Final Five-Year Review Report

for

Brookhaven National Laboratory Superfund Site
Town of Brookhaven, Hamlet of Upton
Suffolk County, New York

July 2006

PREPARED FOR:
The United States Department of Energy
Office of Environmental Management

PREPARED BY:
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Executive Summary

The U.S. Department of Energy (DOE) owns the Brookhaven National Laboratory (BNL) federal facility site and is the lead agency for the Five-Year Review. DOE entered into a Federal Facilities Agreement (also referred to as the Interagency Agreement, or IAG) for the BNL site, along with the U.S. Environmental Protection Agency (EPA) and the New York State Department of Environmental Conservation (NYSDEC). Brookhaven Science Associates (BSA), under contract with the DOE, manages and operates BNL.

The remedies for the BNL Superfund site in Upton, New York include excavation and off-site disposal of contaminated soil, sediment, tanks, structures, capping of landfills, installation and operation of groundwater treatment systems, groundwater monitoring, and institutional controls. All of the remedies for the seven signed Records of Decision (RODs) have been implemented except for remaining Operable Unit (OU) I soil excavation at the former Hazardous Waste Management Facility Waste Loading Area and disposal and the Brookhaven Graphite Research Reactor (BGRR) pile and bioshield removal, and installation of the cap.

A Five-Year Review that was prepared in September 2003 focused specifically on the BNL OU IV remedy. This 2005 Review is comprehensive and covers all of the OUs for the BNL site.

The activity that triggered this first 2005 sitewide Five-Year Review was the start of construction for the OU I contaminated landscape soils, on July 18, 2000. According to data reviewed from the closeout reports, the annual groundwater status reports, site inspections, and regulatory interviews, the remedies were implemented in accordance with the RODs and the *OU III Explanation of Significant Differences (ESD).* The soil cleanup levels were met and the groundwater pump and treat systems have been functioning as intended by the RODs. The cleanup performed continues to meet the remedial action objectives identified in each ROD.

Long-term protectiveness of the Peconic River remedy will be verified by continuing to monitor the sediment, surface water, fish, and revegetation. In addition to annual reporting of the analytical results, the monitoring data will be evaluated during the second sitewide Five-Year Review in 2011 to evaluate the effectiveness of the remedy in meeting the cleanup and restoration objectives. The potential need for additional actions will also be evaluated.

For the OU I soil excavation remedies, the work was performed in accordance with the ROD, applicable design documents, and Remedial Action Work Plans. The soil cleanup levels were met for these areas. The remaining work for the OU I soil excavation at the former Hazardous Waste Management Facility Waste Loading Area and BGRR will be implemented in accordance with the RODs. The remedies are expected to be protective upon attainment of soil cleanup goals once excavation is complete and the groundwater cleanup goals have been met.

A comprehensive sitewide protectiveness determination covering all the OUs and the BGRR must be reserved at this time because:

- Work is not complete for OU I soils at the Waste Loading Area.
- Work is not complete for the BGRR pile, bioshield, and final engineered cap.
- The final remedy for the g-2 Tritium Plume, Brookhaven Linac Isotope Producer (BLIP), and Underground Storage Tanks (USTs) (Areas of Concern [AOC] 16T, 16K, and 12) has not yet been selected. The ROD is due for submittal to the regulators in the fall of 2006.

The second Sitewide Five-Year Review in 2011 will include all OUs, including the g-2 Tritium Plume, BLIP, and USTs. A comprehensive sitewide protectiveness determination will be included at that time. The table below provides a summary of the issues and recommendations by OU from the 2005 Five-Year Review.

