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

I. DECLARATION OF THE RECORD OF DECISION

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. In the absence of Applicable or Relevant and Appropriate Requirements, risk based objectives based on current and future land uses were adopted 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 radiologically 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 reducing 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.

8/12/99
Date

George J. Malosh
Manager, Brookhaven Group
U.S. Department of Energy

8-12-99
Date

Robert P. Gordon
Contracting Officer, Brookhaven Group
U.S. Department of Energy

8-16-55
Date

Jeanne Fox
Regional Administrator, Region 2
U.S. Environmental Protection Agency

TABLE OF CONTENTS

I. DECLARATION OF THE RECORD OF DECISION……. i
Statement of Basis and Purpose ……. i
Assessment of the Site…… i
Description of the Selected Remedies…… i
Declaration…… iii
TABLE OF CONTENTS…….. iv
LIST OF TABLES…… vi
LIST OF FIGURES ……. vii
LIST OF ACRONYMS…… viii
II. DECISION SUMMARY…… 1
1. SITE NAME, LOCATION, AND DESCRIPTION…….. 1
2. SITE HISTORY AND ENFORCEMENT ACTIONS…….. 2
2.1 Radiological Contaminated Soil Sites…….. 2
2.2 Other Areas of Concern…… 2
2.3 Removal Actions…….. 3
3. HIGHLIGHTS OF COMMUNITY PARTICIPATION……. 3
4. SCOPE AND ROLE OF OPERABLE UNIT AND RESPONSE ACTION…….. 4
5. SUMMARY OF SITE CHARACTERISTICS…… 5
5.1 Radiologically Contaminated Soil…… 5
5.2 Other Areas of Concern…… 6
5.3 Removal Actions…….. 7
6. SUMMARY OF SITE RISKS…… 7
6.1 Human Health Risks…… 8
6.1.1 Identification of Contaminants of Concern……. 8
6.1.2 Assessment of Exposure…….. 8
6.1.3 Assessment of Toxicity…… 9
6.1.4 Characterization of Chemical Risks…… 9
6.1.5 Characterization of Radiological Risks…….. 10
6.2 Ecological Risk Assessment…… 10
7. OBJECTIVES OF THE REMEDIAL ACTIONS……. 11
7.1 Basis for Response……... 11
7.2 Objectives of the Remedial Actions……12
7.3 Land Use……...12
7.4 Cleanup Goals……...13
8. DESCRIPTION OF ALTERNATIVES …… 13
8.1 Radiologically Contaminated Soils……... 14
8.2 Other Areas of Concern……...17
8.2.1 Ash Pit……17
8.2.2 Upland Recharge/Meadow Marsh……...18
8.2.3 Recharge Basin HS and the Weaver Drive Recharge Basin HW……...18
8.2.4 Wooded Wetland……19

9. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES…….19
9.1 Radiologically Contaminated Soils……. 19
9.2 Other Areas of Concern……...23
9.2.1 Ash Pit……. 23
9.2.2 Upland Recharge/Meadow Marsh Area…….. 23
9.3 State and Community Acceptance……24
10. SELECTED REMEDIES ……. 24
10.1 Radiologically Contaminated Soils…….. 25
10.2 Other Areas of Concern……25
10.3 Removal Actions……...26
11. STATUTORY DETERMINATIONS……... 27
11.1 Protection of Human Health and the Environment……...27
11.2 Compliance with ARARs……28
11.2.1 Chemical-Specific ARARs……..28
11.2.2 Location-Specific ARARs……...29
11.2.3 Action-Specific ARARs…….. 29
11.2.4 To Be Considered Guidance……29
11.3 Cost-Effectiveness……31
11.4 Use of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable……..31
11.5 Preference for Treatment as a Principal Element……31
11.6 Documentation of Significant Changes……32
11.7 Five-Year Review……32
REFERENCES …….. 33
TABLES……. 35
FIGURES ……...48
III. RESPONSIVENESS SUMMARY……55
TABLE OF CONTENTS……...56
1. INTRODUCTION……57
2. OVERVIEW OF THE RESPONSIVENESS SUMMARY……...58
2.1 Site History……...58
2.2 Site Description…… 59
2.3 Radiologically Contaminated Soils…….. 59
2.4 Other Areas of Concern……59
2.5 Removal Actions……...60
2.6 Level of Community Support for the Proposed Alternatives……...61
2.7 Changes in the Proposed Plan……...61
3. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS 61
3.1 Community Profile……... 61
3.2 History of Community Involvement……62
3.3 Summary of Community Participation Activities for OU I……. 64
4. COMPREHENSIVE SUMMARY OF MAJOR QUESTIONS, COMMENTS, CONCERNS, AND RESPONSES…… 67
4.1 Overview…….. 67
4.2 Summary Questions and Responses……67
5. RESPONSES TO DETAILED COMMENT LETTERS…….. 68
6. CHRONOLOGY OF COMMUNITY RELATIONS ACTIVITIES……73
7. REFERENCES…….. 80

LIST OF TABLES

Table 1 - Description of Operable Units at BNL……36

Table 2 - Summary of Site History……37

Table 3 - Groundwater Standards, Guidance Values and Cleanup Goals for Selected Parameters……...41

Table 4 - Soil Remediation Goals for Principal Radiological Contaminants at BNL… 42

