPONSE ACTION

To adequately evaluate existing and potential environmental problems at BNL, the 29 areas of concern were grouped into six Operable Units. The scope of these Operable Units is shown in Table 1. The Operable Units were established under the Response Strategy Document (SAIC, 1992) based on six criteria: (1) relative proximity of the areas of concern, (2) similar problems, (3) similar phases of action or sets of actions, (4) simultaneous actions, (5) absence of interference with future actions, and (6) similar geology and hydrology.

This Record of Decision selects remedial actions for OU I and areas of concern 6, 8, 10, 16, 17, and 18. Radiologically contaminated soil is the principal threat addressed. The majority of the radiologically contaminated, soil containing the highest contaminant levels is located at the former HWMF. Radiologically contaminated soil poses a risk to human health and ecological receptors from exposure to waste-site contaminants and from the potential for contaminants to migrate to surface water, wetlands, and groundwater.

The Upland Recharge/Meadow Marsh Area requires action to address the potential threat to the Tiger Salamander from chemical contaminants (i.e. metals) in these areas. The Tiger Salamander is a New York State endangered species. The Wooded Wetland will be monitored to assure that remnant contaminants from the Current Landfill will not contaminate the wetland. The principal threat at the Ash Pit is human exposure to lead in soil.

The completed and ongoing removal actions address on-site Volatile Organic Compounds in groundwater and buried wastes in landfills. Groundwater contamination associated with the Former Landfill Area (AOC 2) and off-site groundwater associated with other Operable Unit I AOCs will be addressed in the Operable Unit III Record of Decision.

Conducting this remedial action under OU I is part of BNL's overall response strategy and is expected to be consistent with any planned future actions and actions taken at the other Operable Units, which are at different phases of the CERCLA process.

5. SUMMARY OF SITE CHARACTERISTICS

The following sections summarize the site characteristics of the various areas of concern addressed by this Record of Decision. Various investigations were undertaken to evaluate the nature and extent of contamination. A combination of investigation approaches were utilized including (1) radiation surveys, (2) soil-vapor surveys, (3) soil borings/soil sampling, (4) monitoring well installation and groundwater sampling, (5) groundwater modeling, (6) sediment/surface water sampling, and (9) geophysical investigations. The areas investigated were the landfills, Ash Pit, Chemical/Animal Pits and Glass Holes, the former Hazardous Waste Management Facility, the Waste Concentration Facility, Reclamation Facility and other areas of concern. Information on the site's characteristics also was obtained through implementing of the various removal actions.

5.1 Radiologically Contaminated Soils

The former Hazardous Waste Management Facility Area of Concern contains the majority of the radioactively contaminated soil. The soil became contaminated with radionuclides and mercury due to several spills of hazardous and radioactive materials during operations at the facility. The predominant radionuclide found is cesium-137, which emits beta- and gamma-radiation, and is the primary source of risk from direct exposure. Strontium-90, which emits beta radiation, also is present. Both radionuclides are relatively short-lived, with half-lives of' 30-and 28-years, respectively. The maximum levels detected during remedial investigations was 810,000 picocuries per gram (pCi/g) for cesium- 137, and 1,300 pCi/g for strontium-90.

Most of the contamination in this area is at, or near, the surface, although in some locations it extends to 12 feet below the surface. Approximately 35,000 cubic yards of contaminated soil is anticipated to require remediation at the former Hazardous Waste Management Facility out of a total of' 39,500 cubic yards for all radiologically contaminated sites. Figure 6 illustrates the principal areas of surface contamination, and relative concentrations within the facility, based on radiation surveys and surface-soil sampling. There is no significant widespread chemical contamination of soil within the former Hazardous Waste Management Facility, except for isolated locations where low concentrations of mercury of 184 mg/kg (maximum concentration), lead (maximum concentration of 429 mg/kg) and other metals were detected. Mercury and lead are the only chemical constituents present that require remedial action.

Radiological contaminated surface soils also were found at several locations throughout the site (AOC 16, 17, and 18). The contamination resulted from the use, handling, and storage of activated materials or the use of slightly contaminated landscaping soil. Soils contaminated with low levels of radionuclides from the former Hazardous Waste Management Facility were inadvertently used as landscaping material outside several buildings. The dominant radionuclide found in these locations is cesium- 137, with a maximum concentration of 348 pCi/g at AOC 16E (near building 490). One area (AOC 16 S.3) contained elevated lead at 2,310 mg/kg.

The soils at the Waste Concentration Facility became contaminated with radionuclides as a result of leaks from a tank. The primary contaminants are cesium-137, with a maximum concentration of 1,486 pCi/g and strontium-90 with a maximum concentration of 454 pCi/g. Radionuclides were detected in soil samples to a depth of 12 feet. There are no chemical constituents present that require remedial action. In addition to soils, the Waste Concentration Facility includes liquid-waste transport lines and an enclosed concrete vault. The above-ground 'D' tanks have been removed in a separate removal action. However, six underground tanks containing radioactive sludge remain.

The Reclamation Facility (Building 650) was used to decontaminate radiological- contaminated clothing and equipment. Soils near this facility and the sump-outfall area have become contaminated from the activities conducted at this facility. Several radionuclides exceed the soil cleanup goals. Table 2 identifies the primary contaminants of concern and the maximum concentrations.

5.2 Other Areas of Concern

The Ash Pit, which received ash and slag from a solid-waste incinerator, contains lead above cleanup goals. Radionuclides were detected at background levels. The Upland Recharge/Meadow Marsh Area contains low levels of pesticides and metals. The Recharge Basin HS and the Weaver Drive Recharge Basin HW that receive stormwater effluent operate in accordance with a New York

State Pollution Discharge Elimination System permit. No contaminants were found at levels that would impact public health; however, Tiger Salamanders, a New York endangered species, have been found in both basins. The Wooded Wetland received drainage from the Current Landfill containing metals below levels of-concern for human health.

5.3 Removal Actions

Groundwater beneath the Current Landfill and the former HWMF is contaminated with radionuclides, Volatile Organic Compounds, and metals above maximum contaminant levels (MCLs). The currently operating pump and treat system described in Section 2 is removing the Volatile Organic Compounds. The portion of the plume that has moved off-site will be addressed in the OU III Record of Decision.

The contaminants of concern that were dealt with by capping the Current and Former Landfills are identified in the Landfills Engineering Evaluation/Cost Analysis Report (CDM, 1995a). The Chemical/Animal Pits and Glass Holes, which were excavated in 1997, contained buried wastes and low levels of solvents, metals, and radionuclides that required remediation. These areas are summarized in Table 2.

6. SUMMARY OF SITE RISKS

The risks associated with the Chemical/Animal Pits and Glass Holes were considered through Engineering Evaluation/Cost Analysis process. Risk assessments are not given for the landfill removal actions which are presumptive remedies. Risk assessments were conducted for several areas of radiologically contaminated soils, groundwater and other areas of concern.

A four-step process was used for assessing site-related human-health risks within a reasonable maximum exposure scenario:

- *Hazard Identification* - identifies the contaminants of concern based upon factors such as toxicity, frequency of occurrence, and concentration.

- *Exposure Assessment* - estimates the magnitude of actual and potential human exposures, the frequency and duration of these exposures, and the exposure pathways (e.g., external exposure from gamma radiation of contaminated soil, ingestion of contaminated well water).

- *Toxicity Assessment* - determines the types of adverse health effects associated with exposures, and the relationship between the magnitude of exposure (dose) and severity of adverse effects (response).

- *Risk Characterization* - summarizes and combines outputs of the exposure-and toxicity-assessments to quantify site-related risks.

Human health risks were evaluated for exposures to radiological and chemical contaminants of concern. The chemical Risk Assessment addressed the risk of cancer and non-carcinogenic toxicity. The health risk of concern from radionuclides is cancer. Current federal guidelines for acceptable exposures are: 1) an individual lifetime excess carcinogenic risk in the range of a one-in-ten-thousand (1 x 10^{1}) to one in-a-million (1 x 10^{6}), and 2) a maximum health Hazard Index equal to 1.0, which reflects non-carcinogenic effects. A Hazard Index greater than 1.0 indicates a potential for non-carcinocenic health effects. For radiological risks, EPA's guidance of 15 mrem/yr exposure is consistent with the acceptable risks range (EPA, 1997).

6.1 Human Health Risks

6.1.1 Identification of Contaminants of Concern

Chemicals of potential concern were selected based on procedures specified in EPA's Risk Assessment Guidance for Superfund, Part A (EPA, 1989). Contaminants evaluated in the risk assessment exceeded screening levels based on their degree of toxicity, concentration, frequency of detection, chemical properties important to potential release, transport, and exposure, and significant exposure routes. Table 2 identifies the primary contaminants of concern.

6.1.2 Assessment of Exposure

Present and potential future-use scenarios were quantitatively evaluated for the following receptor populations:

- Present Area Residents (chemical and radiological exposure to trespassers)
- Present and Future Open Space (radiological)
- Future Residents (radionuclides and chemicals)
- Present and Future Industrial Workers (radionuclides and chemicals)
- Future Construction Workers (radionuclides and chemicals).

The areas evaluated included:

- Former HWMF (chemicals)
- Building 650 Sump Outfall (radionuclides)
- Ash Pit (radionuclides and chemicals)
- Recharge Basin HS and theWeaver Drive Recharge Basin HW (radionuclides and chemicals)
- Upland Recharge/Meadow Marsh (radionuclides and chemicals)

The environmental media evaluated in the risk assessment, as applicable to specific areas, land use scenarios and exposure pathways included:

- Surface soil
- Subsurface soil
- Groundwater
- Surface Water
- Sediment

6.1.3 Assessment of Toxicity

The toxicity assessment consisted of examining the toxicological properties of selected chemicals of potential concern using the most current data on human-health effects. Many of the chemical carcinogenic slope-factors and reference doses used were obtained from EPA's Integrated Risk Information System data base. Those not available in that data base were obtained from EPA's second most current source of toxicity information, Health Effects Assessment Summary Tables. Radiological slope-factors developed by EPA were used to assess radiological risks. The potential health hazards from exposure to non-carcinogens was determined by comparing the estimated chronic or subchronic daily intake of a chemical with the risk reference dose. When toxicity values were not available for a specific chemical, its effects were qualified. Uncertainties in the toxicity data were evaluated.

6.1.4 Characterization of Chemical Risks

For carcinogenic chemical contaminants, only groundwater presented an unacceptable risk. For the OU I/VI ethylene dibromide (EDB) plume, future residential carcinogenic risks were 2.7×10^{-4} (2.7 in 10,000) for adults and 1.6×10^{-4} for children for groundwater ingestion and were largely due to ethylene dibromide. The 30-year combined risk for adults and children was 4.3×10^{-4}. For the former HWMF/Current Landfill Plume, the 30-year combined risk for adults and children for future residential ingestion was 1.6×10^{-4}. The principal risk drivers for this plume were ethylene dibromide, 1,1 -dichloroethylene, vinyl chloride, arsenic and beryllium.

For non-carcinogenic chemical contaminants in groundwater, hazard index values for adult and child ingestion of groundwater from the former HWMF/Current Landfill plume were 2.6 and 6.1 and were due primarily to manganese and thallium. The hazard index value for child ingestion of groundwater from the OU I/VI EBD plume was 1.2 and was due primarily to the presence of manganese.

Accelerated actions were taken to address these plumes. A pump-and-treat system was installed to treat VOC-contaminated groundwater from the former HWMF/Current Landfill Plume and is contained in this Record of Decision. The OU I/VI EDB plume was addressed in a separate focused feasibility study and Record of Decision.

For non-carcinogenic chemical contaminants in surface soils, a hazard index of 3.6 was calculated for future soil ingestion by children and was due primarily to mercury. Concentrations of lead at the Former HWMF and the Ash Pit were also above EPA's recommended soil screening level of 400 mg/kg for residential uses.

6.1.5 Characterization of Radiological Risks

Risks from exposure to surface soils contaminated with radionuclides were calculated for the Reclamation Facility (Building650) Sump and Outfall Area (CDM, 1994). Only, the risk estimates for potential future residents (combined adults and children) exceeded EPA's target risk range in both areas with a maximum risk of risk of 4.3 x 10^{-3} (4.3 in 1,000) (or 5.3 x 10^{-3} when alpha activity is assumed to measure uranium-235). The risk was due almost entirely to the external gamma radiation pathway with the major contributors being cesium-137 and uranium-235. Using the higher concentrations found in the May 1994 sampling, the future residential risk was about one order of magnitude higher, i.e. in the 10^{-1} to 10^{-2} (1 in 10 to 1 in 100) range. Risks to on-site workers using the 1994 data was also one order of magnitude higher.

Radiological risks at the former HWMF were not calculated because this facility is a restricted area and an active handling facility for hazardous and radioactive wastes (CDM, 1996a). Levels of contamination in soils were high and remediation was assumed to be required. Current public access and exposure to contaminants in this area is not realistic since there are stringent institutional controls restricting access for the foreseeable future. A radiological worker protection program and procedures protect current site workers. Since concentrations of contaminants in soil are greater at the former HWMF than at the Reclamation Facility, potential future residential risks would also be greater at the former HWMF than the risks described above at the Reclamation Facility.

Radiological risks for AOCs 10, 16, 17 and 18 were evaluated by comparing contaminant concentrations to cleanup levels developed using a future residential land use and EPA's cleanup goal of 15 mrem/yr. (IT, 1999) AOC 10 and six of the AOC 16 sites were above the 15 mrem/yr goal for future residential land use. AOCs 17, 18 and the remaining sites from AOC 16 were below the 15 mrem/year goal for future residential land use. Risks to current site workers and the public at these areas axe controlled by institutional controls, such as fencing, where needed.

Post remediation risks at all areas of concern will meet EPA's acceptable risk range.

6.2 Ecological Risk Assessment

A standard ecological risk assessment (as prescribed by the EPA) consists of a four-step process used for assessing ecological risks for a reasonable maximum exposure scenario:

! *Problem Formulation* - evaluates a contaminant's release, migration and fate; identifies contaminants of concern, receptors, exposure pathways, and known ecological effects of the contaminants; and, selects endpoints for further study.

! *Exposure Assessment* - quantifies the release, migration, and fate of the contaminant; characterizes exposure pathways and receptors; and measures or estimates exposure-point concentrations.

- *Ecological Effects Assessment* - reviews literature, field studies, and toxicity test linking contaminants' concentrations to effects on ecological receptors.

- *Risk Characterization* - estimates current and future adverse effects.

A Preliminary Ecological Risk Screening was performed (CDM, 1996a). That identified the need for a focused ecological-riskassessment at the former HWMF wetland, the Wooded Wetland adjacent to the Current Landfill, Recharge Basin HS, Weaver Drive Recharge Basin HW, and the Upland Recharge/Meadow Marsh Area due to the presence of the Tiger Salamander which is an endangered species in New York State.

The Focused Ecological Risk Assessment and Addendum (CDM, 1999a and 1999b), evaluated potential toxicity risks to the Tiger Salamander in these areas of concern. The assessment concluded that there was an exposure risk associated with various metals for larval salamanders living in the water at each of the areas of concern investigated except the Weaver Road Recharge Basin HW. Aquatic indices calculated for larval salamanders were 26 at the former HWMF wetland due primarily to aluminum, 2,341 at the Upland Recharge/Meadow Marsh due primarily to copper and zinc, and 368 at Recharge Basin HS due primarily to aluminum. For the Wooded Wetland, a comparison of the hazard indices calculated from 1994 to 1997 data showed a reduction in the hazard index from 830 to 23; both were due primarily to aluminum. The Current Landfill cap is designed to reduce impacts from leachate from the Current Landfill on this wetland.

7. OBJECTIVES OF THE REMEDIAL ACTIONS

The following sections identify the basis for taking remedial actions, the objectives of the remedial actions, land-use considerations, and cleanup goals for the radiologically contaminated soil sites and the other areas of concern.

The objectives of the removal actions were addressed in the various Engineering Evaluation/Cost Analysis Reports and Action Memoranda specific to the action. The Current Landfill, Former Landfill, Slit Trench and Interim Landfill were capped in accordance with EPA's presumptive remedy guidance for municipal landfills (OSWER Directive No 93555.0-49) and State guidance (TAGM No. HWR-92-4044). Buried wastes and contaminated soils were removed from the Chemical/Animal Pits and Glass Holes. New York State guidance levels (TAGM No. HWR-94-4046) which are protective of groundwater and residential land use were used for soil cleanup levels for Volatile Organic Compounds. State guidance levels were also used for cadmium and chromium. The cleanup levels used for lead and mercury are listed in Table 5 and are based on EPA soil screening level guidance. Cleanup levels for radionuclides used the industrial land use levels contained in Table 4. These cleanup levels meet EPA's acceptable risk range.

7.1 Basis for Response

The actual or threatened releases of hazardous substances from OU I may present an imminent and substantial endangerment to public health, welfare or the environment if they are not addressed by implementing the remedial actions selected in this Record of Decision. The principal threat is cesium- 137 in the soil. There also is the potential for strontium-90 to migrate from the soil into the underlying sole-source aquifer.

7.2 Objectives of the Remedial Actions

The following objectives for remedial action were established for the radiologically contaminated soils and other areas of concern:

- Minimize threats to human health and the environment from site contaminants,
- Prevent or minimize the leaching of contaminants (chemical and radiological) from the soils into the underlying sole-source aquifer (Upper Glacial Aquifer) caused by the infiltration of precipitation,
- Prevent or minimize the migration of contaminants (chemical and radiological) present in surface soils via surface runoff and windblown dusts,
- Prevent or minimize human exposure including direct external exposure, ingestion, inhalation, and dermal contact (for future residents, trespassers, site workers and construction workers) and environmental exposure tocontaminants (chemical and radiological) in the surface and subsurface soils,
- Prevent or minimize the uptake of contaminants (chemical and radiological) present in the soils by ecological receptors.

7.3 Land Use

Specific cleanup goals (i.e. acceptable contaminant levels) have been identified to achieve the objectivesidentified above. Cleanup goals are based primarily on Applicable or Relevant and Appropriate Requirements (ARARs), EPA andState guidance in combination with an evaluation of land use. BNL is currently used by DOE as a research facility with associated support facilities and is expected to remain so for the forseeable future. Access to the BNL site is currently restricted and controlled.

A future land use study was undertaken and published by BNL in 1995 (BNL 1995). Potential land uses that could occur after BNL closes as a national laboratory were identified as a mix of open space, industrial/commercial, recreational and residential uses. For the purposes of developing radionuclide cleanup goals for OU I, a future industrial use was assumed for the former HWMF, as opposed to the recreational and open space usesidentified in the 1995 study, to give greater flexibility for potential future uses. A future residential use was identified in the OU I Feasibility Study for AOCs 6, 10, 16, 17 and 18 even though these AOCs; are in the developed portion of BNL. This approach was taken since the volumes of contaminated soil are smaller and it is cost effective to use a lower cleanup level. This will also allow greater flexibility in future uses at these AOCs.

An institutional control period of 50 years was also assumed. This is the time period after which BNL might be available to the public for use.

7.4 Cleanup Goals

The cleanup goal or level established for radionuclides in soil is based on a total dose limit of 15 mrem/yr above background (EPA, 1997). EPA's acceptable risk range will also be met upon the completion of remedial action. Cleanup levels for specific radionuclides were calculated using the DOE Residual Radioactive Material Guidelines (RESRAD) computer code, 15 mrem/yr, the assumed future land use and 50 years of continued DOE control. Examples for cesium-137 are given in Table 4. The potential for the contaminated soil to impact groundwater is also considered. A cleanup level for strontium-90 was calculated based on potential impacts to groundwater and is also listed in Table 4. This level is also protective of both residential and industrial uses. A 5 pCi/g cleanup level was also selected for radium-226 based on DOE Order 5400.5. This level is also commonly used by EPA. Post remediation sampling and dose assessments will be performed to ensure that the 15 mrem/year limit will be met for all radionuclides that remain. The NYSDEC guidance of 10 mrem/yr above background has been adopted as an As Low As Reasonably Achievable (ALARA) goal which will be considered during the design and construction phase.