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
Document OU I and OU V monitoring and maintenance requirements in one document	Prepare and submit the OU I Soils and OU V Long-Term Monitoring and Maintenance Plan to the regulators	BNL	DOE, EPA, DEC, SCDHS	July 2005 (actual of 8/12/05)	N	N
Some USTs in AOC 12 are not documented as final remedies in a ROD	Document the final remedy for remaining AOC 12 USTs in the g-2/BLIP ROD	BNL	DOE, EPA, DEC, SCDHS	October 2006	N	N
OU I - Animal burrows in Current Landfill cap, and gates broken	Repair current burrows and fix gates	BNL	DOE, EPA, DEC, SCDHS	July 2005 (gates fixed 12/16/05, burrows repaired 2/27/06)	N	N
OU I - Consistent long-term results from Wooded Wetland Monitoring	Evaluate the need to continue the annual sampling or reduce the frequency	BNL	DOE, EPA, DEC, SCDHS	September 2005 (actual of 8/12/05)	N	N
Institutional controls documentation needs updating	Update Land Use Controls Management Plan and web-based database	BNL	DOE, EPA, DEC, SCDHS	September 2005 (Plan updated 6/17/05)	N	Y
OU I - Consistent low VOCs in OU I extraction wells	Implement pulse pumping of treatment system to optimize performance	BNL	DOE, EPA, DEC, SCDHS	October 2005 (actual of 9/6/05)	N	N
OUs III, VI - Deeds not reflecting operating treatment systems	Complete survey/mapping of treatment systems off of BNL property and record updated deeds with County	BNL	DOE, EPA, DEC, SCDHS	June 2005 (survey/mapping completed 6/30/05)	N	Y
OU III - Consistent low VOCs in WSB extraction wells	Implement pulse pumping of treatment system to optimize performance	BNL	DOE, EPA, DEC, SCDHS	October 2005 (actual of 9/6/05)	N	N
OU III - Consistent low VOCs in IP recirculation well	Implement pulse pumping of UVB-1 to optimize performance	BNL	DOE, EPA, DEC, SCDHS	October 2005 (actual of 10/05)	N	N
OU III - Consistent low VOCs in Airport recirculation wells	Implement pulse pumping of treatment system to optimize performance	BNL	DOE, EPA, DEC, SCDHS	October 2005 (actual of 10/3/05)	N	N
Enhance monitoring well network	Implement changes to various well networks based on 2004 Groundwater Status Report	BNL	DOE, EPA, DEC, SCDHS	October 2005 (actual of 10/05)	N	N
OU V – Restore haul roads	Per the DEC equivalency permit, remove stone/fabric	BNL	DOE, EPA, DEC, SCDHS	September 2005 (actual of 9/30/05)	N	N

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
Housekeeping	Dispose of miscellaneous monitoring well materials at Meadow Marsh & 650 Outfall, remove Spray Aeration piping and RA V tanks	BNL	DOE, EPA, DEC, SCDHS	August 2005 (Spray Aeration piping removed 1/11/06)	N	N

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Brookhaven National Laboratory Superfund Site		
EPA ID *(from WasteLAN)*: NY7890008975		
Region: 2	**State:** NY	**City/County:** Upton, Suffolk

SITE STATUS	
NPL status: ☒ Final ☐ Deleted ☐ Other (specify)	
Remediation status (choose all that apply): ☒ Under Construction ☒ Operating ☒ Complete	
Multiple OUs?* ☒ YES ☐ NO	**Construction completion date:** ___ / ___ / _____
Are the properties associated with this site in use or are they suitable for reuse? ☒ YES ☐ NO	

REVIEW STATUS	
Lead agency: ☐ EPA ☐ State ☐ Tribe ☒ Other Federal Agency (DOE)	
Author name: Rodrigo V. Rimando, Jr.	
Author title: DOE Federal Project Director and IAG Remedial Project Manager	**Author affiliation:** U.S.DOE, Office of Environmental Management, Upton, NY
Review period:** 7/18/2000 to 7/18/2005	
Date(s) of site inspection: 3/10/05 through 5/24/05	
Type of review: ☒Post-SARA ☐ Pre-SARA ☐ NPL-Removal only ☐Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐Regional Discretion	
Review number: ☒ 1 (first) ☐ 2 (second) ☐ 3 (third) ☐ Other (specify) _____	
Triggering action: ☒ Actual RA Onsite Construction at OU I ☐ Construction Completion ☐ Other (specify)	☐ Actual RA Start at OU#____ ☐ Previous Five-Year Review Report
Triggering action date *(from WasteLAN)*: 7/18/2000	
Due date *(five years after triggering action date)*: 7/18/2005	

* ["OU" refers to operable unit.]
** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Report