Table 5 - Soil Remediation Goals for Principal Chemical Contaminants at BNL……. 43

Table 6 - Comparative Analysis of Remedial Alternatives for Radiologically Contaminated Soils……44

Table 7 - Summary of Selected Remedies……..45

Table 8 - Cost Estimates for Remedial Alternatives……...47

LIST OF FIGURES

Figure 1 - BNL Location Map

Figure 2 - Record of Decision - Areas of Concern

Figure 3 - OU I Areas of Concern

Figure 4 - Operable Unit I - Radiologically Contaminated Soils

Figure 5 - Actions covered under the OU I Record of Decision

Figure 6 - Principal Areas of Contamination within the HWMF

LIST OF ACRONYMS

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 - Millirem 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

II. DECISION SUMMARY

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, 3, 4 and 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 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 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 ($1x10^{-4}$) to one in-a-million ($1x10^{-}$

^{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-carcinogenic 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 (Building 650) 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 4.3×10^{-3} (4.3 in 1,000) (or 5.3×10^{-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 are 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 tests, 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-risk assessment 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 ACTION S

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 Action s

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 to contaminants (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 objectives identified above. Cleanup goals are based primarily on Applicable or Relevant and Appropriate Requirements (ARARs), EPA and State 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 uses identified 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
Total 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
Total 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 action would 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
O&M Cost (present worth):	$ 0
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 the 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, volume; 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.

<u>Overall Protection</u>

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 exposure above 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

Long-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 of 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 alternative, 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 remediation sampling 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.
- Techniques which minimize waste volumes or further stabilize wastes to meet disposal facility waste acceptance criteria may also be identified during remedial design and implementation.
- 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.

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 will occur to limit access to the site and prevent 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 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 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 minimize potential 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 Ash Pit 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 implementating 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" (#4003), 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, OSWER 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 (ALARA) 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. 93555.0-49 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 15mrem/yr 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 summarizes the total costs for Operable Unit I.

11.4 Use of Permanent Solutions and Alternative Treatment Technologies to the 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 Rechanrge/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 Coumpounds 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.

REFERENCES

BNL, 1994. Action Memorandum Landfill Closure Removal Action Phase I - Current Landfill. December, 1994.

BNL, 1995. Future Land Use Plan. August, 1995.

BNL, 1996a. Action Memorandum Landfill Closure Removal Action Former Landfill Area. April 8, 1996.

BNL, 1996b. Action Memorandum Operable Unit I Groundwater Removal Action and Operable Units & III Public Water Hookups. December, 1996.

BNL, 1997. Final Action Memorandum Phase III - Landfill Closure Removal Action. June 16, 1997.

BNL, 1999. Proposed Plan for Operable Unit I and Radiologically Contaminated Soils. April 1999.

CDM, 1994. Final Remedial Investigation/Risk Assessment Report, Operable Unit IV. December 1994.

CDM, 1995a. Final Engineering Evaluation/Cost Analysis for Landfill Closure Action, Operable Unit I. March 1995.

CDM, 1995b. Final Engineering Evaluation/Cost Analysis for Groundwater, Operable Unit I. September 1995.

CDM, 1996a. Final Remedial Investigation/Risk Assessment Report, Operable Unit I/VI. June 14, 1996.

CDM, 1996b. Final Construction Certification Report for Current Landfill Capping. May 1996.

CDM, 1997. Chemical/Animal Pits and Glass Holes, Final Evaluation of Alternatives Report. April 1997.

CDM, 1999a. Final Feasibility Study Report Operable Unit I Radiologically Contaminated Soils. February 26, 1999.

CDM, 1999b. Final Focused Ecological Risk Assessment Operable Units I/VI. Appendix L, Final Feasibility Study Report Operable Unit I Radiologically Contaminated Soils. March 31, 1999.

CDM, 1999c. Addendum, Focused Ecological Risk Assessment Operable Units I/VI. June 9, 1999.

EPA, 1989. Risk Assessment Guidance for Superfund; Human Health Evaluation Manual Part A. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency and Remedial Response, OSWER Directive 9285.701A.

EPA, 1994. Guidance on Residential Lead-Based Paint, Lead Contaminated Dust, and Lead Contaminated Soil. U.S. Environmental Protection Agency. July 1994.

EPA, 1996. Soil Screening Guidance: User's Guide. U.S. Environmental Protection Agency, Office of Solid Waste and Remedial Response. OSWER Directive 9355.4-23, 1996.

EPA, 1997. Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination U.S. Environmental Protection Agency, Office of Solid Waste and Remedial Response.. OSWER Directive 9200.4-18, August 1997.

IT, 1999. Final Operable Unit II/VII Remedial Investigation Report. February 1999.

J. Meersman, BNL to J. Lister, NYSDEC, 1999. Operable Unit II/VII Supplemental Surface Sampling - Preliminary Metals Results. June 1, 1999.

J. Meersman, BNL to J. Lister, NYSDEC, 1999. Operable Unit II/VII Supplemental Surface Sampling - Preliminary Radiological Results. May 18, 1999.

NYSDEC, 1994. Technical and Administrative Guidance Memorandum: Determination of Soil Remediation Objectives and Remediation Levels. HWR-94-4046, New York State Department of Environmental Conservation, Division of Hazardous Waste Remediation. January 24, 1994 (revised).