While radionuclides are the primary contaminants of concern in soils, some chemical contamination also exists. Chemical cleanup levels are listed in Table 5. A cleanup level of 1.84 mg/kg for mercury was selected for the former HWMF. This level was calculated using EPA's soil screening level guidance (OSWER 9355.4-23) and is protective of groundwater and a residential use. A cleanup level of 400 mg/kg for lead was also selected for the Ash Pit, the former HWMF and AOC 16 S.3 based on EPA's soil screening level guidance. This level is protective of a residential use.

Cleanup goals for groundwater contaminants are based on an evaluation of Federal and State MCLs and groundwater standards (Table 3). Groundwater treatment will continue until either the cleanup goals are met in the groundwater or the following performance objective is met. If monitoring indicates that continued operation of the groundwater treatment system is not producing significant reductions in the concentrations of contaminants in the groundwater and concentrations are still above the cleanup goals listed in Table 3, then DOE, NYSDEC and EPA will evaluate whether operation of this system can be discontinued in accordance with the National Contingency Plan (NCP). The criteria for discontinuation will include an evaluation of the operating conditions and parameters as well as a determination that the groundwater system has attained the feasible limit of contaminant reduction and that future reductions would be impractical.

8. DESCRIPTION OF ALTERNATIVES

Section 121 of CERCLA requires that each selected remedy protects human health and the environment, is cost effective, complies with other statutory laws, and uses permanent solutions, alternative treatment technologies, and resource-recovery alternatives as fully as practicable. In addition, the statute includes a preference for treatment as a principal way of reducing the toxicity, mobility, or volume of the hazardous substances.

This section summaries the remedial alternatives evaluated for the radiologically contaminated soil sites and other areas of concern addressed by this Record of Decision. Details of the alternatives are given in the Final OU I and Radiologically Contaminated Soils Feasibility Study Report (CDM, 1999a). Several technologies, in addition to those described below, were evaluated and screened from further consideration. Technologies that include processes such as chemical separation, encapsulation, chemical treatment, and phytoremediation, were considered not to be effective.

To evaluate remedial alternatives, information is needed related to future land use and the cleanup standards. For all areas except the former HWMF, residential land use and corresponding cleanup goals, as identified in Section 7, were assumed. Industrial land use cleanup goals were assumed for the former HWMF (Section 7). For some of the alternatives evaluated where contaminated soils will be left on-site, it was necessary to set a secondary action level to determine which soil may require additional treatment or disposal (the principal threat was waste). Cesium-137 was the primary radiological contaminant for all the soils; therefore, the secondary action level is based on this constituent. In the event that institutional controls failed and an inadvertent intruder built a dwelling near to the radiological soil left on-site (e.g., above a capped or engineered cell), the secondary-action level would ensure that the exposure to this waste was not in excess of 75 mrem/yr. Based upon these considerations, this secondary-action level was set at 600 pCi/g of cesium-137.

To estimate costs for the alternatives presented below, assumptions about the institutional control period were developed. This period is assumed to be 100 years, except for radiological contaminated soil alternative 4, where a 50-year institutional control period is assumed. Other common elements for the radiologically contaminated soil alternatives include reconstructing the former HWMF wetland after remediation for all alternatives except alternative 1. Structures (such as pipes, foundations, and tanks) at the Reclamation Facility (Building 650 Sump and Outfall Area) and the Waste Concentration Facility will also require removal to access the contaminated soils. Some buildings at the former HWMF also must be removed to gain access to contaminated soils.

8.1 Radiologically Contaminated Soils

Alternative 1: No Action with Monitoring and Institutional Controls

Capital Cost:	$	52,000
Annual Operation & Maintenance (O&M) Cost:	$	55,513
Total O&M Cost (present worth):	$	792,000
Total Present Worth:	$	844,000

Under the "No Action" alternative, no remedial action would be taken and the sites would continue in their current state except that a fence would be installed around the former HWMF wetland. Groundwater monitoring and surface-water sampling would be conducted in certain areas. The existing institutional controls would remain in place.

Alternative 2: Engineered Cell, Monitoring and Institutional Controls

Capital Cost:	$	7,487,000
Annual O&M Cost:	$	81,380
Total O&M Cost (present worth):	$	1,161,000
Total Present Worth:	$	8,648,000

This alternative includes excavating all of the radiologically contaminated soils exceeding the soil cleanup goals, staging most of the soils at the former HWMF, constructing an engineered cell which includes a leachate collection and removal system, a composite cover, placing the contaminated soils in the engineered cell and covering the area with a composite cover. Approximately 35,000 cubic yards of soils from the former HWMF and approximately 3,450 cubic yards of soils from the other radiologically contaminated areas would be excavated that are above soil cleanup levels in Table 4, and disposed in the cell. Soils contaminated with long half-life radionuclides from the Reclamation Facility (Building 650) Sump and Outfall Area (approximately 1,040 cubic yards) would be excavated and disposed off-site. Long-term monitoring of the cover and groundwater would be conducted along with maintaining of the cover. Institutional controls would be put in to place to limit access to the site, to ensure that the cover is not disturbed, and to prevent the installation of drinking-water wells in contaminated groundwater.

Alternative 3: Moderate Excavation, Off-Site Disposal and RCRA Cap

Capital Cost:	$	14,005,000
Annual O&M Cost	$	63,710
Total O&M Cost (present worth):	$	909,000
Total Present Worth:	$	14,914,000

Alternative 3 involves excavation and off-site disposal of all soils over the secondary action level (600 pCi/g of cesium-137) at the former HWMF. Approximately 14,585 cubic yards of soil and debris will be excavated and disposed off-site. A Resource Conservation and Recovery Act (RCRA) cap will be constructed over the former HWMF soils that are below the secondary action level (19,490 cubic yards). Soils contaminated above the soil cleanup levels with cesium-137 and/or strontium-90 from other areas (approximately 3,450 cubic yards) will be excavated and consolidated under the RCRA cover at the Former HWMF. Approximately 1,040 cubic yards of soils contaminated with long half-life radionuclides from the Reclamation Facility (Building 650) Sump and Outfall Area will be disposed at an off-site facility. Long-term monitoring of the cover and groundwater would be conducted, and the cover maintained. Institutional controls would be put in to place to limit access to the site, to ensure that the cover is not disturbed, and to prevent the installation of drinking water wells in contaminated groundwater.

Alternative 4: Large Scale Excavation and Off-site Disposal

Capital Cost:	$	23,615,000
Annual O&M Cost:	$	45,470
Total O&M Cost (present worth):	$	417,000
Total Present Worth:	$	24,032,000

Alternative 4 involves excavating of contaminated soils above cleanup goals (industrial goals for former HWMF and residential goals for other areas) and off-site disposal, and monitoring the remaining contaminated soils. A 50-year institutional control period is assumed for cost estimating purposes. Approximately 39,500 cubic yards of contaminated soils would be excavated and staged at the former HWMF. Certain waste will likely required pretreatment (e.g., stabilization solidifcation) to meet the waste acceptance criteria at the disposal facility. Groundwater monitoring would be conducted in specific areas. Institutional controls would be put in to place to ensure that land uses remain protective of human health, limit access to the site, to ensure that the cover is not disturbed, and to prevent the installation of drinking water wells in contaminated groundwater.

Alternative 5: Moderate Excavation, Soil Washing, Off-Site Disposal and RCRA Cap

Capital Cost:	$	14,395,000
Annual O&M Cost	$	63,710
100-year O&M Cost (present worth):	$	909,000
Present Worth:	$	15,304,000

Alternative 5 is identical to Alternative 3 in scope, except that all excavated soils with concentrations of radionuclides greater than the secondary action levels (600 pCi/g of cesium-137) and less than 2,800 pCi/g of cesium-137 would be washed on-site to reduce the volume of contaminated material that is shipped off-site for disposal. Approximately 6,030 cubic yards of soil would be washed.

The approximately 24,490 cubic yards of soil below the secondary action level of 600 pCi/g of cesium-
137 but above the soil cleanup level of 67 pCi/g of cesium-137, together with clean soil from the treatment process, will be consolidated at the former HWMF and capped with a RCRA cap, as described in Alternative 3.

With this alternative, approximately 11,404 cubic yards of material will be disposed off-site. Long-term monitoring of the cover and groundwater would be conducted, along with maintenance of the cover. Institutional controls would be put in to place to limit access to the site, to ensure that the cover is not disturbed, and to prevent the installation of drinking-water wells in contaminated groundwater.

Alternative 6: Moderate Vitrification and RCRA Cap

Capital Cost:	$	18,645,000
Annual O&M Cost	$	65,710
100-year O&M Cost (present worth):	$	909,000
Present Worth:	$	19,554,000

Under Alternative 6, soils from the former HWMF with concentrations greater than the secondary action level of 600 pCi/g cesium-137 (approximately 14,585 cubic yards) and approximately 1,040 cubic yards of contaminated soil with long-lived radionuclides from the Building 650 and the Sump Outfall would be treated by vitrification followed by geomembrane capping. All other soils contaminated above the cleanup goal, but below the secondary action level, would be consolidated at the former HWMF under a geomembrane cap. Long-term monitoring of the cover and groundwater would be conducted along with maintenance of the cover. Institutional controls would be put in to place to limit access to the site, to ensure that the cover is not disturbed. and to prevent the installation of drinking water wells in contaminated groundwater.

8.2 Other Areas of Concern

8.2.1 Ash Pit

Three alternatives were evaluated for the Ash Pit (AOC 2F).

Alternative 1: No Action with Monitoring

Capital Cost:	$	0
Annual O&M Cost:	$	2,000
50-year O&M Cost (present worth):	$	29,000
Present Worth:	$	29,000

Under the first alternative, no further actionwould be taken and the Ash Pit would be left in its current status. Long-term monitoring (visual observation of the Ash Pit). A 50-year institutional control period is assumed for cost estimating purposes.

Alternative 2: Soil Cover

Capital Cost:	$	117,000
Annual O&M Cost:	$	2,000
50-year O&M Cost (present worth):	$	29,000
Present Worth:	$	146,000

For the second alternative, the Ash Pit would be covered with a 12-inch layer of soil in accordance with EPA guidance. The Ash Pit would be visually inspected to ensure that ash is not exposed at the surface. Institutional controls would be put in place to limit access to the site and prevent disturbance of the soil cover. A 50-year institutional control period is assumed for cost estimating purposes.

Alternative 3: Excavation with Off-Site Disposal

Capital Cost:	$	3,197,000
Annual O&M Cost:	$	0
50-year O&M Cost (present worth):	$	3,197,000

Alternative 3 would involve excavating and disposing of the 13,960 cubic yards of ash off-site. The area would be backfilled and a portion of the road impacted during remedial construction activities would be replaced.

8.2.2 Upland Recharge/Meadow Marsh

For the two artificial basins at the Upland Recharge/Meadow Marsh Area, the following three remediation alternatives were evaluated to protect the Tiger Salamander:

Alternative 1: No Action with Monitoring

Capital Cost:	$ 0
Annual O&M Cost:	$ 3,000
50-year O&M Cost (present worth):	$ 44,000
Present Worth:	$ 44,000

Under the first alternative, no further action would be taken and the current status of the ponds will remain. Long-term ecological monitoring would be performed.

Alternative 2: Excavation with On-Site Disposal and Reconstruction of the Wetlands

Capital Cost:	$ 184,000
Annual O&M Cost:	$ 3,000
50-year O&M Cost (present worth):	$ 44,000
Present Worth:	$ 228,000

Under the second alternative, water would be removed from the ponds (if necessary) and transported to the BNL wastewater treatment plant, the sediments (1,270 cubic yards) and plastic liners (42 cubic yards) would be removed and placed in an approved on-site clean-fill site. The ponds then would be restored as a wetland. Long-term ecological monitoring would be performed.

Alternative 3: Excavation with Off-Site Disposal and Reconstruction of Wetlands

Capital Cost:	$ 398,000
Annual O&M Cost:	$ 3,000
50-year O&M Cost (present worth):	$ 44,000
Present Worth:	$ 442,000

Under the third alternative, water would be removed from the ponds (if necessary) and transported to the BNL wastewater treatment plant, the sediments (1,270 cubic yards) and plastic liners (42 cubic yards) would be removed and disposed of off-site at an approved landfill. The ponds would then be restored as a wetland. Long-term ecological monitoring would be conducted.

8.2.3 Recharge Basin HS and the Weaver Drive Recharge Basin HW

Alternatives were not evaluated for the Recharge Basin HS and the Weaver Drive Recharge Basin HW because they are operated and monitored according to NYSDEC permits. The basins would continue to be operated, maintained, and monitored in accordance with permit requirements and in a manner to reduce negative impacts to Tiger Salamanders. A Tiger Salamander Habitat

Management Plan will be prepared in coordination with the NYSDEC to reduce the impacts of routine maintenance of the basins on the animal.

8.2.4 Wooded Wetland

Alternatives were not evaluated for the Wooded Wetland because sampling conducted before and after the capping of the Current Landfill indicates that the cap is successfully reducing contamination of the Wooded Wetland by landfill leachate. However, surface water and sediments will be monitored annually to ensure the cap remains successful.

9. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The CERCLA requires a comparision of each remedial alternative identified in the feasibility study according to nine criteria. Those criteria are subdivided into the following three categories:

(a) Threshold criteria that relate directly to statutory findings and must be satisfied by each chosen alternative (overall protection of human health and the environment and compliance with ARARs);
(b) Primary balancing criteria that include long- and short-term effectiveness; implementability; reduction of toxicity, mobility, volur-ne; and cost
(c) Modifying criteria that measure the acceptability of the alternatives to state agencies and the community.

The following sections summarize the comparative analysis described in the feasibility study for the radiologically contaminated soils and other areas of concern.

9.1 Radiologically Contaminated Soils

The following six remedial alternatives were considered for the radiologically contaminated soils:

- Alternative 1: No Action with Monitoring and Institutional Controls
- Alternative 2: Engineered Cell, Monitoring, and Institutional Controls
- Alternative 3: Moderate Excavation, Off-Site Disposal, and RCRA Cap
- Alternative 4: Large Scale Excavation and Off-Site Disposal
- Alternative 5: Moderate Excavation, Soil Washing, Off-Site Disposal, and RCRA Cap
- Alternative 6: Moderate Vitrification and RCRA Cap

Table 6 summarizes the comparative analysis.

Overall Protection

Overall protection of human health and the environment addresses whether or not an alternative provides adequate protection, and describes how risks are eliminated, reduced or controlled through treatment, engineering controls or institutional controls.

Alternative 1 relies on natural dispersion and decay processes to reduce levels of soil contamination. It does not meet the goals for remediating soil and is not effective in reducing risks to human health, if federal control of BNL is lost. In addition, contaminated soil would continue to be a source of groundwater contamination.

All other alternatives protect human health and the environment. For alternatives 2, 3, 5, and 6, long-term maintenance of the cap or cell and institutional controls are required for 100 years for it to remain protective of human health and the environment. Alternative 4 achieves protection of human health and the environment by removing contaminated soils above cleanup levels, with 50 years of institutional controls to reduce risk to acceptable levels.

Compliance with Applicable or Relevant and Appropriate Requirements

These criteria consider if a remedy meets all applicable or relevant and appropriate requirements of federal and state environmental statutes, including provisions for invoking a waiver.

Alternatives 2 through 6 would meet the principal ARARs (i.e., the cleanup goals such as 15 mrem/yr above background levels for radionuclides as identified in Section 7, if control of the site is maintained by DOE). The NYSDEC guidance of 10 mrem/yr also was adopted as an As Low As Reasonably Achievable (ALARA) goal, which will be considered during the design and construction phase. Alternative 1 would not meet these remedial goals.

Alternative 2 is expected to meet these requirements for the 100-year period of institutional control. A potential remains for future exposureabove federal and state requirements, because all soil, though capped, remains in the former Hazardous Waste Management Facility area and is otherwise untreated.

The alternatives for excavation and off-site disposal (Alternatives 3 and 4) and the alternative for soil washing (Alternative 5) involve removing a large fraction of the contaminated soil from the site and would lessen the chance of future exposures above federal and state requirements.

Cap or cell maintenance would be required for alternatives 2, 3, 5, and 6 to remain in compliance.

Alternatives in which soils are left on-site (Alternatives 1, 2, 3, 5, and 6) also would result in the creation of a radioactive waste disposal facility and would be subject to applicable state and federal regulations. State regulations do not allow the siting of a radioactive waste disposal facility, on Long Island or over a sole-source groundwater recharge area.

Long-Term-Effectiveness and Permanence

Lone-term effectiveness and permanence relates to the amount of risk involved and addresses the ability of an alternative to protect human health and the environment over time, after the remediation goals have been met.

Alternative 1 is not effective in the long-term because all contaminated soils are left in place.

Alternative 2 is effective in meeting future-use federal and state requirements by preventing access to contaminated soils as long as institutional controls are maintained. However, the highest levels of contamination remain on-site and rely on the effectiveness and continued maintenance of an engineered barrier. Should that barrier fail or institutional control be lost, the long-term effectiveness of this alternative would be compromised.

Alternatives 3, 5, and 6 are more effective than alternative 2 in that the most contaminated soils are either removed from the site (Alternatives 3 and 5) or immobilized (Alternative 6). However, they also rely to some degree on the maintenance of an engineered barrier and continued institutional controls to assure long-term effectiveness.

Alternative 4 is considered the most effective and permanent alternative in the long-term since all contaminated soil above the soil remediation goals is removed and disposed of off-site.

Reduction of Toxicity, Mobility or Volume

Reduction of toxicity, mobility, or volume addresses the anticipated performance of treatment that permanently and significantly reduces toxicity, mobility, or volume of waste.

Alternative 1 provides no active reduction in on-site toxicity, mobility, or volume. There is a natural reduction in toxicity over time due to radioactive decay.

Alternative 2 provides no treatment of the contaminated soils and, hence, no reduction of toxicity and volume. Shielding of gamma radiation is provided by the cap, and the barrier provides a reduction in mobility.

Alternatives 3 and 5 provide a reduction of toxicity, mobility and volume through off-site disposal. In both alternatives, shielding of gamma radiation, as well as a reduction in radionuclide mobility, is provided by the cap. Soil washing provides an additional reduction in volume by treatment.

Alternative 4 provides a substantial reduction in toxicity, mobility, and volume through off-site disposal; however, no treatment is provided.

Vitrification in Alternative 6 provides the greatest reduction in the toxicity, mobility, and volume of the most contaminated soil through treatment into a glass monolith. The cap provides further shielding of the gamma radiation as well as a reduction in radionuclide mobility.

Short-Term Effectiveness and Environmental Impacts

Short-term effectiveness and environmental impacts addresses the effect to the community and site workers during construction and implementation of the remedy, and includes the time needed to finish work.

Risks to the community were evaluated for both radiological risk and transportation accidents associated with off-site disposal of contaminated soils. All alternatives are considered protective of the community in the short-term. There are no significant pathways of exposure to contaminated soils and dust from excavating and constructing the cap can be easily controlled. Alternatives 2, 3, 4, and 5 involve disposal various volumes of contaminated soils off-site and do have some risks associated with railcar and traffic accidents. These risks can be controlled by federal (i.e., Department of Transportation) shipping requirements and are considered negligible. Alternatives 1 and 6 do not involve any off-site disposal and associated transportation risks.

Risks to remediation workers include both radiation risks and non-radiation construction accident risks. Alternative 1 provides the least risks to workers since there is no active remediation. Alternatives 2 and 5 are expected to provide the highest radiation exposures to remediation workers. Alternatives 3, 4, and 6 result in less exposures than Alternatives 2 and 5.

Implementability

Implementability addresses both the technical and administrative feasibility of an alternative, including the availability of materials and services required for cleanup.

Alternative 1 could be readily implemented with limited technical and administrative requirements.