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List of Acronyms

ALARA	As Low As Reasonably Achievable
AOC	Area of Concern
AS/SVE	Air Sparging/Soil Vapor Extraction
BER	Brookhaven Executive Round Table
BGD	belowground duct
BGRR	Brookhaven Graphite Research Reactor
BHSO	Brookhaven Site Office
BLIP	Brookhaven Linac Isotope Producer
BNL	Brookhaven National Laboratory
BSA	Brookhaven Science Associates
CAC	Community Advisory Council
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act*
CFR	*Code of Federal Regulations*
CSF	Central Steam Facility
DOE	Department of Energy
DQO	Data Quality Objective
EDB	ethylene dibromide
EPA	Environmental Protection Agency
ESD	*Explanation of Significant Differences*
gpm	gallons per minute
HFBR	High Flux Beam Reactor
HWMF	Hazardous Waste Management Facility
IAG	Interagency Agreement
IP	Industrial Park
Linac	Linear Accelerator
LIPA	Long Island Power Authority
LUCMP	*Land Use Controls Management Plan*
LU/IC	Land Use/Institutional Controls
mCi	milliCuries
MCL	maximum contaminant level
mRem	milliRem
MTBE	methyl tertiary butyl ether

NCP	*National Contingency Plan*
NEAR	Neighbors Expecting Accountability and Remediation at Brookhaven National Laboratory
NPL	*National Priorities List*
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	operation and maintenance
ORISE	Oak Ridge Institute for Science and Education
OU	Operable Unit
pCi/L	picocurie(s) per Liter
pCi/g	picocurie(s) per gram
PCBs	polychlorinated biphenyls
PCE	tetrachloroethylene
ppm	part(s) per million
RA	Removal Action
RAO	Remedial Action Objective
ROD	Record of Decision
SCDHS	Suffolk County Department of Health Services
SCWA	Suffolk County Water Authority
SPDES	State Pollutant Discharge Elimination System
Sr-90	strontium-90
STP	Sewage Treatment Plant
SVOC	semivolatile organic compound
TAG	Technical Assistance Grant
TBC	Items “to be considered”
TCA	1,1,1-trichloroethane
TCE	trichloroethene
TVOC	total volatile organic compound
UST	underground storage tank
VOC	volatile organic compound
WCF	Waste Concentration Facility
WSB	Western South Boundary
µg/L	microgram(s) per liter

Glossary

Administrative Record: A file that contains the documents, including technical reports, which form the basis for selection of a final remedy and acts as a vehicle for public participation.

Area of Concern: A geographic area of BNL where there has been a release or the potential for a release of a hazardous substance, pollutant, or other contaminant. There are 30 areas of concern at BNL.

Closeout Report: A report that documents the completion of construction of the remedy and how it complies with the requirements of the remedial design plans, specifications, and the ROD. The report includes post excavation confirmatory sampling results.

Institutional Controls: Measures or restrictions established to prevent exposure of workers or the public to hazards. These may include the establishment of fencing, posting of signs, prevention of unplanned alteration of contaminant plume flow pathways, etc.

Interagency Agreement: A legal binding document established under the Comprehensive Environmental Response, Compensation, and Liability Act, that presents the framework for implementing the cleanup activities at a particular site. At BNL, the IAG was signed in 1992 by the U.S. Department of Energy, the U.S. Environmental Protection Agency, and the New York State Department of Environmental Conservation.

Maximum Contaminant Level: A standard set by the U.S. Environmental Protection Agency, and the New York State Department of Environmental Conservation for contaminants in drinking water. These contaminants represent levels that the regulatory agencies believe are safe for people to drink. DEC standards often apply a safety factor and are more stringent than the Federal standards.

Operable Unit: Groups of areas within a site containing the same or similar contamination. The areas within one operable unit are not necessarily adjacent. BNL has six operable units.

PicoCurie Per Liter: A unit of measure of radioactivity per liter of water.

Record of Decision: Documents the decision by DOE and the regulators on a selected remedial action. It includes the responsiveness summary and a bibliography of documents that were used to reach the remedial decision. When the record of decision is finalized, the remedial design and construction can begin.

Brookhaven National Laboratory
Five-Year Review Report

1.0 Introduction

The purpose of this Five-Year Review is to determine whether the remedies implemented at Brookhaven National Laboratory (BNL) continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review Reports. In addition, Five-Year Review Reports identify issues found during the review, if any, and provides recommendations to address them.