P.W. Grosser, 1997. Interim Landfill Closure Report. November, 1997.

SAIC, 1992. Brookhaven National Laboratory Response Strategy Document. 1992.

Weston, 1997. Former Landfill Closure Construction Certification Report. March 1997.

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 areas, 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	Cesium-137 Strontium-90 Lead Mercury Cesium-137 Aroclor-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. BNL, 1999.

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 VOCs 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	360 ppb 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.
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 Carbon tetrachloride N/A	0.18 mg/kg 240 pCi/l 22 ppb 6 ppb N/A	CDM, 1997. BNL, 1997.

AOC No.	Name	Waste	Contaminated Media	Primary Contaminants of Concern	Maximum Concentration	Reference
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/g (one drum)	CDM, 1995a. BNL, 1996a.
Other Areas 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 ug/l 56 ug/l 252 ug/l 8 mg/kg 28 mg/kg	CDM, 1996a. CDM, 1999a. CDM, 1999b.

AOC No.	Name	Waste	Contaminated Media	Primary Contaminants of Concern	Maximum Concentration	Reference
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 ug/l 73 ug/l 1,550 ug/l 27,800 ug/l 22 mg/kg 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	14,800 ug/l 70 ug/l 297 ug/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 Standard 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)*
Volatile Organics				
Carbon tetrachloride	5P	5	5	5
Chloroethane	5P	5	NS	5
Chloromethane	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]***	***(pCi/l)***	***(pCi/l)***	***(pCi/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] - USEPA 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 annual dose equivalent to the total body or any internal organ greater than 4 millirem/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 is also protective of residential and industrial use.

d. DOE Order 5400.5 Radiation Protection of the Public and the Environment. Also, commonly used by the Environmental Protection Agency.

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/yr 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 (siting) issues for cell Overall: Moderately Complex	$8,648,000
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 (5.3 E-07)	Extremely intrusive remediation Readily implemented/technically feasible Above-average administration requirement due to large offsite disposal volumes Overall: Moderately Complex	$24,032,000
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 ^{137}Cs not demonstrated. High remedial O&M Above-average administration requirements due to large offsite disposal volumes, treatment technology, and cap permitting Overall: Complex	$15,304,000
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 the sump outfall area. Excavation with off-site disposal of pipe (and associated contaminated soils) between the decontamination pad and outfall area. Excavate and consolidate soils contaminated with short-lived radionuclide with AOC 1 soils for off-site disposal. Remove contaminated 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 (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, 16I, 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 Criticality Facility	Institutional controls and monitoring	Achieve 15 mrem/yr remediation goal for future residential land use.	Planned action upon ROD approval.	IT, 1999

AOC No.	Name	Proposed Remedial Actions	Basis for Action	Current Status	Remedial Action Reference
18	Alternating Gradient Synchrotron Storage Yard	Institutional controls and monitoring.	Achieve 15 mrem/yr remediation goal for future residential land use.	Planned action upon ROD approval.	IT, 1999
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 and 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 Stockpile	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 I 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.	Protect 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	24,032,000
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