Alternative 2 is technically feasible. However, it involves extensive excavation and complex administrative requirements for regulatory permits and approvals of an engineered disposal cell.

Alternatives 3 and 5 involve partially intrusive remediation activities. Alternative 3 is technically feasible and uses technologies that can be readily implemented with average administrative requirements, since only limited off-site shipment of waste is involved. Alternative 5 is less technically feasible, since the technology for soil washing has not been demonstrated on cesium-137 contaminated soils.

Alternative 4 involves excavating of large volumes of soils. It is technically feasible and could be readily implemented. Alternative 4 is expected to have above-average administrative requirements due to extensive procedures for documentation involved in the transport and off-site disposal of soil as low-level radioactive waste.

Alternative 6 is less intrusive, except for the consolidation activities. Vitrification has only limited full-scale use and may not be implementable. This alternative would have above- average administrative requirements. Overall, this alternative is considered very complex.

Cost

Cost compares the differences in cost, including capital, operation and maintenance. For estimated current costs of all alternatives, see Section 8. 1.

9.2 Other Areas of Concern

This section summarizes the comparative analysis of the alternatives identified for the Ash Pit and the Upland Recharge/Meadow Marsh Area. Section 8.2 shows the costs. A comparative analysis was not conducted for the Recharge Basin HS, the Weaver Drive Recharge Basin HW, and the Wooded Wetland, as only one alternative was identified for these basins.

9.2.1 Ash Pit

The following three remedial alternatives were considered for the Ash Pit:

Alternative 1: No Action with Monitoring
Alternative 2: Soil Cover
Alternative 3: Excavation with Off-site Disposal

For the Ash Pit, the no action alternative would not protect human health and the environment and did not comply with EPA's soil guidance for lead. In addition the toxicity, mobility, and volume would not be reduced.

For the second alternative, a soil cap would protect workers, the public, and wildlife and meet EPA's guidance. It is relatively simple to implement, would reduce the mobility of contaminants of concern, and is also cost-effective.

The third alterriative, excavation and off-site disposal, would protect workers, the public, and wildlife. It is relatively simple to implement, would reduce the mobility of contaminants of concern, but is relatively costly for the limited benefits received.

9.2.2 Upland Recharge/Meadow Marsh Area

The following three remedial alternatives were considered for the Upland Recharge Meadow Marsh Area:

Alternative 1: No Action with Monitoring
Alternative 2: Excavation with On-site Disposal and Reconstruction of the Wetlands
Alternative 3: Excavation with Off-site Disposal and Reconstruction of the Wetlands

For the two man-made basins at the Upland Recharge/Meadow Marsh Area, the no action alternative would not protect breeding Tiger Salamanders. In addition, the toxicity, mobility, and volume of the contaminants of concern would not be reduced.

For the second alternative, Tiger Salamanders would be protected. It is technically feasible and would reduce the toxicity, mobility, and volume of contaminants in the ponds by removing and disposing the sediments off-site. However, this alternative involves complex administrative requirements for regulatory permits and approvals for on-site disposal.

The third alternative would also protect Tiger Salamanders. It is easy to implement and would reduce the toxicity, mobility and volume of contaminants in the ponds by disposing of the sediments off-site. This alternative is the most costly though it is only slightly more expensive than the second alternative and off-site-disposal is readily available.

9.3 State and Community Acceptance

State Acceptance

State acceptance addresses whether the State agrees with, opposes, or has no comment on the preferred alternative. The State of New York concurs with the selection of remedial actions described in this Record of Decision.

Community Acceptance

Community acceptance addresses the issues and concerns that the public may have on each of the alternatives. Information sessions were held on April 13 and 14, 1999, and a public meeting was held on April 22, 1999 about the proposed plan and feasibility study supporting this Record of Decision. The results of the public meeting and the public comments on the feasibility study and proposed plan indicate overall general acceptance and support of the preferred alternatives. Community response to the remedial alternatives is presented in the Responsiveness Summary in Section III, which addresses questions and comments received during the public comment period.

10. SELECTED REMEDIES

Remedies have been selected based on consideration of CERCLA requirements, the analysis of alternatives and public comments. The selected remedies are believed to provide the best balance of tradeoffs among the alternatives with respect to the nine CERCLA evaluation criteria used to evaluate the remedies (Section 9).

In addition to the remedies discussed below, institutional controls will be maintained to ensure that uses are protective of public health and the environment and that the remedy is not negatively impacted. Examples include land use restrictions (i.e. some areas are not suitable for residential use) and controlling the types of activities that can be performed at certain areas such as limiting construction on the top of capped landfills. In addition, any sale or transfer of BNL properties will also meet the requirements of 120(h) of CERCLA to ensure that future users are not exposed to unacceptable levels of contamination. For example, deed restrictions may be used to limit uses of a particular site and to prevent the installation of drinking, water wells into contaminated groundwater.

The selected remedies address three distinct components: radiologically contaminated soils; other Areas of Concern; and removal actions adopted as final actions. The following is a description of the selected remedial actions, which is also summarized in Table 7. Table 8 summarizes the costs.

10.1 Radiologically Contaminated Soils

The selected remedy for radiologically contaminated soils is Alternative 4 and involves excavation and off-site disposal of soils above cleanup goals, institutional controls and long-term monitoring. The major components of this remedy are:

- Radiologically and chemically contaminated soils and sediments above the cleanup goals identified in Section 7 will be excavated from AOCs 1, 6, 10, 16, 17 and 18. Wetlands at the former HWMF Facility (AOC 1) will be reconstructed. Soils and sediments will be disposed of off-site at a permitted facility. The two likely disposal facilities are DOE's Hanford Facility in Washington and Envirocare of Utah. Post remediationsampling and dose assessments will also be performed to ensure that the cleanup goals are met.

- Out-of-service underground storage tanks (six) and associated piping, the D Tanks pad area at the Waste Concentration Facility (AOC 10), and out-of-service equipment and facilities at the former HWMF (AOC 1) will be removed. Disposal options will be determined during design and will be in compliance with federal and state requirements. Radioactive wastes will likely be disposed of at either DOE's Hanford facility or Envirocare.

- An As-Low-As-Reasonably-Achievable (ALARA) analysis will be performed during the remedial design and implementation of the remedy to identify cost effective measures for further reducing exposure to residual contamination below cleanup goals. Examples of ALARA activities include the consolidation of residual contamination below cleanup goals at one location and the use of a clean soil cover.

- Techniqueswhich minimize waste volumes or further stabilize wastes to meet disposal facility waste acceptance criteria may also be identified during remedial design and implementation.

- Post rernediation monitoring and institutional controls of residual contamination will also be performed in accordance with a Long-term Monitoring and Maintenance Plan. This Plan will ensure that landuses remain protective of public health and the environment.

10.2 Other Areas of Concern

Remedies for the other Areas of Concern are described below:

- A 12 inch soil cap will be installed at the the Ash Pit (AOC 2F) to address metal contamination. Institutional controls, monitoring and maintenance of the soil cap v.-ill occur to limit access to the site andprevent erosion to the soil cap. Recreational and residential uses will be prohibited. These activities will meet EPA guidance on lead contaminated soil (OSWER Directive No. 9355.4-12).

- Chemically contaminated sediments from the two eastern basins at the Upland Recharge/Meadow Marsh Area (AOC 8) which serve as breeding grounds for the Tiger Salamander will be excavated, processed if needed to meet disposal facility waste acceptance criteria and disposed ofoff-site. The excavated wetland areas will be reconstructed. Ecological monitoring will also be performed.

- Operation and monitoring of Recharge Basin HS and the Weaver Drive Recharge Basin HW (AOCs 24 E and 24 F) will continue in accordance with BNL's State Pollutant Discharge Elimination System (SPDES) permit. A Tiger Salamander Habitat Management Plan will detail the routine maintenance required at the basins to reduce impacts to the Tiger Salamander. Annual monitoring of surface water and sediments will be conducted at the Wooded Wetland to ensure that the cap at the Current Landfill remains effective in preventing leachate from contaminating this wetland area.

10.3 Removal Actions

In addition, several removal actions that either have been completed or are ongoing are being selected as final remedies. Each was selected in an Action Memorandum and subject to public participation.

- Geomembrane caps, constructed in accordance with 6 NYCRR Part 360, were placed on the Current Landfill (AOC 3), Former Landfill (AOC 2A), Interim Landfill (AOC 2D) and Slit Trench (AOC 2E). Inspections, monitoring (e.g. groundwater, methane, etc.) and maintenance are underway in accordance with approved Operations and Maintenance Manuals. Institutional controls will also be maintained to prevent activities that may compromise the geomembrane caps.

- One drum of soil containing cesium-137 above cleanup goals from the National Weather Service soil stockpile (AOC 16 S) was segregated and will be disposed of off-site. The remaining soil was used as grading material for the Former Landfill cap.

- Buried chemical and radiological wastes and soils above cleanup goals were excavated from the Chemical/Animal Pits (AOC 2B) and Glass Holes (AOC 2C). Soil samples collected at each pit location demonstrated that cleanup goals were met. Off-site disposal of the excavated materials is underway.

- A pump-and-treat system was installed at BNL's southern boundary to treat on-site Volatile Organic Compounds in the groundwater from the Current Landfill (AOC 3) and the former Hazardous Waste Management Facility (AOC 1). This system became operational in December 1996 and will continue to operate until the one of the following performance objectives is met.

1) Concentrations of contaminants in the groundwater have reached the cleanup goals listed in Table 3; or

2) If monitoring indicates that continued operation of the groundwater treatment system is not producing significant reductions in the concentrations of contaminants in the groundwater and concentrations are still above the cleanup goals; then DOE, NYSDEC and EPA will evaluate whether operation of this system can be discontinued in accordance with the National Contingency Plan (NCP). The criteria for discontinuation will include an evaluation of the operating conditions and parameters as well as a determination that the groundwater system has attained the feasible limit of contaminant reduction and that future reductions would be impractical.

In addition, institutional controls will be maintained to prevent the installation of drinking water wells into contaminated groundwater and to prevent the installation of supply or other pumping wells that may mobilize remaining contaminants or otherwise interfere with the cleanup.

Groundwater contamination associated with the Former Landfill Area (AOC 2) and off-site groundwater contamination associated with other Operable Unit I AOCs will be addressed in the Operable Unit III Record of Decision. An evaluation of remedial alternatives for deep contaminated soil associated with the Brookhaven Linear Accelerator Isotope Producer (BLIP) facility (AOC 16K) is underway. The final remedy for this AOC will be documented in a subsequent Record of Decision.

11. STATUTORY DETERMINATIONS

Selection of a remedy is based on CERCLA, and its amendments, and the regulations in the National Contingency Plan. All remedies must meet the threshold criteria, protect human health and the environment, and comply with ARARs. CERCLA also requires that the remedy uses permanent solutions and alternative technologies for treatment to the maximum extent practicable, and that the implemented action is cost-effective. Finally, the statute includes a preference for remedies that employs treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

11.1 Protection of Human Health and the Environment

The selected remedy for the radioactively contaminated soils protects human health and the environment by removing and disposing of contaminated soils and associated structures and by implementing monitoring and institutional controls to prevent exposure to contaminants that pose a risk. Removing these wastes minimizes both risks of expose to on-site workers and risks associated with future-use scenarios, as well as minimizing the potential for migration of contaminants into the underlying groundwater.

Reconstructing and monitoring the Upland Recharge/Meadow Marsh Area and the routine maintenance and monitoring of Recharge Basin HS and the Weaver Drive Recharge Basin HW will minimizepoteniial risks to the Tiger Salamander and other ecological receptors. A Tiger Salamander Habitat Management Plan will be developed to minimize the impacts to the Tiger Salamander from continued operation of the Recharge Basin HS and the Weaver Drive Recharge Basin HW under NYSDEC permits.

The soil cover that will be placed at the AshPit eliminates the potential for direct exposure to the ash.

The covers placed at the Current Landfill, Former Landfill, Interim Landfill, and Slit Trench eliminate the potential for direct exposure to the landfill's contents, control landfill gases, and minimize the infiltration of precipitation and migration of contaminants to subsurface soils, surface water, and groundwater. The excavation of buried wastes and contaminated soils at the Chemical/Animal Pits and Glass Holes has removed the potential for further contamination of underlying soils and groundwater.

Potential future risks to human health and the environment due to contaminated groundwater will be eliminated through extraction and treatment. For contamination presently on-site, the groundwater cleanup goals will be met by extracting groundwater contaminated with VOCs from the Current Landfill/former HWMF plume.

No unacceptable short-term risks or cross-media impacts will be caused by implementati ng these remedies.

11.2 Compliance with ARARs

The National Contingency Plan, Section 300.430 (P) (5) (ii) (B) requires that the selected remedy attains the federal and state ARARs, or obtains a waiver of an ARAR.

11.2.1 Chemical-Specific ARARs

The chemical-specific ARARs that the selected remedies will meet are listed below.

1. Safe Drinking Water Act, Public Law 95-523, as amended by Public Law 96502,22 USC 300 et. seq. National Primary Drinking Water Regulations (40 Code of Federal Regulations 141) and National Secondary Drinking Water Regulations (40 Code of Federal Regulations 143). This establishes MCLs and secondary MCLs for public drinking water supplies that are relevant and appropriate for establishing goals for remediating, groundwater.

2. New York Water Quality Standards, 6 NYCRR Part 703. This requirement establishes standards of quality and purity for groundwaters of the State and effluent guidelines.

3. 6 NYCRR Part 212, General Process Emission Sources. This state regulation will be used to establish the need for air-emission control equipment for the air stripper associated with the groundwater extraction system.

4. RCRA (40 Code of Federal Regulations parts 260-268), this defines hazardous wastes. All wastes classified as hazardous will be handled, stored, and disposed of in accordance with these regulations. Hazardous wastes will be disposed of off-site at a permitted facility.

5. New York State Hazardous Waste Regulations (6 NYCRR Part 370 - 373). This defines hazardous wastes in New York State. All wastes classified as hazardous will be handled, stored, and disposed of in accordance with these regulations. Hazardous wastes will be disposed of off-site at a permitted facility.

6. 10 NYCRR Part 5, New York State Department of Health Drinking Water Standards.

11.2.2 Location-Specific ARARs

No location-specific ARARs were identified.

11.2.3 Action-Specific ARARs

1. 10 Code of Federal Regulations Part 835. This regulation establishes the requirements for controlling and managing radiologically contaminated areas.

2. 6 NYCRR Part 360, Solid Waste Management Facilities. The landfills were and will be capped in accordance with these requirements. Solid wastes will be handled in accordance with these requirements.

3. RCRA (40 Code of Federal Regulations parts 260-268). As described above.

4. New York State Hazardous Waste Regulations (6 NYCRR Part 370 - 373). As described above.

5. Clear Air Act (42 U.S.C Section 7401, et seq.) and National Emissions Standards for Hazardous Air Pollutants (40 Code of Federal Regulations Part 61). These regulate and limit emissions of hazardous air pollutants, including radionuclides.

11.2.4 Guidance To Be Considered

In implementing the selected remedy, the following significant guidance will be considered. Those which are not promulgated are not legally binding.

1. NYSDEC Technical and Administrative Guidance Memorandum "Remediation Guideline for Soils Contaminated with Radioactive Materials" (#4OO3), September, 1993).

This memorandum contains State guidance for remediating radiologically contaminated soils. The State's value of 10 mrem/yr above background serves as an additional goal for remediation to be evaluated during remedial design and implementation.

2. NYSDEC Division of Air Guidelines for Control of Toxic Ambient Air Contaminants, Air Guide 1. This guide will be used to evaluate the impacts of air emissions from the air-stripping portions of the selected remedy, and to assist with evaluating., the need for air-emissions control equipment.

3. NYSDEC Technical and Administrative Guidance Memorandum: Determination of Soil Remediation Objectives and Remediation Levels (# 4046), January 1994. The recommended soil remediation objectives for Volatile Organic Compounds, chromium and cadmium were selected as remediation goals to guide excavations at the Chemical/Animal Pits and Glass Holes.

4. U. S. EPA Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, OSWR Directive No. 9355.4-12, PB94-963282, August 1994. Guidance for remediating soil for lead at the Ash Pit.

5. U.S. EPA Soil Screening Guidance: User's Guide, EPA/540/R-96/018, April, 1996. Goals for remediating soil for lead and mercury were developed using this guidance. These goals were used to guide excavations at the Chemical/Animal Pits and Glass Holes.

6. DOE Order 5400.5 and Draft 10 Code of Federal Regulations 834 “Radiation Protection of the Public and the Environment.” This order, and its current draft rule-making, were used to develop radiological soil remediation levels. The basic public dose limit for exposure to residual radioactive material for DOE facilities such as BNL, is 100 mrem/yr above background plus application of the As Low As Reasonably Achievable (ALAR.A) policy. Based on BNL site-specific conditions and ALARA, 15 mrem/yr above background was selected. This level is consistent with risk requirements under CERCLA and EPA guidance.

7. NYSDEC Technical and Administrative Guidance Memorandum: Accelerated Remedial Actions at Class 2, Non-RCRA Regulated Landfills. HWR-92-4044, March 9, 1992. This memorandum defines the Chemical/Animal Pits and Glass Holes as “hot spots”, which contain concentrated wastes and meet criteria to consider source removal as an option.

8. U.S. EPA Presumptive Remedy for CERCLA Municipal Landfill Site (Office of Solid Waste and Emergency Response. Directive No. 9555.0-49 Feasibility Study, EPA 540-F-93-035 September, 1993). Capping of the landfills was an appropriate remedy. This directive considers wastes found in the Chemical/Animal Pits and Glass Holes as not appropriate for capping.

9. U.S. EPA Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination. OSWER Directive 9200.4-18, August, 1997. This directive recommends an allowable exposure to radionuclides to 15mremyr above natural background as consistent with EPA's acceptable risk range.

11.3 Cost-Effectiveness

Based on the expected performance standards, the selected remedies were determined to be cost-effective because they provide overall protection of human health and the environment, long and short-term effectiveness, and compliance with ARARs, at an acceptable cost. Table 8 summarize the total costs for Operable Unit I.

11.4 Use of Permanent Solutions and Alternative Treatment Technologies to the to Maximum Extent Practicable

The selected remedies represent the maximum extent to which permanent solutions and treatment technologies can be used cost-effectively. The selected remedies provide the best balance of tradeoffs in terms of long-term effectiveness and permanence; reduction in toxicity, mobility, or volume achieved through treatment; short-term effectiveness; implementability; and cost. The statutory preference for treatment as a principal element as well as State and community acceptance also was considered.

Large-scale excavation and off-site disposal of radiologically contaminated soils is a permanent solution that removes contamination from the areas of concern. Treatment technologies for radiologically contaminated soils were evaluated but not selected due to limited effectiveness and the poor ability to implement.

Permanent solutions also were selected for the other areas of concern to the extent practicable, considering the best balance in trade-offs. Removing sediments and reconstructing the wetlands at the Upland Recharge/Meadow Marsh Area represents a permanent solution that will protect the Tiger Salamander. The Tiger Salamander will also be protected at the Recharge Basin HS and the Weaver Drive Recharge Basin HW with the development of a Tiger Salamander Habitat Management Plan. Soil cover of the Ash Pit eliminates direct exposure.

The remedies previously implemented of capping the Current Landfill, Former Landfill, Slit Trench, and Interim Landfill, and bulk excavation and off-site disposal of the Chemical/Animal Pits and Glass Holes, are solutions for source control and minimizing the migration of contaminants. Groundwater solutions include treating Volatile Organic Compounds at the BNL southern boundary, monitoring, and institutional controls. Groundwater treatment for Volatile Organic Compounds represents a permanent solution and implementation of treatment technology.

11.5 Preference for Treatment as a Principal Element

Treatment of radiologically contaminated soils was not found to be practical since there are no techniques to reduce radioactivity. Techniques which minimize waste volumes or further stabilize wastes to meet disposal facility requirements may be identified during remedial design.