The U.S. Department of Energy (DOE) prepared this Five-Year Review Report pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

DOE interpreted this requirement further in the NCP; 40 Code of Federal Regulations (CFR) §300.430(f)(4)(ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

Brookhaven Science Associates (BSA), under contract with the DOE, manages and operates BNL. BSA's Environmental and Waste Management Services Division (EWMSD) and Environmental Restoration (ER) Projects Directorate conducted this Five-Year Review of the remedial actions implemented at the BNL site in Upton, New York under the direction of the DOE Remedial Project Manager. This report documents the results of the review.

This is the first sitewide Five-Year Review for the BNL site that includes all the Operable Units (OUs) and the Brookhaven Graphite Research Reactor (BGRR). A Five-Year Review was previously prepared but was focused specifically on the OU IV remedy at BNL (September 2003). In addition, Five Year Evaluation Reports were prepared for the Current and Former Landfills in 2001 and 2002 in accordance with New York State Part 360 requirements. The triggering action for this 2005 sitewide statutory review is initiation of the remedial action for OU I contaminated landscape soils, on July 18, 2000. The review is required because hazardous substances, pollutants, or contaminants at the site are above levels that allow for unlimited use and unrestricted exposure.

This first sitewide Five-Year Review includes an evaluation of all the Areas of Concern (AOCs) at BNL, except for the g-2 Tritium Plume (AOC 16T) and Brookhaven Linac Isotope Producer

(BLIP AOC 16K). Remedial actions for those AOCs will be presented in a Record of Decision (ROD) that is scheduled for submittal to the regulators in October 2006. Another decision document will be prepared for the High Flux Beam Reactor (HFBR). The second sitewide Five-Year Review will include all AOCs, including the g-2 Tritium Plume and BLIP.

2.0 Site Chronology

The BNL site is currently being addressed under six OUs covering 30 AOCs. The chronology in Table 1 first identifies general site information, and then breaks each OU down by major event. Table 2 presents each OU and Removal Action AOC.

3.0 Facility-Wide Background

3.1 Physical Characteristics

The BNL site is located in Upton, Suffolk County, New York, near the geographic center of Long Island. The BNL property approximates a square, 3 miles on each side, comprising an area of approximately 5,265 acres (about 8 square miles). The boundaries of BNL are either near or adjacent to neighboring communities. Approximately 150 people live in apartments and cottages on site, and many of the approximately 4,000 scientists and students who visit each year stay in the Lab's dormitories. The site's terrain is gently rolling, with elevations varying between 40 and 120 feet above mean sea level. The land lies on the western rim of the Peconic River watershed, with a tributary of the river rising in marshy areas in the northern part of the site.

3.2 Geology/Hydrogeology

BNL is underlain by unconsolidated glacial and deltaic deposits that overlie gently southward sloping, relatively impermeable, crystalline bedrock. The deposits are about 2,000 feet thick in central Suffolk County. The aquifer beneath BNL is comprised of three water-bearing units: the Upper Glacial, the Magothy, and the Lloyd aquifers. These units are hydraulically connected and make up a single zone of saturation with varying physical properties extending from depth of 45 to 1,500 feet below the land surface. These three bearing units are designated as a "sole-source aquifer" by the EPA and serve as the primary source of drinking water for Nassau and Suffolk counties.

3.3 Land and Resource Use

The site where BNL is located was formerly occupied by the U.S. Army as Camp Upton during World Wars I and II. Between the wars, the Civilian Conservation Corps operated the site. In 1947, the Atomic Energy Commission established BNL. The Laboratory was transferred to the Energy Research and Development Administration in 1975 and to the DOE in 1977. BNL is currently a federal facility that conducts research in physical, biomedical and environmental sciences and energy technologies.

The developed region of the site includes the principal BNL facilities which are near the center of the site on relatively high ground. These facilities comprise an area of approximately 900 acres, of which 500 acres were originally developed for Army use. Outlying facilities occupy approximately 550 acres and include an apartment area, agricultural field, former Hazardous Waste Management Facility (HWMF), Sewage Treatment Plant (STP), firebreaks, and former landfill areas.