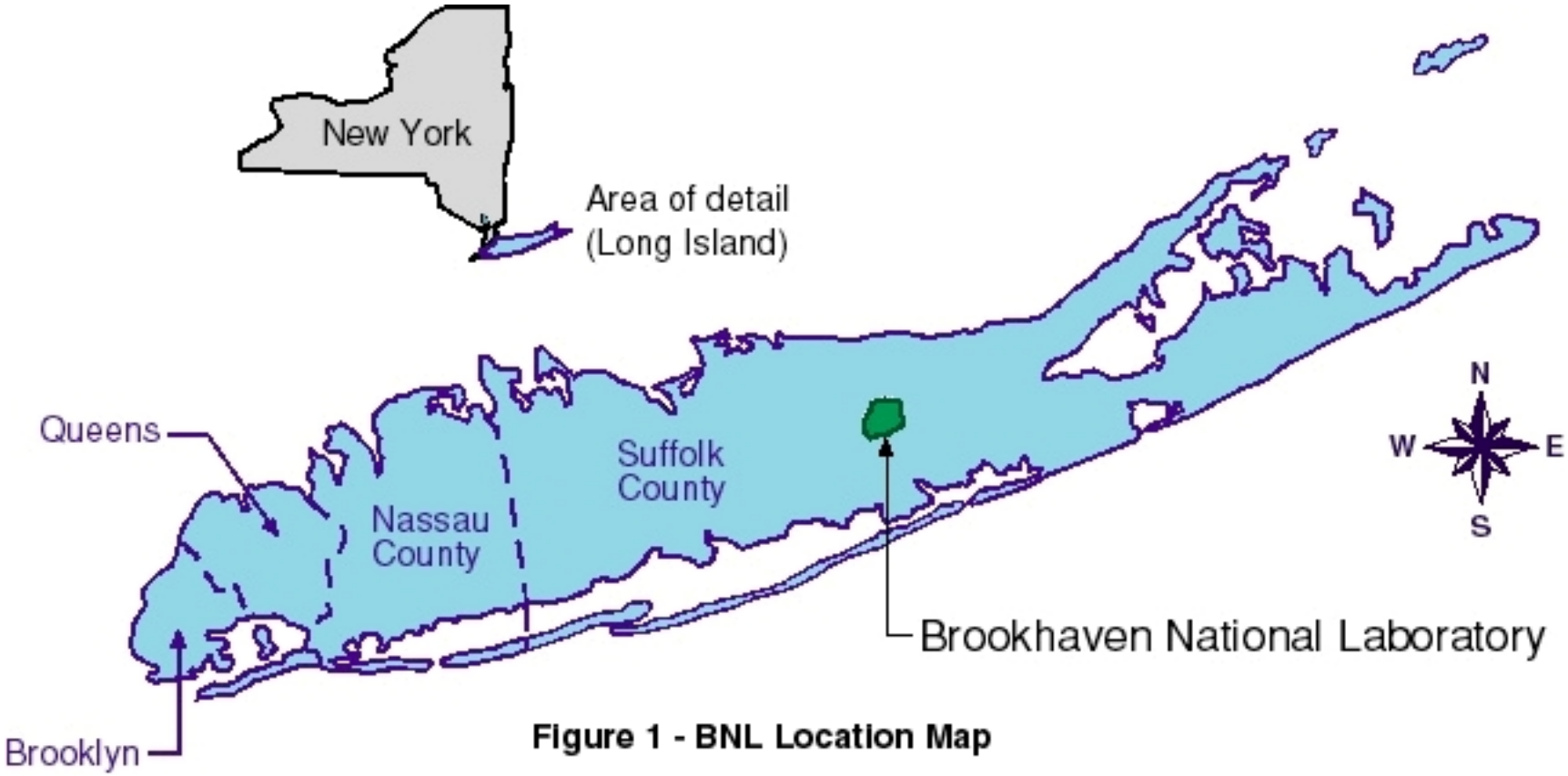
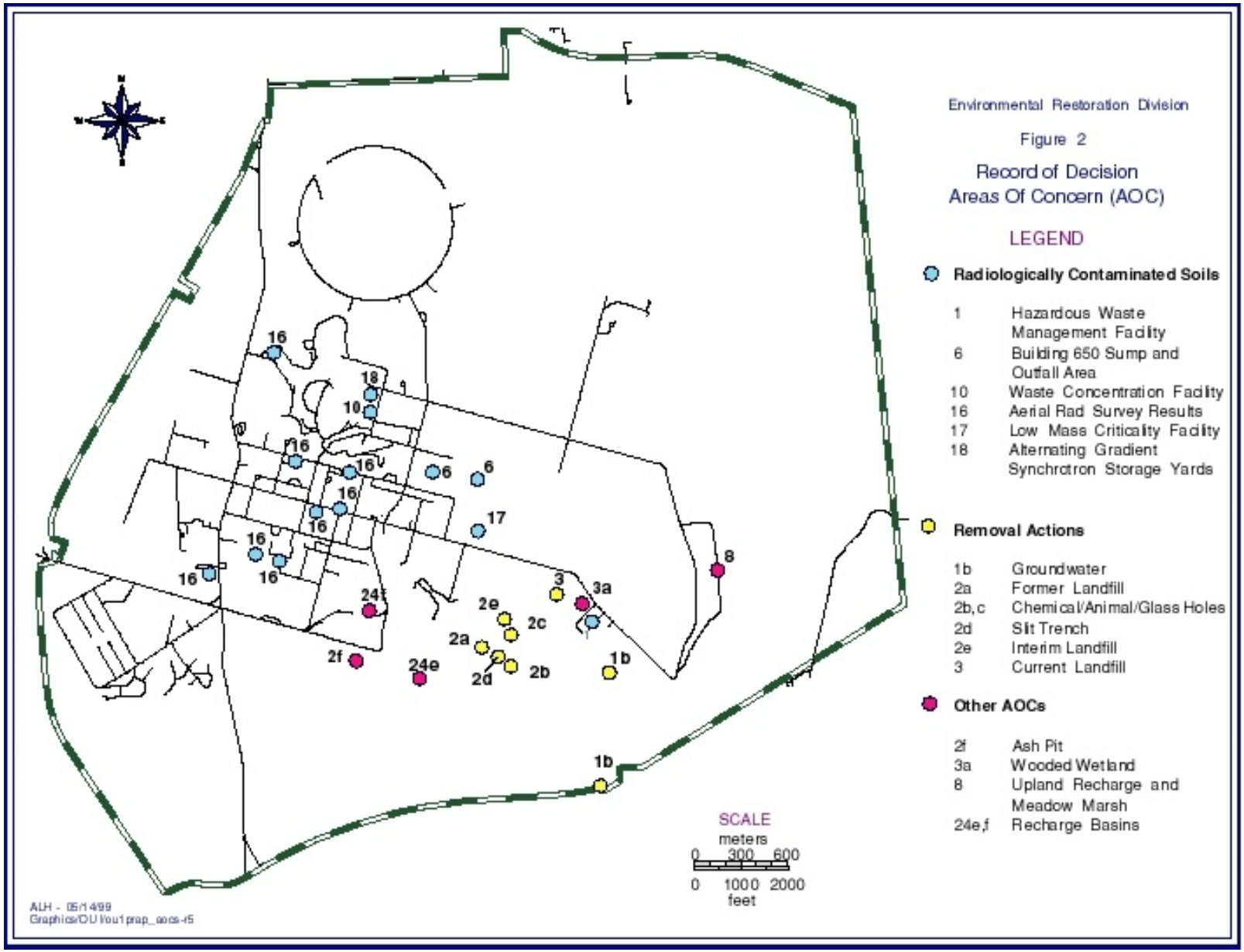