The components of the selected remedy for groundwater are final actions and satisfy the statutory preference for treatment as a principal element. Groundwater contaminated with total Volatile Organic Compounds is being extracted and treated by air-stripping before recharge back to the aquifer.

11.6 Documentation of Significant Changes

Comments received during the public comment period for the proposed plan and feasibility study that support this Record of Decision were reviewed. No significant changes to the selected remedy, as originally identified in the proposed plan, were necessary.

11.7 Five-Year Review

Five-year reviews will be needed to evaluate the effectiveness of the institutional control period to achieve total reduction in risk at the radiological contaminated waste sites, to evaluate the activities taken to protect the Tiger Salamander, and to evaluate the effectiveness of landfill caps and the groundwater treatment system.

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TABLES

Table 1
Description of Operable Units at BNL

Operable Unit	Description
I	*Operable Unit I* is a relatively undeveloped 950-acre area in the southeastern part of the site. It includes historical waste handling area, such as the Former and Current Landfills (AOCs 2 and 3), and the Former Hazardous Waste Management Facility (AOC 1). It also includes the Ash Pit (AOC 2F) and two recharge basins (AOCs 24E & 24F). Operable Unit I contains six areas covered by accelerated removal actions: the Current and Former Landfills, Chemical/Animal Pits and Glass Holes, the Interim Landfill, the Slit Trench and Groundwater.
III	*Operable Unit III* contains the south central and developed portions of the site. This operable unit contains most of the site's contaminated groundwater.
II/VII	*Operable Unit II/VII* consists of several AOCs located in the developed central portion of the site. It includes contaminated soils and out-of-service underground storage tanks and pipelines proposed for removal at the Waste Concentration Facility (AOC 10), along with various isolated areas of contaminated surface soils (AOC 16, 17, 18). It also includes the BLIP facility (AOC 16K).
IV	*Operable Unit IV* is located on the east-central edge of the developed portion of the site. It includes the 1977 Oil/Solvent Spill (AOC 5) as well as the Reclamation Facility Building 650 and Sump Outfall Area (AOC 6), where radiologically contaminated soils have been found. A Record of Decision has been issued for this Operable Unit and an Interim Remedy of access restrictions and monitoring has been implemented for AOC 6. The final remedy for the radiologically contaminated soils (AOC 6) is included in this Record of Decision.
V	*Operable Unit V* is located in the northeast portion of the site and includes the Sewage Treatment Plant (AOC 4) and releases to the Peconic River.
VI	*Operable Unit VI* is located on the southeastern edge of the site. It is a largely wooded area which contains various agricultural research fields and human made experimental basins (AOC 8). No contaminated soils of concern have been found in this operable unit, however, contaminated sediments in two of the human made basins pose an ecological risk to the Tiger Salamander. Ethylene dibromide, a pesticide, has been found in groundwater south of BNL's southern boundary, and is addressed in a separate Record of Decision.

Table 2
SUMMARY OF SITE HISTORY

AOC No.	Name	Waste	Contaminated Media	Primary Contaminants of Concern	Maximum Concentration	Reference
Radiologically Contaminated Soils						
1	Former Hazardous Waste Management Facility (HWMF)	Processing, storage and shipping of hazardous and radioactive wastes from 1947 to 1977. Twelve acres containing approximately 35,000 cubic yards of contaminated soil and debris (i.e. concrete and asphalt). Contains buildings and structures with no planned future use. Also, an adjacent wetland contains contaminated sediments.	Soil Sediment	Cesuim-137 Strontium-90 Lead Mercury Cesium-137 Acrotor-126 Aluminum Zinc	810,000 pCi/gm 1,300 pCi/gm 429 mg/kg 184 mg/kg 13 pCi/g 36 ug/kg 8,150 mg/kg 14 mg/kg	CDM, 1996a. CDM, 1999a. BNL, 1999. CDM, 1999a.
6	Reclamation Facility (Building 650) sump and outfall area	Equipment decontamination pad at Building 650 drained into a sump. Pipe from sump drained into an outfall area 800 feet northeast of Building 650. Contaminated soil exists near the decontamination pad and at the outfall area. The sump outfall area was fenced off as an Interim Remedy under the Operable Unit IV ROD.	Soil	Cesium-137 Strontium-90 Plutonium-239/240	2,800 pCi/gm 140 pCi/gm 170 pCi/gm	CDM, 1994. CDM, 1999a. BNL, 1999.
10	Waste Concentration Facility (Building 811)	Facility for processing and concentration liquid radioactive wastes since 1947. Liquid wastes were stored in 100,000 gallon above-ground D tanks from 1947 to 1987. Several leaks were documented in the 1980s. Tanks were dismantled in 1995 and disposed of off-site. Contaminated concrete, asphalt pad and soil remain. Out-of-service piping and six 8,000 gallon underground tanks also remain.	Soil	Cesium-137 Strontium-90	1,486 pCi/gm 454 pCi/gm	IT, 1999. CDM, 1999a. BNL, 1999.
16	Aerial Radiation Survey Results/ Landscape Soils	Radiologically contaminated soils were found near several buildings. The source of the contaminated soils was originally from the former HWMF, which was used for landscaping.	Soil	Cesium-137 Strontium-90 Lead	348 pCi/gm 2 pCi/gm 2,310 mg/kg	IT, 1999. CDM, 1999a. BNT, 1999.

Table 2
SUMMARY OF SITE HISTORY

(Continued)

AOC No.	Name	Waste	Contaminated Media	Primary Contaminants of Concern	Maximum Concentration	Reference
17	Low Mass Criticality Facility	Slightly elevated levels of radiation were found near the former Low Mass Criticality facility, which was in operation from 1955 through mid 1960s. The facility was dismantled in 1994. The former silo area is currently a recharge basin for the OU I groundwater treatment system.	Soil	Cesium-137	0.5 pCi/gm	IT, 1999. CDM, 1999a. BNL, 1999.
18	Alternating Gradient Synchrotron Storage Yards	Two of the three yards are used for more than 20 years to store activated steel used in the synchrotron accelerator facilities. The third yard is used to store non-activated steel.	Soil	None	Not Applicable	IT, 1999. CDM, 1999a. BNL, 1999.
Removal Actions						
1B	OU I Groundwater (HWMF/current Landfill)	In 1984, radiological and volatile organic compounds associated with AOC 1 and AOC 3 were found in the groundwater in the southeast portion of the BNL site. In 1992, VOCs were found in groundwater at the site boundary 130-150 feet below the surface and are migrating off-site. Tritium is also co-located with the VOCs. A pump and treat system for the Ocs is currently in operation. The strontium-90 remains on the BNL site.	Groundwater	1,1 Dichloroethane Chloroethane 1,1,1 Trichloroethane 1,1 Dichloroethene Tritium Strontium-90	360ppb 210 ppb 62 ppb 34 ppb 37,000 pCi/l 150 pCi/l	CDM, 1995b
2A & 2E	Former Landfill and Slit Trench	This eight-acre landfill was operated by the U.S. Army during World War II and by BNL from 1947 to 1966. Used primarily for disposal of sanitary, municipal-type and construction wastes. Limited amounts of low-level radioactive waste and some laboratory chemical wastes also were disposed in this landfill. The landfill, including adjacent Slit Trench, was capped in 1996.	Groundwater Buried Waste	Strontium-90 N/A	150 pCi/l N/A	CDM, 1995a. BNL, 1996.

Table 2
SUMMARY OF SITE HISTORY

(Continued)

AOC No.	Name	Waste	Contaminated Media	Primary Contaminants of Concern	Maximum Concentration	Reference
2B & 2C	Chemical Animal Pits/Glass Holes	These disposal pits were used from the late 1950s to 1981. Wastes consisted of laboratory glassware, equipment, chemical bottles, laboratory animal carcasses, and other laboratory wastes. Fifty-five pits were excavated in 1997, and wastes were sorted and stockpiled. They are currently being disposed of off-site.	Soil Groundwater Buried Waste	Mercury Strontium-90 Trichloroethene Carbontetrachloride N/A	0.18 mg/kg 240 pCi/l 22 ppb 6 ppb N/A	CDM, 1997. BNL, 1997.
2D	Interim Landfill	This three-quarter acre landfill was operated BNL from 1966 to 1967. Used temporarily for municipal-type, sanitary and construction waste disposal until the Current Landfill was built. Limited amounts of low-level radioactive waste and some laboratory chemical wastes also were disposed of in this landfill. The landfill was capped in 1997.	Groundwater Buried Waste	Strontium-90 N/A	150 pCi/l N/A	CDM, 1995a. BNL, 1996a.
3	Current Landfill	This eight-acre landfill was operated by BNL from 1967 to 1990. Used primarily for municipal-type, sanitary and construction waste disposal. Limited amounts of low-level radioactive waste and some laboratory chemical wastes also were disposed in this landfill. The landfill was capped in 1995.	Groundwater Buried Waste	1,1 Dichloroethane 1,1,1 Trichloroethane Chloroethane N/A	48 ppb 6 ppb 34 ppb N/A	CDM, 1995a. BNL, 1994.
16S	National Weather Service Stockpile	In 1992, soil excavated from the National Weather Service site at BNL was found to contain low levels of radioactive contamination. About 127 cubic yards of soil was below cleanup goals and one drum of soil was above cleanup goals. The drum is being stored at the former Hazardous Waste Management Facility and the 127 cubic yards was used as fill under the cap of the Former Landfill.	Soil	Cesium-137	greater than 23 pCi/gm (one drum)	CDM, 1995a. BNL, 1996.

Table 2
SUMMARY OF SITE HISTORY

(Continued)

AOC No.	Name	Waste	Contaminated Media	Primary Contaminants of Concern	Maximum Concentration	Reference
			Other Area of Concern			
2F	Ash Pit	This three-acre area was used for disposal of incinerator ash from 1943 to 1963. No records indicate incineration of radiological or hazardous wastes. Portions of the ash pit are covered with a fire break and a paved road.	Soil	Lead	2,100 mg/kg	CDM, 1995a. CDM, 1996a.
3	Wooded Wetland	This two-acre wetland is adjacent to the capped Current Landfill. Runoff contaminated with leachate for the landfill drained into the area before capping the landfill in 1995. Elevated levels of metal below human health concerns may be a potential threat to the New York State endangered Tiger Salamander.	Surface Water Sediment	Aluminum Copper Zinc Copper Lead	38,600 Fg/l 56 Fg/l 252 Fg/l 8 mg/kg 28 mg/kg	CDM, 1996a. CDM, 1999a. CDM, 1999b.
8	Upland and Recharge Meadow Marsh	Used for experiments in the 1960s and 1970s on use of natural ecosystems for treatment of sewage and recharge to groundwater. The sewage contained metal and radionuclide contaminants. The area currently contains abandoned artificial basins and ponds. No chemicals of concern exceed human health risk criteria; metal concentrations are a potential concern for the New York State endangered Tiger Salamander.	Surface Water Sediment	Aluminum Cadmium Copper Zinc Cadmium Copper Mercury Silver	5,110 Fg/l 73 Fg/l 1,550 Fg/l 27,800 Fg/l 22 mg/lg 1,880 mg/kg 12 mg/kg 138 mg/kg	CDM, 1996a. CDM, 1999a. CDM, 1999b.
24E & 24F	Recharge Basin HS Recharge Basin HW	These two recharge basins receive storm water effluent from the center of the BNL site and warehouse area. They are New York State permitted Basins. No chemicals of concern exceed human health risk criteria. Metal concentrations are a potential concern for the New York State endangered Tiger Salamander.	Surface Water Sediment	Aluminum Copper Zinc Cadmium Copper Lead Zinc	14,880 Fg/l 70 Fg/l 297 Fg/l 3 mg/kg 143 mg/kg 297 mg/kg 806 mg/kg	CDM, 1996a. CDM, 1999a. CDM, 1999b.

Table 3
Drinking Water Standards, Groundwater Standards, Guidance Values and Cleanup Goal for Selected Parameters
Brookhaven National Laboratory - Operable Unit I

Constituent	*NYS Drinking Water Satandard 10NYCRR Subpart 5-1 (ug/l)*	*Groundwater Quality for GA Waters 6NYCRR 703.5 (ug/l)*	*USEPA Primary Drinking Water Standards Part 141 MCL (ug/l)*	*Selected Cleanup Goal (ug/l)*
Violatile Organics				
Carbon tetrachloride	5P	5	5	5
Chloroethane	5P	5	NS	5
Chloroethane	5P	5	NS	5
1,2 Dibromoethane	0.05P	5	0.05	0.05
1,1 Dichloroethane	5P	5	NS	5
1,2 Dichloroethane	5P	5	5	5
1,1 Dichloroethene	5P	5	7	5
1,2 Dichloroethene	5P	5	70 / 100 [1]	5
1,2 Dichloropropane	5P	5	5	5
Tetrachloroethene	5P	5	5	5
1,1,1 Trichloroethane	5P	5	200	5
Trichloroethylane	5P	5	5	5
Vinyl chloride	2P	2	2	2
Inorganics				
Cadmium	5	10	5	5
Lead	15	25	15 [2]	15
Thallium	2	4	2	2
Radionuclides	*(pCI/l) [3]*	*(pCl/l)*	*(pCl/l)*	*(pCl/l)*
Gross alpha	15	NS	NS	15
Gross beta	50	NS	50 [4]	50 [4]
Strontium-90	8	NS	8	8
Tritium	20,000	NS	20,000	20,000

Notes:

NS- No Standard
P- Principle Organic Contaminant
[1]- cis isomer = 70 ug/l, trans isomer = 100 ug/l.
[2]- Based on USEPA 1996 Drinking Water Regulations.
[3]- Based on NYSDOH MCLs-January 1992. Current MCLs, based on the last revision of the Safe Drinking Water Act
[4]- USEP Drinking Water Standards as per CFR 40 part 141.16 are listed for Strontium-90, tritium, and gross beta. MCL for both beta particle and photon radioactivity, i.e., from human made radionuclides in drinking water is the average annual concentration that shall not produce an animal dose equivalent to the total body or any internal organ greater than 4 milliren/year (40 CFR 141.16a).

Table 4
Soil Cleanup Levels for
Principal Radiological Contaminants at BNL

Radionuclide[e]	Soil Cleanup Level Residential Land Use (pCi/g)	Soil Cleanup Level Industrial Land Use (pCi/g)
Cesium-137	23 [a]	67 [b]
Strontium-90	15 [c]	15 [c]
Radium-226	5 [d]	5 [d]

a. Acceptable soil concentration for 15 mrem/yr above background exposure and residential land use with 50 years of institutional control of the site. This Goal applies to areas other than the Former Hazardous Waste Management Facility.
b. Acceptable soil concentration for 15 mrem/yr above background exposure and industrial land use with 50 years of institutional control and residential land use with 100 years of institutional control of the site. This Goal applies to the Former Hazardous Waste Management Facility.
c. The Strontium-90 goal is based on an evaluation. of groundwater impacts. It also is protective of residential and industrial use.
d. DOE Order 5400.5 Radiation Protection of the Public and the Environment. Also, commonly used by EPA.
e. In addition to the radionuclide specific levels, a post remediation sampling and a dose assessment will be performed to ensure that the dose from the remaining concentrations of all radionuclides present is less than 15 mrem/year above background considering 50 years of institutional control for the selected land use.

Table 5
Soil Cleanup Levels for Principal Chemical Contaminants at BNL

Contaminant	Soil Cleanup Level (mg/kg)
Lead	400 [a]
Mercury	1.84 [b]

a. Based on EPA's soil screening level guidance (OSWER 9355.4-23). Protective of residential use.

b. Based on EPA's soil screening level guidance (OSWER 9355.4-23)). Protective of groundwater and residential use. This goal applies to the former Hazardous Waste Management Facility (AOC 1).

TABLE 6

COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR RADIOLOGICALLY CONTAMINATED SOILS

Alternative	1. Protection of Human Health & Environment [1] (after Federal institutional control)	2. Compliance with ARARs	3. Long-Term Effectiveness and Permanence [2]	4. Reduction of Toxicity, Mobility or Volume (TMv) by Treatment	5. Short-Term Effectiveness [3]	6. Implementability	7. Cost
1. No Action with Monitoring	■ Remedial action objectives not met Residual Risk to future HWMF users. 50 years 6.3E-02 (6.3E-02) 100 years 2.0E-02 (2.0E-02)	■ Does not meet ARARs either during or following remediation	■ Not Effective in achieving future use allowable exposure levels	■ No active reduction of TMV. All contaminated media remains on site ■ Natural reduction of toxicity by radioactive decay and dispersion only ■ Overall Very Low	Remediation Risk Ranking Worker - 1 (9 person rem) Community - 1 None	■ Readily implemented ■ Limited technical requirements ■ Limited administration ■ Overall Very Simple	$844,000
2. Engineered Cell ■ **Dispose soils above cleanup goals On Site**	■ Remedial action objectives met Residual Risk to future HWMF users 50 years 4.8E-05 (1.5E-04) 100 years 1.5E-05 (4.3E-05)	■ Remediation Expected compliance with cleanup goal ■ Post-Remediation Potential siting issue with State as all media remains on site in de facto rad waste disposal facility Waiver required	■ Marginally Effective ■ Highest contaminated soil remains within cell ■ Permanence to prevent direct external exposure to all contaminated soils dependent on cover maintenance and zoning controls for perpetuity	■ No reduction of TMV through treatment ■ Natural reduction of toxicity over time (decay) ■ Source of direct external exposure shielded and contaminant mobility reduced by cover and liner system ■ Overall Low	Remediation Risk Ranking Worker - 6 (168 person rem) Community - 3 (4.4E-10)	■ Extremely intrusive remediation ■ Readily implemented technically feasible ■ Complex administration requirements due to permitting (other issues for cell ■ Overall Moderately Complex	$6,618,000
3. Moderate Excavation, Off-site Disposal, and RCRA Cap ■ **Excavate/Dispose soils above secondary action level** ■ **Cap remaining soils above cleanup goals**	■ Remedial action objectives met Residual Risk to future HWMF users 50 years 4.5E-05 (5.1E-05) 100 years: 1.4E-05 (1.5E-05)	■ Remediation Expected compliance with cleanup goal ■ Post-Remediation Media remaining on site meets secondary action level, however, potential siting issue with State, which may require waiver	■ Effective (if cap maintained) ■ Highest contaminated soils permanently removed ■ Permanence to prevent direct external exposure to lower activity contaminated soils dependent on cap maintenance for 100 years	■ Reduction of TMV through offsite disposal ■ Additional toxicity and mobility reduction via cap ■ Overall Medium	Remediation Risk Ranking Worker - 2 (45 person rem) Community - 5 (2.6E-07)	■ Partially intrusive remediation ■ Readily implemented technically feasible ■ Above average administration requirements due to offsite disposal volumes and cap permitting ■ Overall Moderately Complex	$14,915,000
4. Large-Scale Excavation and Offsite Disposal ■ **Excavate/Dispose soils above cleanup goals**	■ Remedial action objectives met Residual Risk to future HWMF users 50 years 6.5E-05 (7.1E-05) 100 years 2.0E-05 (2.1E-05)	■ Remediation Expected compliance with cleanup goal ■ Post-Remediation Expected compliance since all soils above remediation goals removed from site	■ Very Effective ■ Permanent ■ All contaminated soils above risk-based remediation goals removed ■ Institutional control period 50 years (vs. 100 years for other alternatives)	■ Substantial reduction of TMV through offsite disposal however, no treatment is provided ■ Overall, Very High	Remediation Risk Ranking Worker - 4 (90 person rem) Community - 6 (5.3E-07)	■ Extremely intrusive remediation ■ Readily implemented technically feasible ■ Above average administration requirement due to large offsite disposal volumes ■ Overall Moderately Complex	$21,032,000
5. Moderate Excavation, Soil Washing, Offsite Disposal, and RCRA Cap ■ **Dispose >2800 pCi/g** ■ **Wash above secondary action level** ■ **Cap remaining soils above cleanup goals**	■ Remedial action objectives met Residual Risk to future HWMF users. 50 years 4.5E-05 (5.1E-05) 100 years. 1.4E-05 (1.5E-05)	■ Remediation Expected compliance with cleanup goal ■ Post-Remediation Media remaining on site meets secondary action level, however, potential siting issue with State, which may require waiver	■ Effective (if cap maintained) ■ Highest contaminated soils removed ■ Permanence to prevent direct external exposure to lower activity contaminated soils dependent on cap maintenance for 100 years	■ Reduction of TMV through offsite disposal ■ Additional reduction in volume via soil washing ■ Additional toxicity and mobility reduction via cap ■ Overall Relatively High	Remediation Risk Ranking Worker - 5 (120 person rem) Community - 4 (8.8E-08)	■ Partially intrusive remediation ■ Readily implemented Less technically feasible as soil washing of Cs not demonstrated High remedial O&M ■ Above-average administration requirements due to large offsite disposal volumes treatment technology and cap permitting ■ Overall Complex	$15,301,000
6. Moderate Vitrification and RCRA Cap ■ **Vitrify soil above secondary action level** ■ **Cap remaining soil above cleanup goals**	■ Remedial action objectives met Residual Risk to future HWMF users 50 years 4.5E-05 (5.2E-05) 100 years 1.4E-05 (1.6E-05)	■ Remediation Expected compliance with cleanup goal ■ Post-Remediation Highest soils vitrified and capped and effectively immobile, however, potential siting issue with State, which may require waiver	■ Effective (if cap maintained) ■ Highest contaminated soils permanently immobilized and then capped ■ Permanence to prevent direct external exposure dependent on cap maintenance for 100 years ■ Permanence to prevent leaching and inadvertent intrusion provided by vitrified mass	■ Greatest reduction of TMV via treatment ■ No soils transferred off site ■ Additional toxicity and mobility reduction via cap ■ Overall Very High	Remediation Risk Ranking Worker - 3 (75 person rem) Community - 2 (None)	■ Less intrusive remediation of highest contaminated soils ■ Limited full-scale use Promising field study results High O&M and remediation time ■ Above average administration requirements for technology and cap permitting ■ Overall Very Complex	$19,554,000

[1] Future HWMF user is assumed to be industrial commercial. Risks are shown both with the drinking water pathway turned off and on (value in parentheses) for both 50 and 100 years of Federal institutional control

[2] Federal BNL controls assumed to be effective during 50-year control period for all Alternatives

[3] The Remediation Risk Ranking has been presented from lowest (1) to highest (6)

Table 7
SUMMARY OF SELECTED REMEDIES

AOC No.	Name	Proposed Remedial Actions	Basis for Action	Current Status	Remedial Action Reference
Radiologically Contaminated Soils					
1	Former Hazardous Waste Management Facility (HWMF)	Excavation with off-site disposal of approximately 35,000 cubic yards of contaminated soil, debris and sediments. Habitat restoration of the wetland. Demolition and disposal of facilities and buildings. Institutional controls and monitoring.	Protect groundwater from Strontium-90. Achieve 15 mrem/yr cleanup goal for future industrial land use.	Planned action upon ROD approval.	CDM, 1999a BNL,1999
6	Reclamation Facility (Building 650) Sump and Outfall Area	Excavation with off-site disposal of soil contaminated with long-lived radionuclides near Building 650 and at sump outfall area. Excavation with off-site disposal pipe (and associated contaminated with short-lived radionuclide with AOC 1 soils for off-site disposal. Remove cotaminated concrete at decontamination pad and dispose of off-site. Post-excavation soil sampling and dose assessment. Institutional controls and monitoring.	Protect groundwater from Strontium-90. Achieve 15 mrem/yr remediation goal for future residential land use.	Interim Remedy (fencing and access restrictions) in place. Planned action upon ROD approval	CDM, 1999a BNL,1999
10	Waste Concentration Facility	Remove and dispose of off-site contaminated concrete and asphalt pad at D Tanks Area, out-of-service piping and six 8,000 gallon underground tanks. Excavate/consolidate soils with AOC 1 for off-site disposal. Post-excavation soil sampling and dose assessment. Institutional controls and monitoring.	Protect groundwater. Achieve 15 mrem/yr remediation goal for future residential land use.	D Tanks removed. Planned action upon ROD approval.	CDM, 1999a BNL, 1999 IT,1999
16	Aerial Survey Results Results (Sub-AOCs 16E, 16F, 16G, 16S.1-4 and 16S.6a-f)	Excavate soils above cleanup goals and/consolidate soils with AOC 1 for off-site disposal. Extent of excavation to be determined during design phase. Post-excavation soil sampling and dose assessment. Institutional controls and monitoring.	Achieve 15 mrem/yr remediation goal for future residential land use. Achieve 400 mg/kg cleanup level for lead at AOC 16S.3.	Planned action upon ROD approval.	CDM, 1999a BNL, 1999 IT, 1999
16	Aerial Rad Survey Results (Sub-AOCs 16A-D, 161, 16J and 16M-Q	Active facilities that will be monitored. Institutional controls. Facilities will be decontaminated and decommissioned upon closure.	Monitor active facilities to insure that unacceptable environmental releases do not occur.	Planned action upon ROD approval.	BNL, 1999 IT,1999
17	Low Mass Critically Facility	Institutional controls and monitoring	Achieve 15 mrem/yr remediation goal for future residential land use.	Planned action upon ROD approval.	IT, 1999
18	Alternating Gradient Synchroton Storage Yard	Institutional controls and monitoring.	Achieve 15 mrem/yr remediation goal for future residential land use.	Planned action upon ROD approval.	IT, 1999

Table 7
SUMMARY OF SELECTED REMEDIES (Continued)

AOC No.	Name	Proposed Remedial Actions	Basis for Action	Current Status	Remedial Action Reference
Other Areas of Concern					
2F	Ash Pit	Soil cap. Annual visual inspection to ensure ash is not exposed at surface. Institutional controls and monitoring.	Protection from direct exposure to lead.	Planned action upon ROD approval.	CDM, 1999a BNL, 1999
3A	Wooded Wetland	Institutional controls and annual monitoring of surface water sediments.	Protection of State endangered species.	Monitoring performed with current landfill monitoring.	CDM, 1999b BNL, 1999
8	Upland and Recharge Meadow Marsh	Excavation of contaminated sediments with off-site disposal. Reconstruction of the wetlands. Maintenance and monitoring.	Protection of State endangered species.	Planned action upon Rod approval.	CDM, 1999a CDM, 1999b BNL, 1999
24E & 24F	Recharge Basins HS and HW	Institutional controls. Monitoring and Maintenance under current NYSDEC SPDES permit and BNL implementation of Tiger Salamander Habitat Management Plan.	Protection of State endangered species.	Planned action upon ROD approval.	CDM, 1999a BNL, 1999
Removal Actions Selected as Final Actions					
2A & 2E	Former Landfill Areas and Slit Trench	Geomembrane cap. Institutional controls and monitoring including methane monitoring, groundwater sampling, monthly inspections.	Protect groundwater. Presumptive remedy for landfills.	Completed October 1996.	CDM, 1995a BNL, 1996a
3	Current Landfill	Geomembrane cap. Institutional controls and monitoring including methane monitoring, groundwater sampling, monthly inspections.	Protect groundwater. Presumptive remedy for landfills.	Completed November 1995.	CDM, 1995a BNL, 1994
16S	National Weather Service Stoclkpile	Fill for Former Landfill. Off-Site Disposal of contaminated portion.	Achieve 15 mrem/yr remediation goal for future residential land use.	Completed October 1996.	CDM, 1995a BNL, 1996a
1B	OU 1 Groundwater	Pump and treat. Groundwater monitoring.	Prevent migration of off-site contaminant and achieve MCLs for groundwater.	Pump-and- treat system completed December 1996.	CDM, 1995b BNL, 1996b
2B& 2C	Chemical/Animal Pits and Glass Holes	Excavation and off site disposal of buried wastes and contaminated soils.	Protective groundwater. Presumptive remedy for landfills.	Excavation completed September 1997.	CDM, 1997a BNL, 1997
2D	Interim Landfill	Geomembrane cap. Institutional controls and monitoring including methane monitoring, groundwater sampling, monthly inspections.	Groundwater protection. Presumptive remedy for landfills.	Completed.	CDM, 1995a BNL, 1996a

Table 8
Cost Summary for Selected Remedies

REMEDIATION TASK	REMEDIATION COSTS
Radiologically Contaminated Soils	
Radiological Soils	24,032,00
HWMF Demolition & Disposal	1,380,000
Bldg. 811-D Tanks	1,440,000
Bldg. 811-Underground A and B Tanks	1,008,000
Sub Total	**$27,860,000**
Other Areas of Concern	
Ash Fill	146,000
Meadow Marsh Basins	442,000
Sub Total	**$588,000**
Removal Actions	
Current Landfill*	3,300,000
Former Landfill and Slit Trench*	6,460,000
Chemical/Animal Pits & Glass Holes*	6,587,000
Interim Landfill*	1,590,000
OU I Groundwater Pump and Treat System*	4,076,000
Sub Total	**$22,013,000**

*Incurred costs

FIGURES

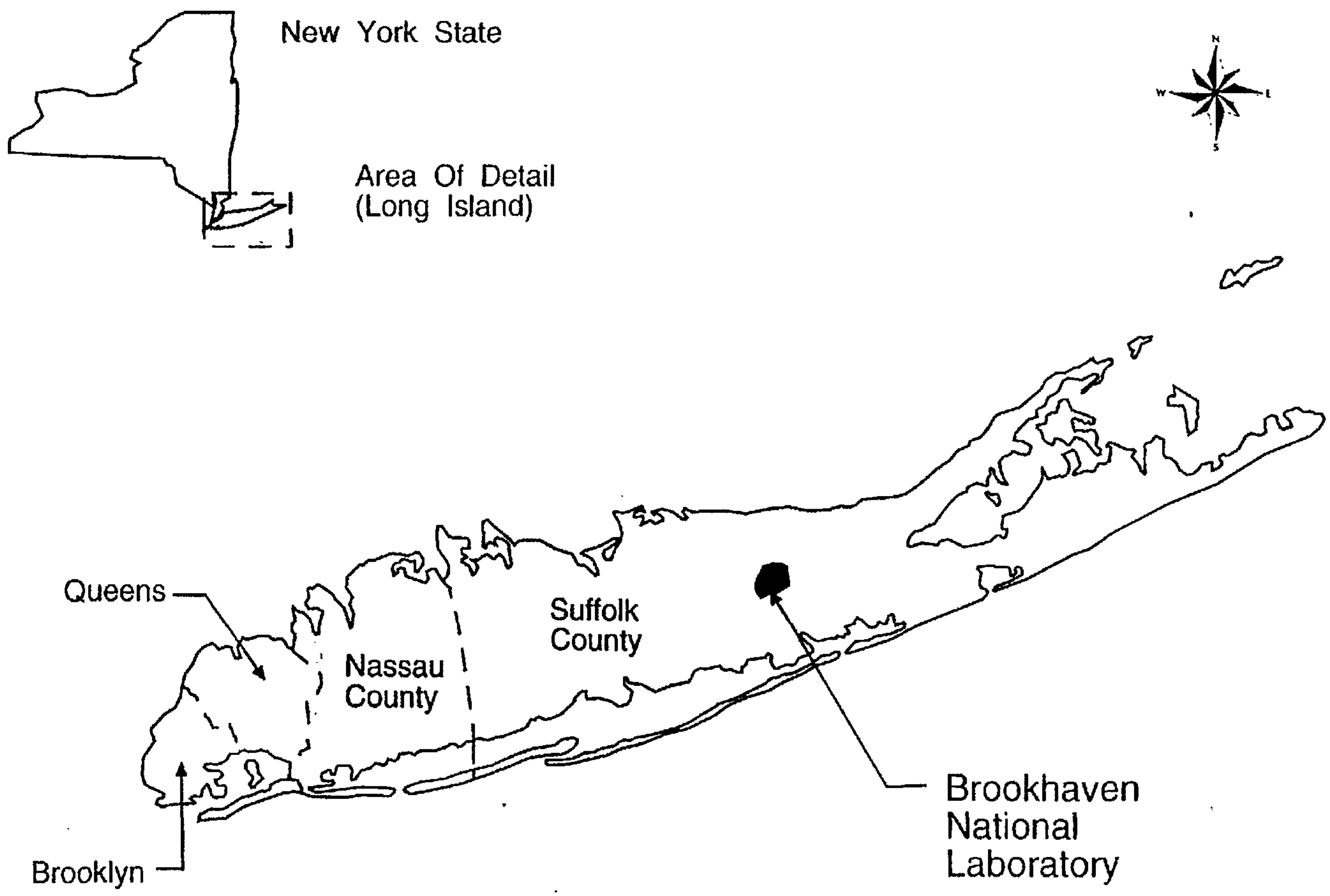

Figure 1

BNL Location Map

MLD - 11/08/96
gis3/dwgs/bnl nys.map

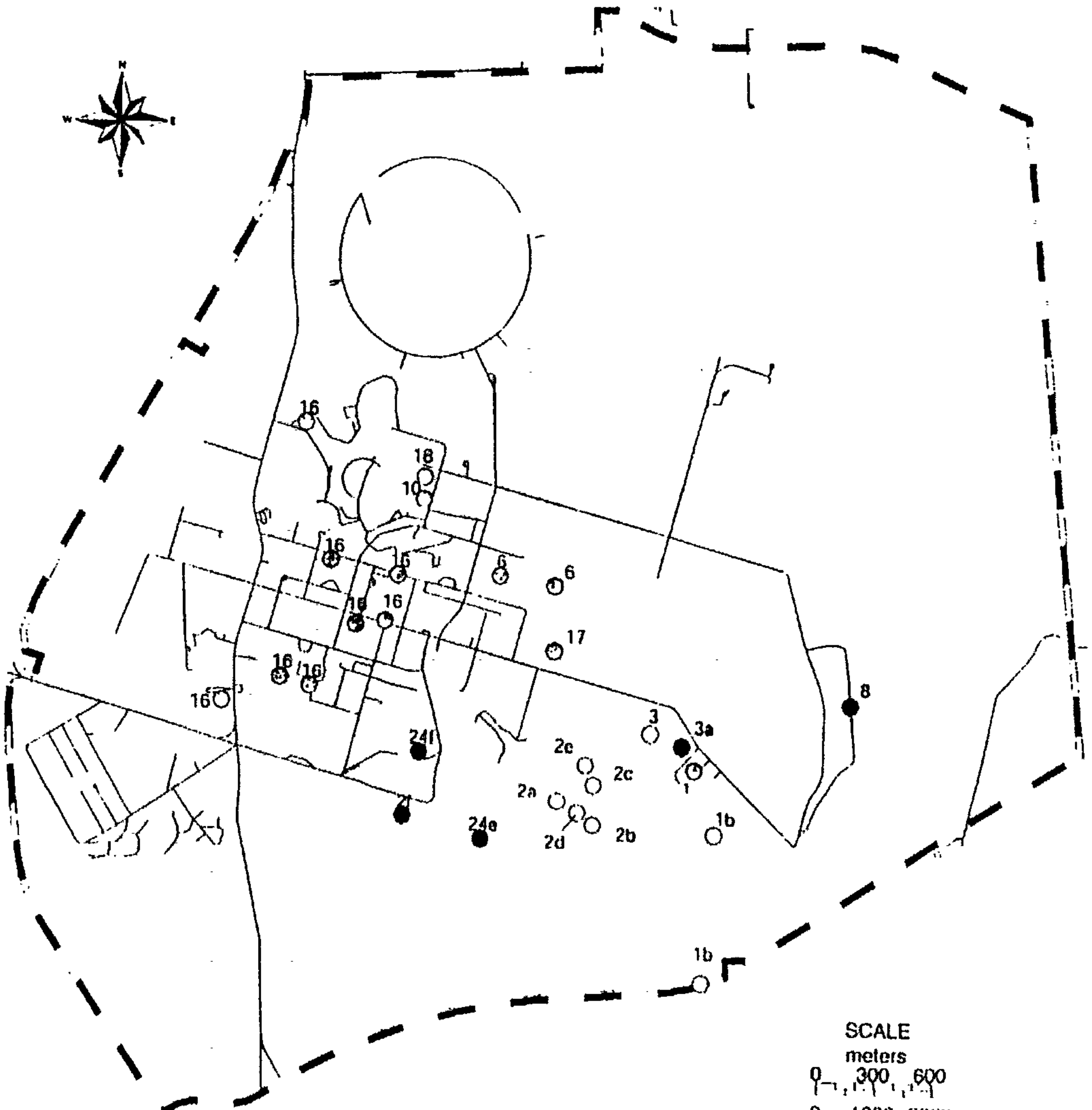

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Figure 2

Record of Decision
Areas Of Concern (AOC)

LEGEND

○ **Radiologically Contaminated Soils**

1	Hazardous Waste Management Facility
6	Building 650 Sump and Outfall Area
10	Waste Concentration Facility
16	Aerial Rad Survey Results
17	Low Mass Criticality Facility
18	Alternating Gradient Synchrotron Storage Yards

○ **Removal Actions**

1b	Groundwater
2a	Former Landfill
2b,c	Chemical/Animal/Glass Holes
2d	Slit Trench
2e	Interim Landfill
3	Current Landfill

● **Other AOCs**

2f	Ash Pit
3a	Wooded Wetland
8	Upland Recharge and Meadow Marsh
24e,f	Recharge Basins