Figure 1 - BNL Location Map


Environmental Restoration Division
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
SCALE
meters
0 300 600
0 1000 2000
feet
ALH - 05/14/99
Graphics/OU1/ou1prop_aocs-r5

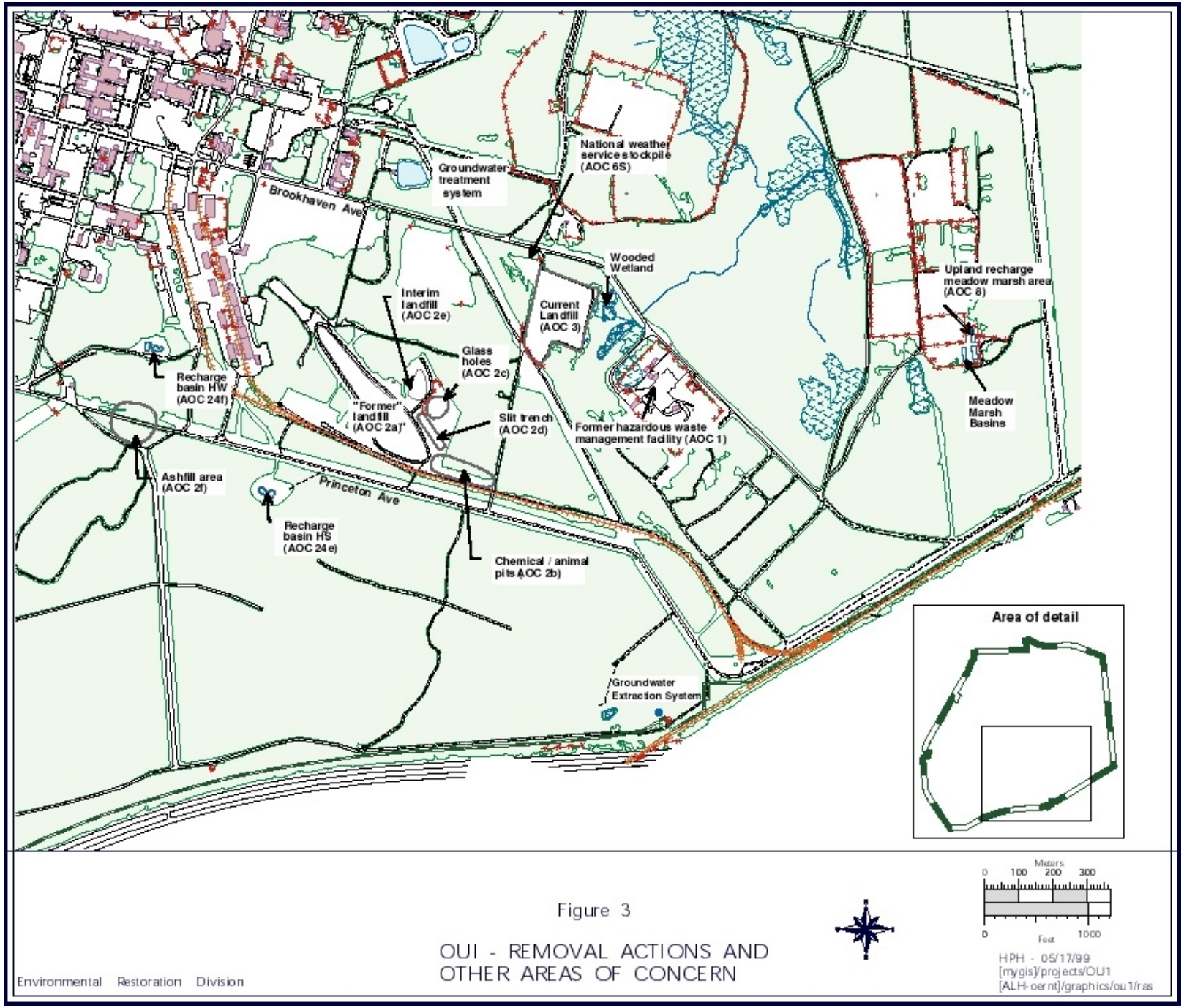


Figure 3

OUI - REMOVAL ACTIONS AND OTHER AREAS OF CONCERN

Environmental Restoration Division

HPH - 05/17/99