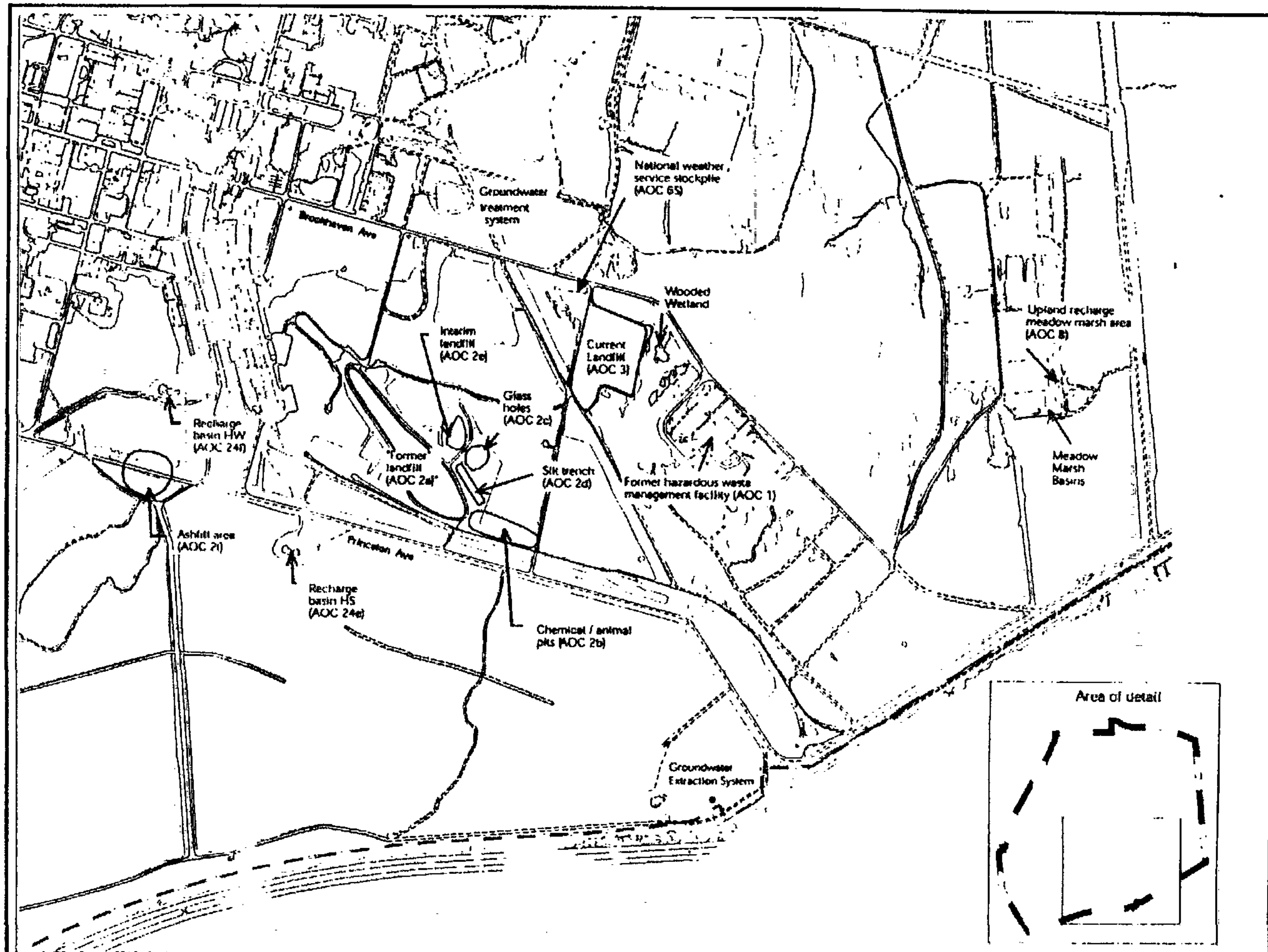

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Figure 3

OUI - REMOVAL ACTIONS AND
OTHER AREAS OF CONCERN

Meters
0 100 200 300
0 Feet 1000

HPEI 05/17/99
(mygis/projects/OU1
(ATH oerm)/graphics/ou1/ras

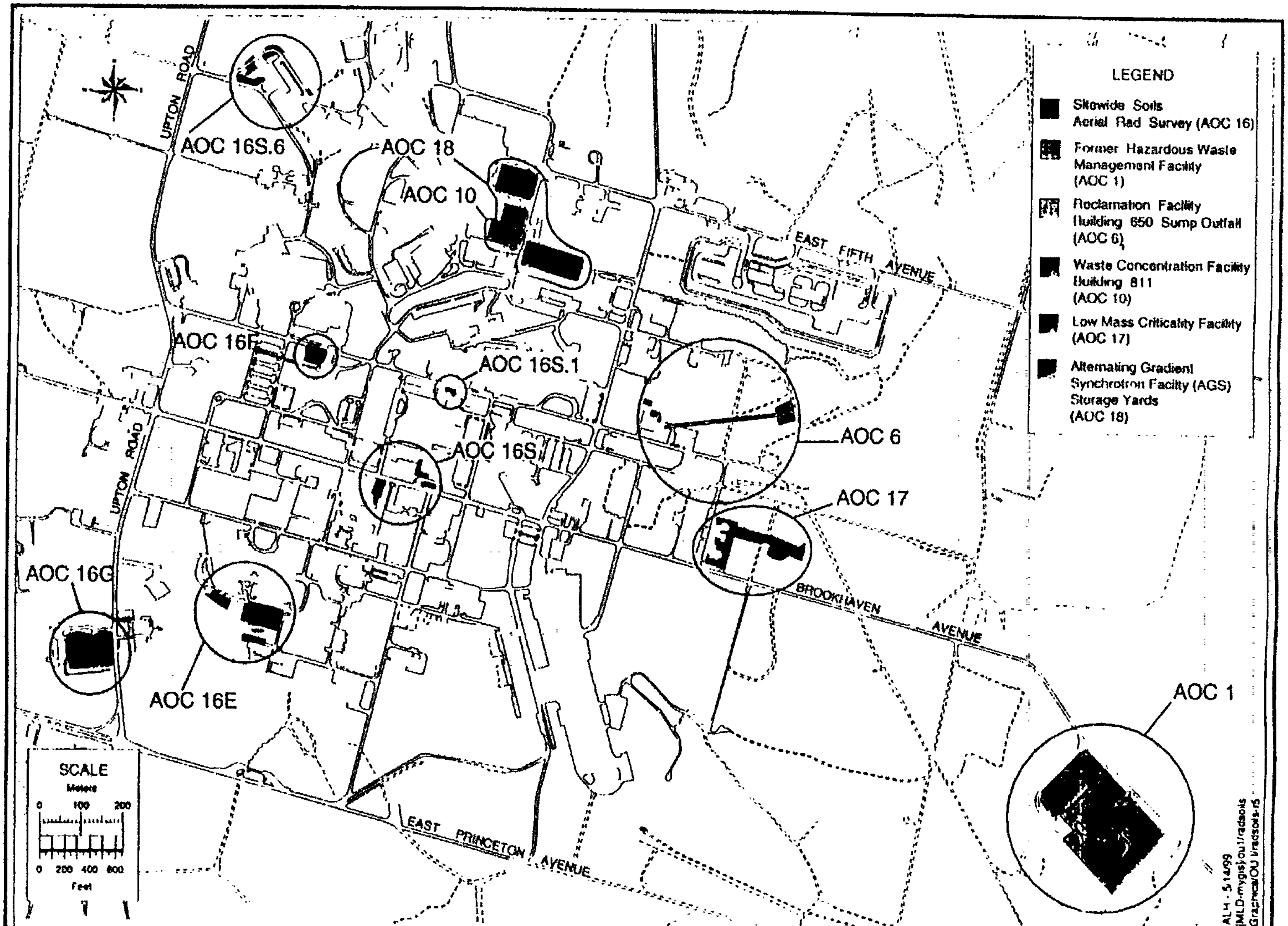

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Figure 4
Operable Unit 1
Radiologically Contaminated Soils

Environmental Restoration Division

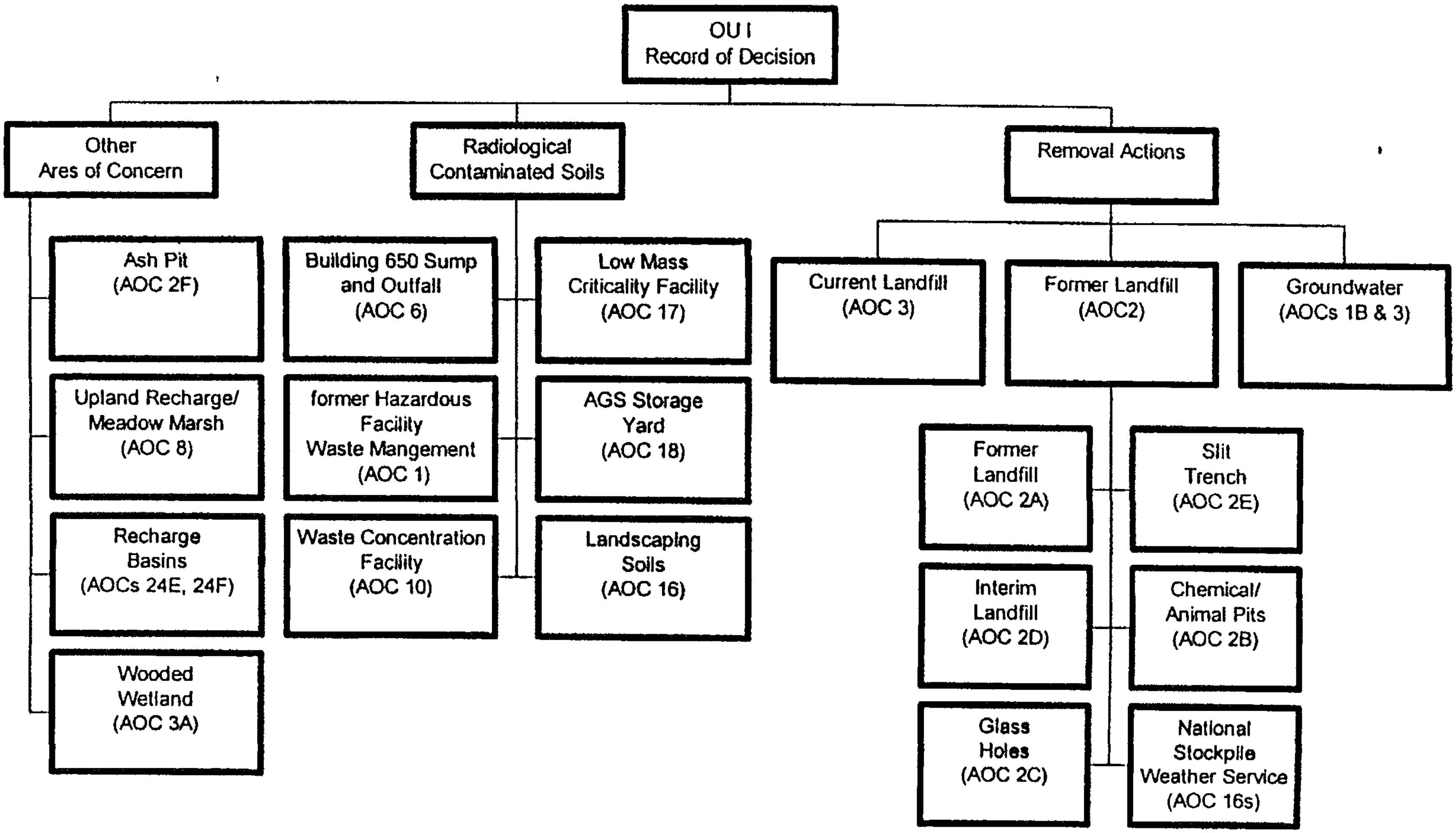

Figure 5: Actions covered under the OU I Record of Decision

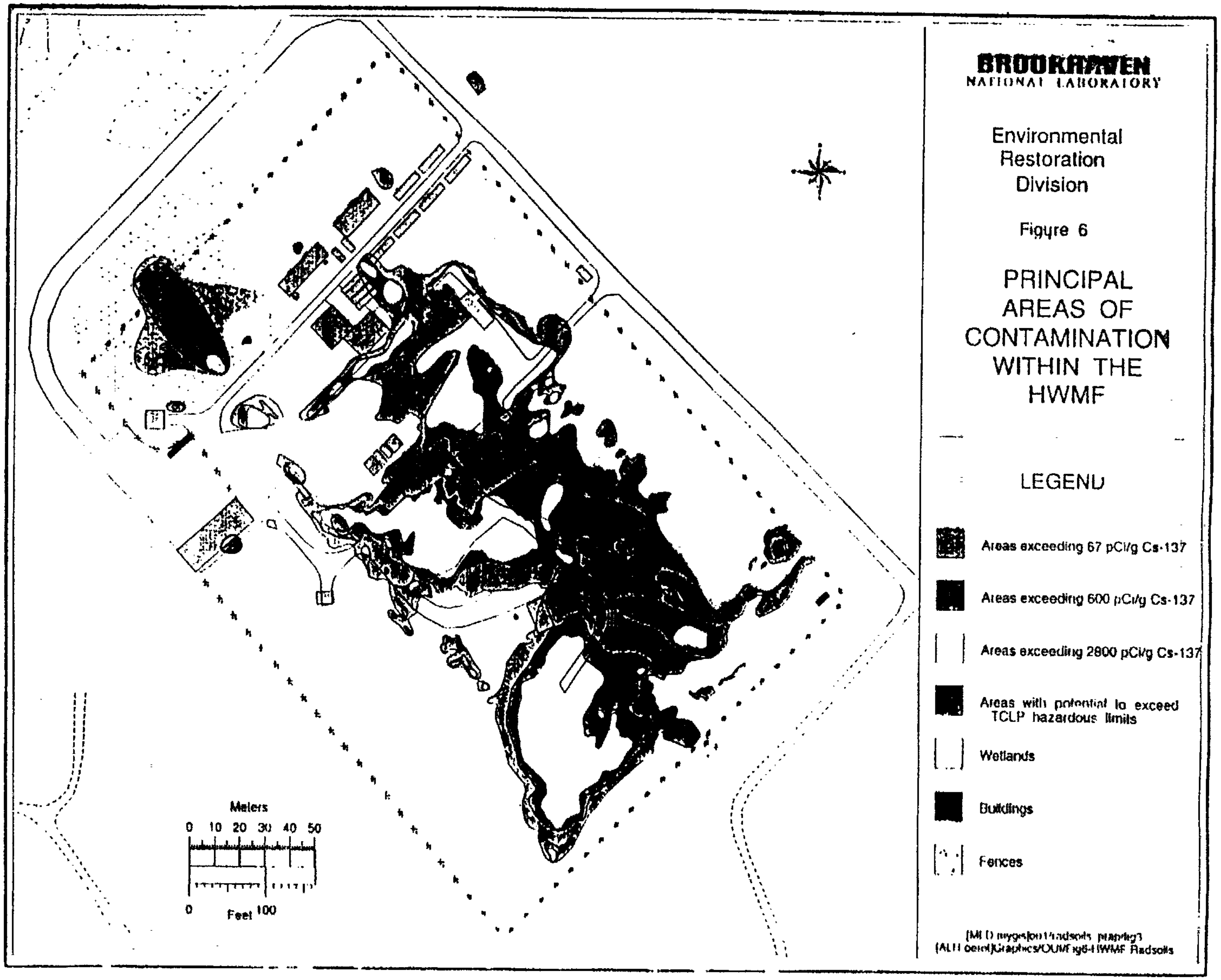
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Figure 6
PRINCIPAL AREAS OF CONTAMINATION WITHIN THE HWMF
LEGEND
Areas exceeding 67 pCi/g Cs-137
Areas exceeding 600 pCi/g Cs-137
Areas exceeding 2800 pCi/g Cs-137
Areas with potential to exceed TCLP hazardous limits
Wetlands
Buildings
Fences
Meters
0 10 20 30 40 50
0 Feet 100

U. S. DEPARTMENT OF ENERGY

BROOKHAVEN NATIONAL LABORATORY

RECORD OF DECISION

OPERABLE UNIT I
AND RADIOLOGICALLY CONTAMINATED SOILS
(INCLUDING AREAS OF CONCERN 6, 8, 10, 16,17, and 18)

III. RESPONSIVENESS SUMMARY

TABLE OF CONTENTS

1. INTRODUCTION

This Responsiveness Summary of the Record of Decision presents the public comments and concerns and the U.S. Department of Energy's (DOE) responses to those comments and concerns that address the Feasibility Study Report (FS) and the Proposed Plan for Operable Unit I (OU 1) and several areas of radiologically contaminated soils at Brookhaven National Laboratory (BNL).

The Responsive Summary serves the following two functions:

- It provides decision-makers with information about the views of the community regarding the proposed remedial action and feasible alternatives; and

- It documents how public comments have been considered during, the decision-making and provides answers to major comments.

A public comment period for the review of the OU I Proposed Plan and the OU I Feasibility Study began on April 1, 1999 and ended on April 30, 1999. A public meeting was held on April 22, 1999 at 7:30 p.m. in the BerknerHall Auditorium at Brookhaven National Laboratory. Approximately 40 people attended this meeting. Copies of the Proposed Plan and other related informational material were available. Copies of the OU I Proposed Plan and the Feasibility Study were provided at the following Administrative Record/Information Respositories for public review:

- U.S. EPA Region II, Administrative Records Room, New York, NY
- Longwood Public Library, Middle Island, NY
- BNL Research Library, Upton, NY
- Mastic-Moriches-Shirley Library, Shirley, NY

Based on the comments received during the public meeting and comment period, the DOE believes that the EPA, NYSDEC, BNL, local government officials and residents were responsive to the Proposed Plan and generally support DOE's preferred remedial alternatives. No major objections to the preferred remedy were raised at the public meeting or during the comment period. Section 4 of this Responsiveness Summary summarizes responses to all comments pertaining to the Proposed Plan and Feasibility Study.

The Responsiveness Summary is divided into the following sections:

2. OVERVIEW OF THE RESPONSIVENESS SUMMARY
   This section briefly describes the site background and DOE's proposed alternatives.

3. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS
   This section provides the history of community concerns and describes community involvement in selecting a remedy for OU I.

4. COMPREHENSIVE SUMMARY OF MAJOR QUESTIONS, COMMENTS AND CONCERNS, AND DOE RESPONSES
This section summarizes the written comments DOE received during the public comment period, the oral and written comments received during the public meeting, and DOE's responses.

5. RESPONSES TO DETAILED COMMENT LETTERS
This section contains specific written responses to the significant comment letters. Comments from these letters also are given in the summaries in Section 4 of this document.

6. CHRONOLOGY OF COMMUNITY RELATIONS ACTIVITIES
This section gives a chronology of the significant Community Relations activities that pertain to OU I.

7. REFERENCES

2. OVERVIEW OF THE RESPONSIVENESS SUMMARY

2.1 Site History

The BNL site, formerly Camp Upton, was occupied by the U.S. Army during World Wars I and II. Between the wars, the site was operated by the Civilian Conservation Corps. It was transferred to the Atomic Energy Commission in 1947, to the Energy Research and Development Administration in 1975, and to DOE in 1977.

In 1980, the BNL site was placed on NYSDEC's list of Inactive Hazardous Waste Sites. On December 21, 1989, the BNL site was included on EPA's National Priorities List because of contamination of soil and groundwater that resulted from past operations of the facility. Subsequently, the EPA, NYSDEC, and DOE entered into a Federal Facilities Agreement (herein referred to as the IAG) that became effective in May 1992 (Administrative Docket Number: II-CERCLA-FFA-00201) to coordinate cleanup activities. The IAG identified areas of concern that were grouped into Operable Units to be evaluated for response actions. The IAG requires a Remedial Investigation/Feasibility Study for OU I, pursuant to 42 U.S.C. 9601 et. seq., to meet CERCLA requirements. The IAG also requires cleanup actions to address the identified concerns. Cleanup at the BNL site will be conducted pursuant to CERCLA, 40 CFR Part 300.

BNL's Response Strategy Document (SAIC, 1992) grouped the identified areas of concern into seven Operable Units. OU II and VII were subsequently combined. Remedial investigations and risk assessments (CDM Federal 1996a, IT 1999a) were conducted. In addition, several accelerated cleanup actions were taken as discussed in Section II and an interim action was taken at the Building 650 Sump Outfall Area. The Sump Outfall Area was fenced off to prevent unnecessary access. Risk assessments were conducted to evaluate the nature and extent of contamination, and potential risks associated with the areas of concern are addressed in this Record of Decision. A Feasibility Study

(CDM Federal 1999a) was prepared to evaluate the alternatives for remediating the radiologically contaminated soils and other areas of concern addressed in this Record of Decision.

2.2 Site Description

An overview of the areas of concern addressed in this Record of Decision is presented below.

2.3 Radiologically Contaminated Soils

Radiologically contaminated soils from the following areas of concern are included in this Record of Decision.

- the former Hazardous Waste Management Facility (AOC 1)
- the Waste Concentration Facility Building 811 (AOC 10)
- the radiologically contaminated surface soils (Areas of Concern 16, 17, and 18), and
- the Reclamation Facility Building 650 and Sump Outfall Area (AOC 6).

The OU I and Radiologically Contaminated Soils Feasibility Study evaluated several remedial alternatives to address soil and sediment contamination. The Proposed Plan recommended that radiologically contaminated soil above cleanup goals be excavated, disposed of off-site and institutional controls be implemented. Some associated structures also will be removed.

All wastes will be transported off-site to a permitted disposal facility.

2.4 Other Areas of Concern

There are other areas of concern which have low concentrations of metals as the primary contaminant of concern.

<u>Upland Recharge/Meadow Marsh Are</u>

The Upland Recharge/Meadow Marsh Area (AOC 8) was the site of an experiment for evaluating the capacity of small natural and artificial terrestrial and aquatic ecosystems for sewage treatment and recharge of ground and surface waters.

The Remedial Investigation found no human health risks from exposures to soils or sediments. However, the focused Ecological Risk Assessment identified the potential for ecological risk to tiger salamanders by exposure to metals. Groundwater contaminated with ethylene dibromide and contaminated soils is addressed in a separate Record of Decision for
OU VI.

The recommended remedy for two ponds in the Upland Recharge/Meadow Marsh Area is excavating of contaminated sediments and disposing of the wastes off-site. The two wetlands will be reconstructed.