[mygis]/projects/OU1
[ALH-oernt]/graphics/ou1/ras

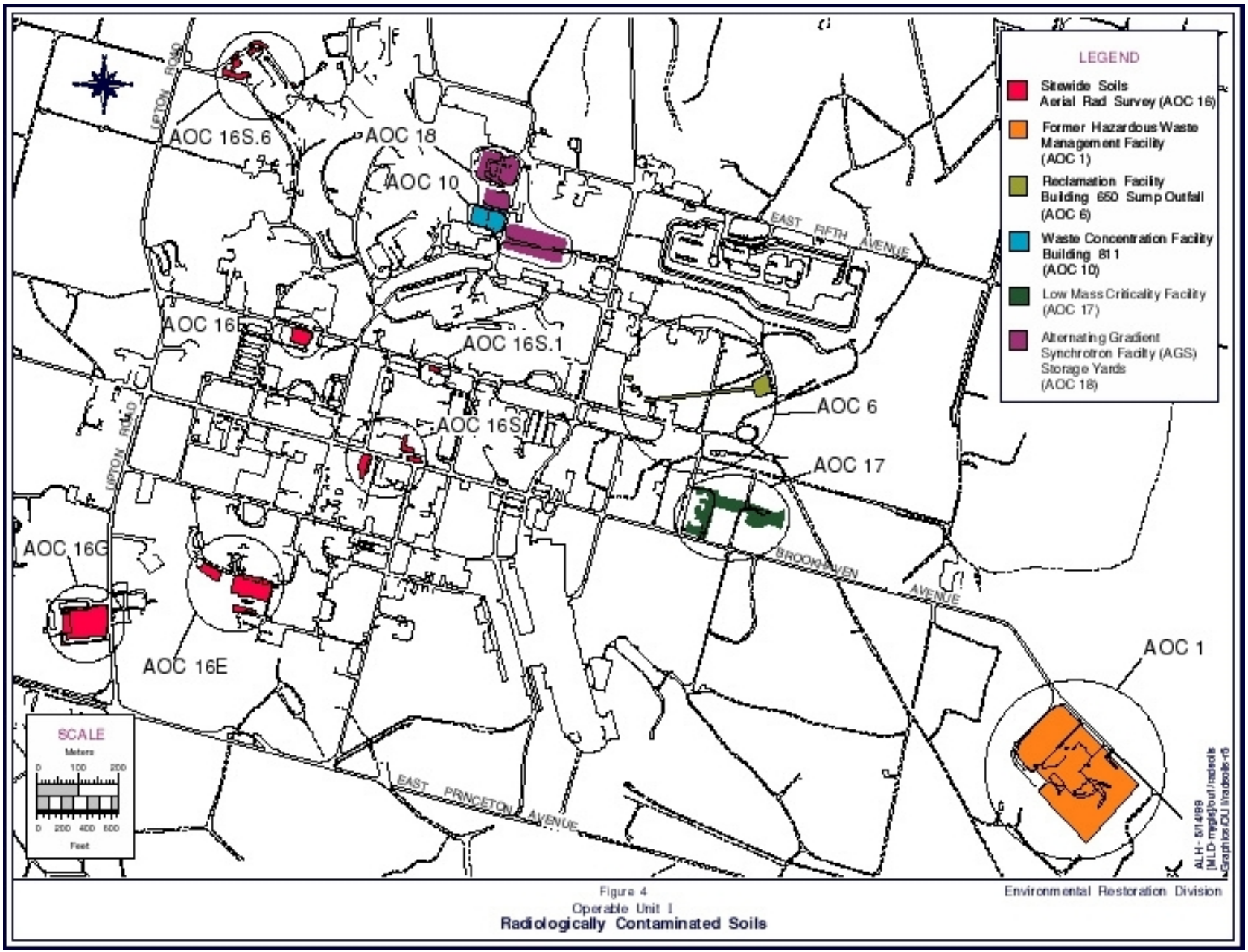
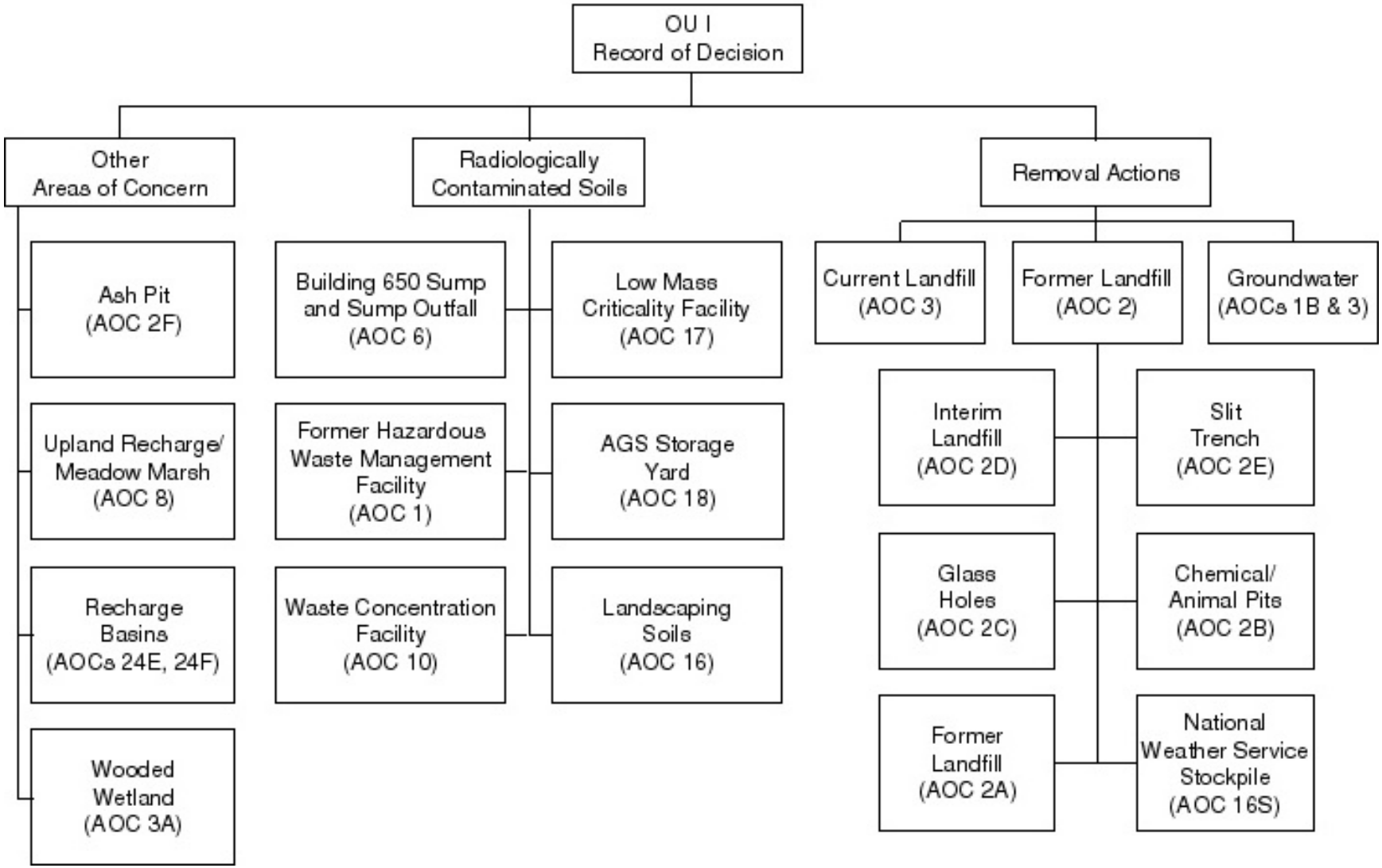
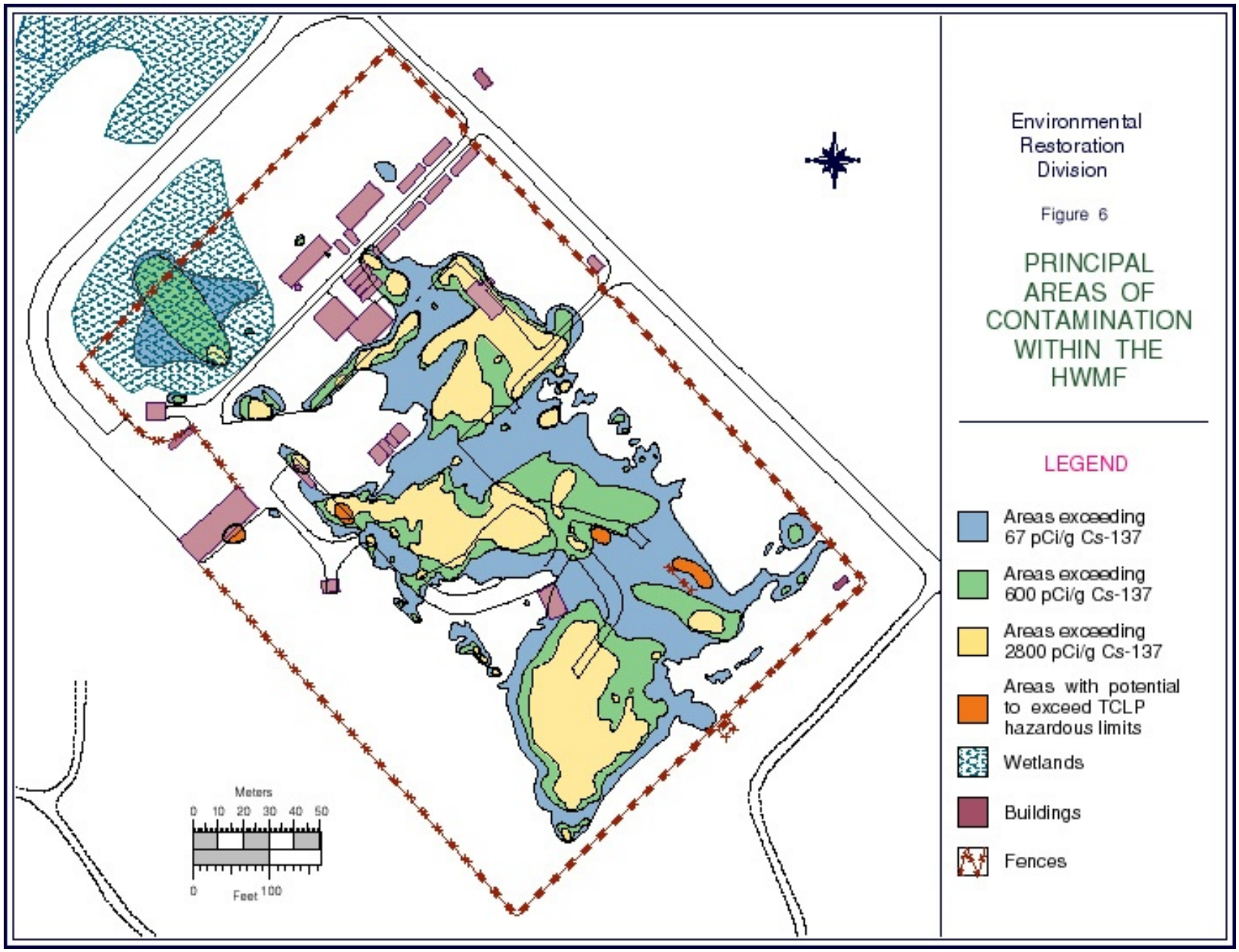


Figure 4
Operable Unit I
Radiologically Contaminated Soils

Environmental Restoration Division

Figure 5: Actions Covered Under the OU I Record of Decision




Environmental
Restoration
Division
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……..... 57

2. OVERVIEW OF THE RESPONSIVENESS SUMMARY……58
   - 2.1 Site History…… 58
   - 2.2 Site Description……...59
   - 2.3 Radiologically Contaminated Soils……59
   - 2.4 Other Areas of Concern…… 59
   - 2.5 Removal Actions……60
   - 2.6 Level of Community Support for the Proposed Alternatives…… 61
   - 2.7 Changes in the Proposed Plan……61

3. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS…… 61
   - 3.1 Community Profile…… 61
   - 3.2 History of Community Involvement……..62
   - 3.3 Summary of Community Participation Activities for OU I……...64

4. COMPREHENSIVE SUMMARY OF MAJOR QUESTIONS, COMMENTS, CONCERNS, AND RESPONSES…… 67
   - 4.1 Overview……67
   - 4.2 Summary Questions and Responses…….. 67

5. RESPONSES TO DETAILED COMMENT LETTERS……...68

6. CHRONOLOGY OF COMMUNITY RELATIONS ACTIVITIES……. 73

7. REFERENCES……...80

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 I) 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 Berkner Hall 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 Repositories 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. REFERENC`ES

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 Concern16, 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.

Upland Recharge/Meadow Marsh Area

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 downdgradient 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 "Environmental 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
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

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. Transportation off Long Island

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 hazards 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 **best** 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 inadvertent 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 Agreement Final 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 - The public comment period for review and comment on BNL's "Response November 15 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 - The public comment period for review and comment on the "OU I/VI September 30 RI/RA Report" was held. A public notice was published.

Summer - The following articles were published in the newsletter ***cleanupdate***, which is mailed to the 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 on 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

Brookhaven National Laboratory, 1994. Action Memorandum Landfill Closure Removal Action Phase I - Current Landfill. December, 1994.

Brookhaven National Laboratory, 1996a. Action Memorandum Landfill Closure Removal Action Former Landfill Area. April 8, 1996.

Brookhaven National Laboratory, 1996b. Action Memorandum Operable Unit I Groundwater Removal Action and Operable Units I & III Public Water Hookups. December, 1996.

Brookhaven National Laboratory, 1997. Final Action Memorandum Phase III - Landfill Closure Removal Action. June 16, 1997.

Brookhaven National Laboratory, 1999b. Final Proposed Plan for Operable Unit I and Radiologically Contaminated Soils. March 1999.

CDM Federal Programs Corporation, 1995a. Final Engineering Evaluation/Cost Analysis for Landfill Closure Action, Operable Unit I. March 1995.

CDM Federal Programs Corporation, 1995b. Final Engineering Evaluation/Cost Analysis for Groundwater, Operable Unit I. September 1995.

CDM Federal Programs Corporation, 1996a. Final Construction Certification Report for Current Landfill Capping. May 1996.

CDM Federal Programs Corporation, 1996b. Final Remedial Investigation/Risk Assessment Report, Operable Unit I/VI. June 14, 1996.

CDM Federal Programs Corporation, 1997a. Chemical/Animal Pits and Glass Holes, Final Evaluation of Alternatives Report. April 1997.

CDM Federal Programs Corporation, 1997b. Current Landfill Annual Monitoring Report. 1997.

CDM Federal Programs Corporation, 1999a. Final Feasibility Study Report Operable Unit I Radiologically Contaminated Soils. February 26, 1999.

Grosser, 1997. Interim Landfill Closure Construction Certification Report. November 1997.

International Technology Corporation, 1995. RI/FS Work Plan for Operable Unit II and Operable Unit VII. April 1995.

International Technology Corporation, 1999a. Final Operable Unit II/VII Remedial Investigation Report. March 1999.

International Technology Corporation, 1999b. Final Operable Unit III Remedial Investigation Report. March 1999.

SAIC, 1992. Brookhaven National Laboratory Response Strategy Document. 1992.

Science Applications International Corporation, 1993a. Work Plan for Remedial Investigation/Feasibility Study Operable Unit I, Brookhaven National Laboratory. October 1993.

Science Applications International Corporation, 1993b. Sampling and Analysis Plan for the Landfills Closure Removal Action Project at Brookhaven National Laboratory. October 1993.

Science Applications International Corporation, 1993c. Sampling and Analysis Plan for the Spray Aeration Area project, Operable Unit I, Brookhaven National Laboratory. October 1993.

Weston, 1997. Former Landfill Closure Construction Certification Report. March 1997.