Recharge Basins

Recharge Basins HS (AOC 24E) and Weaver Drive Basin HW (AOC 24F) receive storm water effluent, and are included in the BNL State Pollution Discharge Elimination System (SPDES). The recommended remedy is operational maintenance and monitoring for the recharge basins. A Tiger Salamander Habitat Management Plan is being prepared in conjunction with the NYSDEC to protect this species from routine basin maintenance.

Ash Pit

The Ash Pit was used disposing of ash and slag from a solid waste incinerator that operated from 1943 to 1963. The proposed remedy is to cover the Ash pit with a soil cap and provide institutional controls and maintenance to prevent exposures.

Wooded Wetland

The Wooded Wetland received runoff from the Current Landfill when it was operating. The proposed remedy is institutional control and monitoring.

2.5 Removal Actions

DOE determined that accelerated cleanup actions, called removal actions, were required for several areas of concern. The potential removal actions were evaluated in Engineering Evaluation/Cost Analysis Reports that were prepared pursuant to CERCLA (CDM Federal, 1995a; CDM Federal, 1995b; and CDM Federal, 1997a). These reports were made available for public review and were approved by the regulatory agencies. The removal actions selected, after considering public comments, are documented in Action Memorandum (BNL, 1994; BNL, 1996; BNL, 1997).

Several landfill areas of concern were capped to prevent contaminates from migrating. Geomembrane caps, constructed pursuant to 6 NYCCR Part 360, were placed over the Current Landfill, Former Landfill, Slit Trench, and Interim Landfill. Its construction was completed in November, 1995 at the Current Landfill, in October 1996 at the Former Landfill and Slit Trench, and in November 1997 at the Interim Landfill. Details are documented in construction certification reports (CDM Federal, 1996b; Weston, 1997; and P.W. Grosser, 1997). The National Weather Service stockpile was used as fill for the Former Landfill cap. A 55-gallon drum containing soil with levels of radionuclides too high to place under the cap is stored at the former HWMF and will be disposed of off-site.

Contaminant soil, debris, and intact bottles were excavated and segregated for treatment and/or disposal from the Chemical/Animals Pits and Glass Holes. Samples were taken at each pit to ensure that cleanup levels of soil were met.

Several actions are being taken to address contamination of groundwater resulting from waste disposal at the former HWMF and the Current Landfill. A groundwater pump and treat system was installed in December 1996 at the BNL southern boundary to extract and treat Volatile Organic Compounds (VOC) that contaminate groundwater downgradient of OU I source areas. The system is designed to remove these chemicals by air stripping. The groundwater is recharged upgradient using a recharge basin. Groundwater from the area is being monitored. Contamination of groundwater associated with the Former Landfill and contaminated groundwater that has migrated off-site will be addressed in the OU III Record of Decision.

These removal actions are being adopted as final actions in this Record of Decision.

2.6 Level of Community Support for the Proposed Alternatives

Based on comments received during the public comment period, DOE and BNL believe that the public and local elected officials are in general agreement with the above recommended remedial alternatives. One-third of the comments received endorsed the proposed alternatives. There was one comment indicating a preference for using vitrification or soil washing. The remaining comments did not express an opinion for or against the proposed alternatives. The principal issues of concern were control of dust during excavation, the potential for transportation accidents, and deer contaminated with cesium-137.

2.7 Changes in the Proposed Plan

No changes to recommended remedies given in the Proposed Plan are required based on public or local official comments, or based on the EPA's and the NYSDEC's recommendations.

3. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS

3.1 Community Profile

BNL is located in Brookhaven Town at the geographic center of Suffolk County, which encompasses the central and eastern part of Long Island. With a population of approximately 430,000, Brookhaven Town accounts for about 16 percent of Long Island's 2.6 million residents.Suffolk County is operated by a county executive and an 18-member legislature. Brookhaven Town employs a town council (six at-large councilors) and a supervisor. Both governments maintain professional planning, development and environment departments, plus planning boards.

Many villages and hamlets dot Brookhaven Town's 260 square miles, and BNL is surrounded by the unincorporated communities of East Yaphank, Yaphank, Ridge, Middle Island, and Manorville. Most of these villages and hamlets have citizen-run civic or taxpayer organizations with large and active memberships. Most organizations join one or both of the area's two umbrella civic groups, the Affiliated Brookhaven Civic Organization and the Longwood Alliance. These communities support service clubs, which represent the businesses, churches, and other aligned interests within the community.

The town of Riverhead is another Suffolk County town where BNL activities generate interest. It is to the east of BNL beyond the Town of Brookhaven, has a population of about 24,500, and an area of about 60 square miles of which 41 percent is farmed. Riverhead employs a supervisor-town council government, which maintains professional planning, development and environment departments, plus a planning board.

3.2 History of Community Involvement

Historically, public involvement in BNL's environmental restoration activities was low, but after the establishment of a Community Relations program in 1991, public interest and contact with BNL increased. Evidence of the growth of community involvement can be measured by the steady increase in the size of the Environmental Restorations Division's (BNL) stakeholder mailing list, which currently numbers 2,312. BNL has made concerted efforts to inform and involve the community in its remediation efforts since its formation, and OU I has been routinely included in community involvement efforts.

On March 1, 1998 Brookhaven Science Associates became the management group responsible for BNL. Since then, interaction with the community has been a major focus of BNL's administration and employees.

Two established mechanisms for community involvement meet monthly at BNL. The Brookhaven Executive Roundtable (BER) (established in August 1997) is composed of elected officials (or their representatives), regulators, and the Suffolk County Water Authority. Community members routinely attend the meetings and an opportunity for public comment is on agenda. The BER was created to facilitate and expedite the flow of information from BNL to some of its key stakeholders on significant environmental, operational and/or regulatory/oversight issues. An independent Community Advisory Council has been meeting since September 1998. Composed of representatives of established stakeholder groups on Long Island, BNL employees and several individuals, the council meets to learn about and discuss issues relating to the laboratory and to offer recommendations to BNL's director.

Community relations activities concerning BNL CERCLA activities have echoed the new emphasis on community involvement at the decision-making level. Since August 1998, ten roundtables and workshops have been conducted to solicit community input on groundwater remediation and sampling of the Peconic River before the final remedies or plans were selected by BNL. To emphasize the importance of environmental issues, BNL's Director scheduled a BNL "Enviromental Fair Day" in the fall of 1998, which 3,600 community members attended, including many families with children. As part of the festivities BNL sponsored a "photo opportunity" for children (and adults) to have their picture taken on a huge drill rig, staffed a display about each of the Operable Units, and led tours of remediation-sites. Volunteers from BNL staffed the display, the drill rig, and the tours.

The goals of the Community Relations program are the following:

- To inform stakeholders (on-site employees and members of the public) about the issues being addressed.
- To solicit input from stakeholders about these issues.
- To provide stakeholder input to DOE/BNL senior management and regulators to be used as one of the decision-making criteria for evaluating cleanup alternatives.
- To develop relationships with on-site employees, community members and leaders, and community environmental activists.
- To increase regular communication with stakeholders through expansion of the BNL stakeholder mailing list.

A Community Relations Plan was finalized for the BNL site in September 1991. In accordance with this plan and CERCLA Section 113 (k) (2)(B)(I-v) and 117, the community relations program focused on public information and involvement. A variety of activities was used to provide information and to seek public participation, including the following.

The compilation of a stakeholder mailing list

- The regular issuance of the newsletter ***cleanupdate***.
- Meetings held with stakeholders in the form of roundtables, workshops, public meetings or individual stakeholder contacts.
- Maintenance of the BNL home page on the internet.
- Attendance at and updates provided to civic organization monthly meetings.
- Mailings of fact sheets about specific projects.
- An Administrative Record, documenting the basis for the selection of removal and remedial actions at the BNL site, has been established and is maintained at the local libraries listed below. The libraries also maintain site reports, press releases, and fact sheets. The libraries are:

Longwood Public Library
80 Middle Country Road
Middle Island, NY 11953

Mastic-Moriches-Shirley Library
301 William Floyd Parkway
Shirley, NY 11967

Brookhaven National Laboratory
Research Library
Bldg. 477A
Upton, NY 11973

EPA Region II
Administrative Records Room
290 Broadway
New York, New York 10001-1866

3.3 Summary of Community Participation Activities for OU I

Listed below are the major areas of community relations activities relating to the remedial activities that are covered by the OU I Feasibility Study and the Proposed Plan. Section 6 provides a detailed chronology of all the community relations activities for OU I.

Operable Unit I - Sampling and Analysis Plans

A public notice of availability for review and comment for the "OU I Remedial Investigation/Feasibility Study, Sampling and Analysis Plans and Site Health and Safety Plan" was published in local newspapers in October 1993. The public comment period for these documents was October 25 to November 26, 1993. A public meeting at BNL was held to discuss these reports.

Removal Action VI - Landfills and Chemical Holes

The Removal Action VI "Current Landfill Action Memorandum" was available for public review in the Administrative Record in January 1995, and a public notice of availability was published in local newspapers. In May 1995 a public notice for review and comment of Removal Action VI "Engineering Evaluation/Cost Analysis for Landfill Closure" was published in local newspapers. A 30-day extension of the comment period was requested, and the extension was granted and noted in an article published in ***cleanupdate.***

A presentation was made to the Community Work Group (an independent citizen group which looked into operations at BNL during 1996) in May 1996 about the cleanup methods under consideration for the "chemical/animal/glass holes." An article about the meeting was published in ***cleanupdate.*** In April 1997 a letter was sent to stakeholders advising them that the "Chemical/Animal Pits and Glass Holes Final Evaluation of Alternatives Report" was available for public review and comment. A fact sheet on the document also was enclosed. A public notice appeared in local newspapers. In the spring of 1997 an article about the initiation of the excavation and remediation of the former waste pits was included in ***cleanupdate.***

In July 1996 the Removal Action VI "Former Landfill Action Memorandum" was available for public review, and a public notice was published in local newspapers. An extensive article about the capping of the oldest inactive landfill was published in ***cleanupdate.*** The article included photos, a "cutaway", and a description of the capping process. In June 1997 a public notice of availability for review and comment of Operable Unit I "Action Memorandum Phase III - Landfill Closure Removal Action" was published in local newspapers.

Removal Action V Operable Unit I - Groundwater Removal Action and Operable Units I and III Public Water Hookups

A press release titled "Brookhaven Laboratory to Hold Public Meeting on Environmental Remediation, January 16, 1996" was issued in December 1995. A public notice for review and comment of the "Engineering Evaluation/Cost Analysis" (EE/CA) was published in January 1996. The 30-day public comment period for this document began January 2, and as a result of requests from the community, was extended twice, ending on March 18, 1996. An announcement of the January 16, 1996 public meeting also was included in the public notice. Summary sheets were sent to the stakeholders.

A public meeting was held on January 16,1996 at BNL to discuss the findings of the Removal Action EE/CA. Approximately 700 people attended the meeting.

An announcement of the extension of the public comment period was sent to the mailing list. A presentation to the Community Work Group regarding the public water hookups and a briefing on the "Groundwater EE/CA" were held at BNL. Two on-site briefings (January 4, 1996 and February 8, 1996) regarding the proposed groundwater treatment plant were given to the National Weather Service staff.

A Suffolk County legislator hosted a meeting to brief elected officials on the public water hookup project and BNL groundwater contamination. Two question-and-answer sessions (February 5 and 6, 1996) were offered to BNL employees regarding Operable Unit I groundwater issues. Also, four fact sheets about this project were published and distributed, as well as articles in six editions of the Brookhaven Bulletin (between February and March 1996). Several letters were received from the community and responded to by DOE.

Operable Unit I/VI -Remedial Investigation/Risk Assessment Report

In July 1996 a public notice for review and comment of the OU I/VI "Remedial Investigation/Risk Assessment" was published. The public comment period began July 29, 1996 and was originally scheduled to end August 30, 1996. Upon a request from a community group, it was extended to September 30, 1996. An article about the upcoming meeting was published in ***cleanupdate*** in the spring 1996 issue, and a notice of availability of the reports was published in the summer 1996 issue.

A summary sheet titled "Remedial Investigation and Risk Assessment of the Southeast Area of the Laboratory" was hand-delivered to the potentially affected community and mailed to the stakeholders. Later, when the public comment period was extended, it again was sent to the stakeholders with a letter announcing the extension.

OU II/VII Remedial Investigation Report

The Operable Unit II/VII Remedial Investigation Report was made available for public review and comment on February 17, 1999. A public notice and a display advertisement announcing the public comment period and the dates of the information/poster sessions were published in local newspapers. A DOE press release that announced the comment period and provided a summary of the report was issued to media contacts.

A mailing to the stakeholder mailing list, to all BNL employees, and to others who work on the BNL site but are not BNL employees (for example, the Day Care Center workers) included a cover letter, fact sheet and a copy of the public notice. The cover letter mentioned the dates and locations of the information/poster sessions.

An article in the Brookhaven Bulletin briefly summarized the topic and provided dates and times for information/poster sessions.

Two information/poster sessions were held in Berkner Hall, BNL. Total attendance at the two information sessions was 48, including 8 members of the public and 40 BNL employees. One written comment was received on the RI Report, and was responded to by DOE.

OU I Feasibility Study and Proposed Plan

The lead story of the December 1998 issue of ***cleanupdate*** "Meeting Scheduled on Lab Soil Cleanup" focused on the OU I Feasibility Study, detailing the cleanup options under consideration and announcing that the documents would be available for public review shortly. The OU II/VII Remedial Investigation Report also was featured in the article.

The Operable Unit I Feasibility Study and Proposed Plan was made available for public review and comment on April 1, 1999. A public notice and a display advertisement announcing the public comment period, the dates of the information/poster sessions, and the date of the public meeting were published in local newspapers. A DOE press release that announced the comment period and summarized the report was issued to media contacts.

A mailing was sent to the stakeholders, to all BNL employees, and to others who work on-site. The mailing, which was formatted in a fashion similar to the newsletter ***cleanupdate,*** included a summary of the report, mentioned the dates and locations of the information/poster sessions and public meeting, and provided a phone number to call to receive a copy of the entire OU I Proposed Plan. Two additional display advertisements announcing meeting dates were published in local newspapers. The Executive Summary of the Feasibility Study and the entire Proposed Plan were available on the BNL web site, along with the dates and times of the information sessions and public meeting.

Two laboratory-wide e-mails reminded BNL employees of the information sessions and the public meeting dates just before each occurred. An article in the Brookhaven Bulletin explained the proposed plan briefly and gave meeting dates and the web address.

Flyers announcing the upcoming poster sessions and public meeting were sent to all the public libraries in Suffolk County to be posted on their community bulletin boards. Five local civic organizations were briefed on the upcoming events and the flyers were distributed at the meetings. One civic association president was briefed by phone. The flyers also were distributed at the April 1999 meeting of the Community Advisory Council.

The Brookhaven Executive Roundtable was provided with an update and overview of OU I in December 1998 and a comprehensive status report in March 1999. The Community Advisory

Council was given an overview of all the Operable Units in December 1998 and a budget update in January 1999.

Elected officials were briefed in a letter sent in February 1999, and offered a personal briefing if that was desired. The staffs of Congressman Forbes and Senators Moynihan and Schumer were briefed by representatives of BNL and the local DOE-Brookhaven office in March of 1999.

Two poster/information sessions were held at BNL, one at lunchtime and one in the evening. The public meeting was held at Berkner Hall, BNL on April 22, 1999. Approximately 75 people attended the three sessions, including 19 members of the public.

4. COMPREHENSIVE SUMMARY OF MAJOR QUESTIONS, COMMENTS, CONCERNS AND RESPONSES

4.1 Overview

Public comments on the Feasibility Study and the Proposed Plan were submitted during the public comment period. These comments are presented in the following two categories:

1. Summary of questions and responses from the OU I Public Meeting held April 22, 1999. These comments were addressed by the panel at the public meeting and are summarized below.

2. Responses to written public comments received during the public comment period between April 1 and April 30, 1999. These are presented in Section 5, Responses to Detailed Comments.

4.2 Summary Questions and Responses

Similar questions and comments from different sources were combined and summarized for a common response. These general topics include the following:

1. Transportation off Long Island
2. Contamination of deer at BNL
3. Off-site disposal of wastes
4. Proposed cleanup remedies

1. <u>Transportation off Long Island</u>

The concerns expressed relate to the planned mode of transportation of contaminated soils by truck or rail and associated safety concerns and community acceptance.

At present no final decision has been made to use rail or truck. Some wastes will require truck transportation. Overall it is more cost-effective and safer to transport by rail. The concern of public acceptance of trucks going through Long Island communities was raised. BNL currently ships hazardous and radioactive wastes by truck off Long Island. Where appropriate, BNL will notify authorities of large shipments of wastes.

2. Contamination of deer at BNL

Several comments were received regarding contamination of deer with cesium-137. It was recommended that all areas with contaminated soils be fenced to keep deer away from these areas.

The NYS Department of Health has concluded that hunters who are potentially exposed to levels of cesium-137 are not exposed to be a health hazard. Since plans are to cleanup these areas as a first priority, there is no need to fence these areas now.

3. Off-site disposal of wastes

There were several comments expressing approval of the proposed remedy for excavation and off-site disposal of the radiologically contaminated soils. There was concern expressed for persons that may be living near the disposal facility.

The two available facilities, DOE's Hanford, Washington facility and Envirocare of Utah are fully permitted and licensed by their respective states and comply will all Federal and State requirements for protection of public health and the environment.

4. Proposed cleanup remedies

Although excavation was generally accepted as the preferred remedy, there was a recommendation that either "vitrification " or soil washing be adopted.

Vitrification or melting the wastes into a glassy form was evaluated by BNL. Leaving vitrified wastes in place would require approval by NYSDEC as a low-level radioactive waste disposal facility. Such a facility would not be permitted over a sole source aquifer or on Long Island under NY State law. Soil washing also was evaluated in the Feasibility Study and was found to be not cost effective. The smaller volume of wastes would have the radionuclides concentrated in the fine soil particles and would require disposal off-site.

5. RESPONSES TO DETAILED COMMENTS

Comment: As a community member, I am very concerned with the specifics in addressing the cleanup of hazardous waste sites located in BNL. This newsletter has been concise in the explanation of the cleanups and proposed cleanups of the sites in question. Upon reading this newsletter, I feel that the methods described herein are all appropriate. Please keep me posted in this regard with future newsletter mailings.

Response: None required.

Comment: After reading your brochure and the efforts you are making to right the years that where not concerned with contamination, it seams to me that BNL should continue to exist for the good that is serves the public. The off-site disposal should go a long way to protect us who live in the area.

Response: None required.

Comment: You are doing a great job of keeping public informed of your progress.

Response: None required.

Comment: As a resident of Yaphank for 30 years, I feel betrayed by the BNL. I do not believe that contaminants in the soil at the Lab were not known for years. My faith is totally destroyed and I feel real anger. Why is the cleanup taking so long? What else is being hidden? I'm sure everyone at the Lab hid their heads in the sand and looked the other way. All our lives are in danger, so Lab employees paychecks are not disturbed.

Response: Contaminants in the soil outside of the Hazardous Waste Management Facility were first discovered as the result of aerial radiation surveys in 1980 and 1983. In the 1960s sensitivity of instruments and guidelines for exposure to radiation were less stringent. BNL was placed on the National Priorities List of Hazardous waste sites in 1989. However, the full extent and nature of the contamination was not known in 1989. Under U.S. Environmental Protection Agency requirements, BNL is required to follow a process of planning and investigations to characterize the nature and extent of contamination and its associated health risks. One of the objectives of these investigations is to find any additional areas of contamination that might exist or find any potential sources of contamination. According to these investigations, the radiologically contaminated soils on the BNL site are not a current health hazard to nearby residents. While cleanup is still in the planning stage for some of the areas, action has been taken on others. For example, the three landfills were capped between 1995 and 1997, and the 55 pits of laboratory wastes were excavated in 1997 to protect the groundwater.

Comment: Proceed with the proposed remedies.

Response: None required.

Comment: Regarding the cleanup actions on radiologically contaminated soils on various BNL sites, I'm concerned about the excavation and disposal off-site. What if people live around the off-site disposal? That includes animals, such as deer, tiger salamander, etc. They could consume those soils or deer meat after eating them. I suggest that they should do either of 2 methods: soil washing or vitrification (breakdown the soil). If you wash or breakdown the soil, that should remove all of the contaminants and heavy metals in order to make it clean and healthy for those people. Like I said, they should be recycled.

Response: Currently, the available off-site disposal areas for low level radiologically contaminated soils are the DOE Hanford site in the state of Washington and Envirocare of Utah. Both sites are in remote desert areas. The disposal facilities comply with all state and federal requirements for protection of human health and the environment. The facility design is also protective of wildlife to ensure that they are not exposed to the waste soils. On-site vitrification (melting waste into glass) was examined and rejected as an alternative because it would be considered by the NYSDEC to be a low-level radioactive waste facility which are banned on Long Island over its sole source aquifer. Approval of an application for such a permit would be difficult to obtain under current laws. Also, the most cost effective vitrification alternative would be to vitrify only the most contaminated soils with disposal of the remaining soils off-site. Soil washing was considered but was not too effective in removing all of the radioactivity. Also the radioactive contaminants are not broken down and are concentrated in the fine soil particles which would then be disposed of off-site.

Comment: You continually refer to health hands for humans. Has there been or is there in progress any study done on effects to vegetation in the immediate area and the surrounding drainage basin (Peconic drainage) for the area? I live on 9 Scudder Avenue in Manorville, due east of BNL.

Response: A site-wide biological inventory was prepared in 1994 and is in the Administrative Record. An assessment of general vegetation stress was presented in that report. No visible stress to plants was noted that could be associated with on-site contamination. Also an ecological risk assessment of vegetation and wildlife was made on the Peconic River area in the 1998 Operable Unit V Remedial Investigation Report. Potential risk to vegetation at some on-site locations was identified for metals such as chromium, silver and mercury. No off-site impacts to vegetation have be identified.

Comment: My comment about the ongoing cleanup actions the Brookhaven National Laboratory is taking is that in order to get the best technicians to do the cleanup, the Lab must pay in according to other facilities pay around the country. Currently the wages are too low. In order to get the <u>best</u> technicians, you have to pay for the best.

Response: The BNL compensation policy is to pay rates which are competitive with the job market based upon the type of job performed.

Comment: What is "institutional control?" (Top p.6) How will this cleanup a wetland? I could see that it could prevent further pollution, but it's not clear how this will help the salamanders deal with current contamination. Along with monitoring, this hardly sounds like a remedy. It makes more sense for the recharge basins, assuming they are still in use. Wetland reconstruction should be done carefully, it's often unsuccessful. What measures will ensure its protection.

Response: Institutional control refers to the controls and procedures that BNL exercises to limit and prevent exposures. These include fences and gates to restrict access, restrictions and procedures on digging and excavation, postings, restrictive land uses, and monitoring and maintenance of areas. Institutional controls are not designed to cleanup the wetlands but are meant to prevent and limit exposures. Those wetlands that contain contaminants below levels that are not likely to pose a hazard that will be monitored and controlled. Those wetlands that were determined to pose a potential risk to the salamanders are proposed to be cleaned up. Detailed plans will be prepared and approved before any wetlands are reconstructed.

Comment: Critique of material mailed to stakeholders about OU I. 1) Please don't use acronyms in documents for public. I couldn't find a definition of VOC. Even if there was one, it doesn't hurt to spell it out, people shouldn't have to search. 2) Site map: these are easy for people to look at and they may not read carefully. More info about what contaminations are should be on map. Otherwise, the worst is assumed.

Response: BNL will try to reduce technical terminology and acronyms. Contaminants were not located on the maps in order to make the maps more readable.

Letter from the Suffolk County Department of Health Services dated April 5, 1999
Feasibility Study Report OU I and Radiologically-Contaminated Soils

Response to Comments

Comment 1: The referenced reports have given little attention to the possibility of uptake of cesium by vegetation in the exposed areas of the contaminated soil except to state that "frequency of the exposure is considered to be low," referring to animals that might graze there. Nevertheless, this seems to be a problem since measurable levels of cesium have been found in the flesh of deer from the Lab property. It seems reasonable to conclude that the sources of the cesium in the deer are those vegetated areas with contamination near or on the surface where uptake by the plants can occur, and where the animals have freedom to graze.

Response: The OU II/VII Remedial Investigation Report does discuss the results on contaminated deer from the BNL Site Environmental Report on page 6-29. This report was put in the Administrative Record prior to completion of the NYS Department of Health (DOH) report on BNL contaminated deer. The OU I Feasibility Study discusses the contaminated deer issue on page 1-17 and summarizes the NYSDOH findings and conclusions. Although several deer have been found with elevated levels of cesium-137, the frequency of exposure is considered to be low because only about 5 unfenced acres out of the 5,300 acres or 0.01% are contaminated above background levels. Although deer have been seen in these areas, they do not feed in these areas more frequently than the rest of the site. It is assumed that contamination is due to deer feeding on contaminated grass, woody plants and soil in open areas of known contamination. At present the concentrations found in the deer on-site cannot be completely explained based on the known concentrations in the soil, grass and areas of surface contamination. Site specific bioconcentration factors for cesium in BNL deer are not adequately known. The number of deer samples distant from BNL is small. The amount of contaminated soil consumed by deer is unknown and level of potassium which competes with cesium uptake in the soil is unknown.

Comment 2: Though the levels (of cesium-137) detected so far have not reached a sufficient level to be considered a public health concern, it would seem a prudent act, in someway, to restrict the ability of plants to grow in the contaminated areas, or restrict the access of the animals to the contaminated plants. The easiest way to accomplish this would probably be to surround the sites with temporary fencing until remediation can take place. It is somewhat puzzling why this was not done long ago when contamination was first discovered.

Response: Areas considered to contain levels of cesium-137 of public and worker health concerns have been fenced and restricted. The landscaping soils associated with buildings 30, 490, 355, 515, 510, 555, and 930 have levels of cesium-137 below public and worker health concerns that would require posting or fencing. A review of DOE and BNL requirements by BNL health physicists and environmental restoration staff found that these areas do not require postings or restrictions. In addition NYSDEC staff surveyed these areas in the fall of 1998 and concur with the current BNL policy.

Comment 3: Since this is a potential health problem, this Department requests that positive action be taken now to restrict the access of grazing animals to contaminated areas of BNL property.

Response: The recent March 1999 NYSDOH study of deer on and near the BNL site concludes that the contaminated deer are not a health hazard and do not require any special restrictions on hunting although they plan to issue a deer advisory to local hunters. Once the Record of Decision is approved, BNL and DOE plan to remediate these landscape soils as a priority in 2000. Therefore, immediate fencing of these areas does not seem warranted at this time.

Comment 4: If it is thought there is some additional means of animal exposure that might account for the elevated levels, then this should also be discussed.

Response: Based on the aerial radiation surveys, ground confirmatory radiation surveys, extensive sampling and analysis and historical site reviews; BNL has not found any significant areas of additional surface soil contamination that might expose animal populations. Contaminated grass, woody browse and ingested soil are thought to be the principal source of deer contamination. Except for the Building 650 sump outfall (which is now fenced) and the locust trees and grass at Building 830 (which soils and plants are now removed), no additional areas are known where grass or woody plant browse would be a significant source of contaminated food. Other additional sources of animal exposure are unknown.

Comment 5: Since it seems apparent that the grass in the contaminated areas has been successfully taking up the cesium, the grass mowing practices in these areas should be examined to see if in advertent further distribution has been occurring. If the grass has been simply cut and left in place, there is of course, no problem. But if the grass has been collected and transported elsewhere, there might now be another area of unexpected contamination.

Response: The standard practice at BNL is to cut the grass and leave it in place. Ground radiation surveys and sampling and analysis conducted for the OU II/VII Remedial investigation do not show any appreciable spreading of contamination by grass beyond the areas of maximum soil contamination. Although grass does take up low levels of cesium-137, it does not bioconcentrate at levels that would result in significant spreading of contamination. Bioconcentration estimates by BNL staff show levels in grass that are a fraction of the amount of cesium-137 found in the soil.

6. CHRONOLOGY OF COMMUNITY RELATIONS ACTIVITIES

Following is a chronology of general and OU I focused community relations activities at BNL.

1991

September 11 BNL Interagency AgreementFinal Site Community Relations Plan was prepared based on community and other stakeholder interviews to summarize public concerns and DOE's plan for addressing them. The document was finalized and placed in the Administrative Record.

September 26 A public meeting was held on September 26, 1991 at BNL to solicit comments and questions on the "DOE Environmental Restoration and Waste Management Five-Year Plan" and the "BNL Site Specific Plan." As part of the meeting, additional presentations were made regarding the status of BNL's environmental restoration activities. Public input and comments were requested on the draft "Response Strategy Document," the draft "Site Community Relations Plan," and the draft "Remedial Investigation/Feasibility Study Work Plan" for OU I. A 30-day public comment period was provided.

October 14-November 15 The public comment period for review and comment on BNL's "Response Strategy Document" and "Community Relations Plan" was held. A public notice was published.

1992

February 28 Superfund fact sheets were made available to the public and entered in the Administrative Record.

1993

October 25 - November 26 -	The public comment period for review and comment on the "OU I Remedial Investigation/Feasibility Study, Sampling and Analysis Plans and Site Health and Safety Plan" was held. A public notice was published.
November 17	A public meeting at BNL was held to discuss the OU I RI/RA plans.

1995

January 17	Public notice announcing availability of "Removal Action VI Current Landfill Action Memorandum" was published.
May 8 - July 8	Public comment period for review and comment on the "Removal Action VI Engineering Evaluation/Cost Analysis (EE/CA) for Landfill Closure." Public notice was published.
December	A press release titled "Brookhaven Laboratory to Hold Public Meeting on Environmental Remediation, January 16, 1996" was issued.

1996

January 2 - March 18	The public comment period for the "Engineering Evaluation/Cost Analysis" (EE/CA) for OU I Groundwater was held. A full-page public notice was published in Part II of Newsday and in the LI Advance, which also included an announcement of the January 16, 1996 public meeting. Two summary sheets were sent to the stakeholder mailing list. An announcement of the extension of the comment period also was sent to the stakeholder mailing list.
January	A presentation to the Community Work Group regarding the public water hookups and a briefing on the "Groundwater EE/CA" was held at BNL.
January 16	A public meeting was held at BNL to discuss the findings of the OU I EE/CA.
February	A Suffolk County legislator hosted a meeting to brief elected officials on the public water hookup project and BNL groundwater contamination in OU I.
February	Four fact sheets regarding the OU I groundwater contamination were published and distributed.
February - March	Articles on the OU I groundwater contamination appeared in six editions of the Brookhaven Bulletin.
February 5, 6	Two question-and-answer sessions were offered to BNL employees regarding OU I groundwater issues.

February 8	Briefing regarding the proposed groundwater treatment plant was given to the National Weather Service staff.
Spring	The following articles were published in the newsletter ***cleanupdate,*** which is mailed to the stakeholders, all BNL employees, and to BNL retirees. "Comment period extensions facilitate community inquiries" "Investigation progressing in Laboratory's central area"
May	Presentation made to Community Work Group by BNL staff on Chemical/Animal/Glass Holes."
July 24	Public notice announcing availability of "Removal Action VI Former Landfill Action Memorandum" was published.
July 29 - September 30	The public comment period for review and comment on the "OU I/VI RI/RA Report" was held. A public notice was published.
Summer mailed to the	The following articles were published in the newsletter ***cleanupdate,*** which is stakeholder mailing list, all BNL employees, and to BNL retirees. "Design set, construction underway for groundwater cleanup operation" "Autumn public meeting anticipated at Lab" "Chemical Holes cleanup discussed with work group"
August 5	Stakeholder mailing list sent a cover letter, copy of the public notice and fact sheet on the OU I/VI RI/RA Report and information on the "Annual Schedules Update/Report for Site Removal and Remedial Actions" and the Action Memorandum for Landfill Capping Removal Action, Phase II."
1997	
Winter	The following articles were published in the newsletter ***cleanupdate,*** which is mailed to the stakeholder mailing list, all BNL employees, and to BNL retirees. "Community concerns voiced at Manorville public meeting" "Soils remedy anticipated during 1997" "BNL's oldest landfill receives a geo cap" "Responsiveness Summary (for OU I Groundwater Removal Action) release expected soon"
January 8	Public notice of availability for Action Memorandum for OU I Groundwater Removal Action and Operable Units I and III Public Water Hookups was published.
April 22	Letter sent to stakeholder mailing list informing them of the public comment period for "Chemical/Animal/Glass Holes Final Evaluation of Alternatives Report". A summary sheet and a copy of the public notice were included in the mailing.

April 23 - May 23	Public comment period was held for review and comment on the "Chemical/Animal/Glass Holes Final Evaluation of Alternatives Report." A public notice was published.
Spring	The following articles were published in the newsletter *cleanupdate,* which is mailed to the stakeholder mailing list, all BNL employees, and to BNL retirees. "How wells, sampling track contamination" "Lab's second pump-and-treat system readied for scheduled June start-up" "Waste pit cleanup planned to begin in June" "Agency to assess local health concerns" "ATSDR formed through, for Superfund"
June 18	Public notice of availability of the "Operable Unit I Action Memorandum Phase III - Landfill Closure Removal Action (Chemical/Animal Pits and Glass Holes Removal Action)" was published.
July	The following articles were published in the newsletter *cleanupdate,* which is mailed to the stakeholder mailing list, all BNL employees, and to BNL retirees. "OER shifts focus to remediation" "Waste pit cleanup begins at landfills" "Public meeting expected this fall regarding radioactive soils cleanup" "BNL's second Record of Decision undergoing final regulator review"
August 14	Brookhaven Executive Roundtable given update on Superfund activities including OU I.
September	The following articles were published in the newsletter *cleanupdate,* which is mailed to the stakeholder mailing list, all BNL employees, and to BNL retirees. "Summer projects set stage for fall" "Solvents are key concern in aquifer" "BNL applies technologies to plumes"
November	The following articles were published in the newsletter *cleanupdate,* which is mailed to the stakeholder mailing list, all BNL employees, and to BNL retirees. "Health agency: Water not a risk to area residents" "Cleanup work continues independent of report" "Completed projects adding up as Lab cleanup moves forward"
1998	
January	The following articles were published in the newsletter *cleanupdate,* which is mailed to the stakeholder mailing list, all BNL employees, and to BNL retirees. "Sampling underway in Manorville" "Waste pit excavation completed"

April 17	Request from community member for information on OU I/VI.
May	The following articles were published in the newsletter ***cleanupdate,*** which is mailed to the stakeholder mailing list, all BNL employees, and to BNL retirees. "New waste management facility opens; cleanup of old facility due to begin in 2000"
May 6	Visited sixteen homes south of the Laboratory to inform them about the impending installation of a groundwater monitoring well.
November 20	Request from community member for information on Chemical/Animal/Glass Holes cleanup.
December 16	Brookhaven Executive Roundtable given presentation on "Overview/update of Operable Unit I."

1999

January 15	Request from community member for information on public water hookups.
February 17	Letter sent to: 1)the stakeholder mailing list; 2)all BNL employees; and 3)others who work on-site, but are not BNL employees informing them of the public comment period for the "Operable Unit II/VII Remedial Investigation/Risk Assessment Report." A fact sheet and a copy of the public notice were included in the mailing. Dates and locations for the two information sessions were included in the cover letter.
February 19 - March 20	Public comment period for the "Operable Unit II/VII Remedial Investigation/ Risk Assessment Report." A public notice and a display advertisement were published in local newspapers announcing the availability for review and comment on the documents and citing the dates for the information sessions.
February 19	Press release issued by DOE titled "DOE is Seeking Public Comment of Brookhaven Lab Contaminated Soils Report."
February 19	Elected officials notified, sent letter briefing them on upcoming activities relating to OU I/OU II/VII, OU III and OU V.
February 19	BNL Web page updated to include Executive Summary of OU II/VII RI/RA, the dates and locations for information sessions, and public comment period dates.
February 23	Brookhaven Executive Roundtable given update on OU I Schedule.
February 25	Information Session #1 on OU II/VII RI/RA Report held in Berkner Hall, BNL.

February 26	Article in Brookhaven Bulletin on OU II/VII RI/RA Report, giving information session dates.
March 3	Information Session #2 on OU II/VII RI/RA Report held in Berkner Hall, BNL.
March 19	Staffs of Congressman Forbes, Senator Moynihan and Senator Schumer were briefed by representatives of BNL and DOE-Brookhaven Group.
March 23	Brookhaven Executive Roundtable given presentation on OU I Feasibility Study and Proposed Plan.
March 31	"Booklet" mailed to: 1.) the stakeholder mailing list; 2.)all BNL employees; and 3.)others who work on-site but are not BNL employees informing them of BNL's plans for the "Cleanup of Contaminated Soils." The booklet summarized information from the "Operable Unit I Feasibility Study Report and Proposed Plan," and announced the public comment period from April 1, 1999 through April 30, 1999. Dates and locations for the public meeting and information sessions also were included.
March 31	BNL Web page updated to include Executive Summary of Feasibility Study and entire Proposed Plan. Also listed were the dates and locations of the information sessions, the public meeting, and the comment period dates.
April 1	Public notices and display advertisements were published in local newspapers, announcing the public comment period and meeting dates. DOE issues press release titled "DOE seeks public comment on Brookhaven Lab contaminated soils report."
April	Five civic associations briefed on upcoming OU I meetings and flyer distributed with meeting dates listed was distributed. OU I mailing also was made available.
April 7	Flyers about meetings taken to Suffolk cooperative Library Services for distribution to all the libraries in Suffolk County. Libraries were requested to put the flyers on the Community Bulletin Boards.
April 8	Flyers distributed at the monthly meeting of the Community Advisory Council.
April 9	Article in Brookhaven Bulletin on OU I reports and upcoming meetings.
April 11	Advertisement of upcoming OU I information sessions and public meeting published in Sunday edition of Newsday.
April 12	Laboratory-wide e-mail reminded employees of the dates and times for information sessions and the public meeting.

April 13 Lunchtime Information Session on OU I Feasibility Study and Proposed Plan held at Berkner Hall, BNL.

April 14 Evening Information Session on OU I Feasibility Study and Proposed Plan held at Berkner Hall, BNL.

April 22 Public meeting on OU I Feasibility Study and Proposed Plan held from 7:00 - 9:00 p.m. at Berkner Hall, BNL.

April 26 Tour/talk for class from Nassau County Community College, including visit to landfill

May 17 Tour/talk for class from Nassau County Community College, including visit to landfill

7. REFERENCES

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ROD FACT SHEET

SITE

Name: Brookhaven National Laboratory
Location/State: Upton, Suffolk County, New York
EPA Region: 2
HRS Score: 39.92 (7/89)
Site ID #: NY7890008975

ROD

Date Signed: 9/16/99
Remedies: excavation and off-site disposal of contaminated soils and sediment; removal of out of service facilities; wetland reconstruction; monitoring and institutional controls
Operable Unit Number : OU-1
Capital cost: $ 23,615,000 (in 1999 dollars)
Construction Completion: 12/2004
0 & M annually: $ 45,470 (in 1999 dollars)
Total 0 & M (present worth): $417,000
Present worth: $ 24,032,000 (number of 0 & M years assumed - 50)

LEAD

Federal Facility
Primary contact (phone): Mary Logan (212) 637-4321
Secondary contact (phone): Bob Wing (212) 637-4332
Main PRP(s): Department of Energy (DOE)
PRP Contact (phone): Gail Penny (516) 344-3429

WASTE

Type: radiological (cesium-137, strontium-90)
Media: soil and sediment
Origin: leaks and spills
Est. quantity: 39,000 cubic yards