Figure 1 provides the current land-use designations for the BNL site. This includes industrial use in the central portion of the site, with open space borders. A significant portion of land on the eastern portion of the site has been designated as the Upton Ecological Reserve. A small portion of the site is residential and agricultural. Further detail of the land use designations for specific remediation areas is identified in the BNL Land Use and Institutional Controls (LUIC) website (http://luic.bnl.gov/website/landcontrols/). These land use settings are projected to remain the same. These include:

- Soil Remediation Complete - Unrestricted Land Use (A)
- Soil Remediation Complete - Restricted Land Use (B)
- Capped/Controlled Contaminated Soils - Restricted Land Use (C)
- Known or Potentially Contaminated Soils, Remediation Pending - Restricted Land Use (D)
- Groundwater Contamination Areas - Restricted Groundwater Use (E)
- Radiological Facility, Decontamination & Demolition Pending - Restricted Land Use (F)

Table 1: Chronology of Site Events

General Site Information	
Site of future BNL serves as Army Camp Upton for World Wars I and II, operated by the Civilian Conservation Corps between wars	1917 – 1940s
Site transferred to the Atomic Energy Commission, BNL developed	1947
BNL transferred to the Energy Research and Development Administration	1975
BNL transferred to the Department of Energy	1977
BNL added to NYSDEC list of Inactive Hazardous Waste Sites	1980
BNL listed on EPA National Priorities ("Superfund") List	1989
DOE entered into Interagency Agreement with EPA and NYSDEC under CERCLA	1992
Operable Unit I	
Removal Action (RA) for "D-waste" tanks removal	1994
RA for Landfill capping	1995–1997
RA for South Boundary groundwater treatment system construction, and public water hookups	1996
RA for Chemical/Animal Pits and Glass Holes excavation	1997
ROD signed	1999
Completed excavating landscape soil; Closeout Report issued	2000, 2001
Completed excavating sludge from Building 811 underground storage tanks (USTs); Closeout Report issued	2001
Completed excavating soil and /pipeline associated with Building 650; Closeout Report issued	2002
Completed capping Ash Pit; Closeout Report issued	2003/2004
Completed excavating soil and reconstructed Upland Recharge and Meadow Marsh); Closeout Report issued	2003/2004
Completed excavating former Hazardous Waste Management Facility (HWMF) soil; Closeout Report issued	2005
Completed excavating Building 811 USTs/soils, Closeout Report issued	2005
Completed excavating former Chemical Holes residual surface soils; Addendum to Closeout Report issued	2005
Operable Unit II/VII	
Remedial Investigation (RI)/RA Report issued	1999
Evaluation of alternatives included under OU I Feasibility Study (FS)	NA
RA for BLIP Facility (AOC 16K) cap, drainage control, grout injection, and Closeout Report issued	1998/2002
Operable Unit III	
RA for Building 479 PCB-contaminated soil excavation	1992
RA for Building 464 mercury-contaminated soil excavation	1993
RA for South Boundary groundwater treatment system construction	1997
RA for High Flux Beam Reactor (HFBR) tritium plume groundwater treatment system	1997
RA for public water hookups	1996–1998
RA for cesspools/septic tanks completed, Closeout Report issued	1994–1999
RA for USTs completed, Closeout Report issued	1994–1999
RA for Carbon Tetrachloride groundwater treatment system construction	1999
RA for Industrial Park groundwater treatment system construction	1999
ROD signed	2000
Completed constructing Building 96 groundwater treatment system	2000
Completed constructing Middle Road groundwater treatment system	2001
Completed constructing low-flow pumping system for HFBR tritium plume	2001
Completed constructing Western South Boundary groundwater treatment system	2002
Completed constructing Chemical Holes Sr-90 groundwater treatment system (Pilot Study)	2003
Petition approved for shutdown of the Carbon Tetrachloride treatment system	2004
Completed constructing four remaining off-site groundwater treatment systems: Industrial Park East, North Street, North Street East, LIPA/Airport	2004
Completed constructing BGRR/Waste Concentration Facility (WCF) Sr-90 groundwater treatment system	2004
Completed excavating Building 96 PCB-contaminated soil; Closeout Report issued	2005
Explanation of Significant Differences (ESD) issued	2005
Building 96 Groundwater Treatment System Shutdown Petition Issued	2005

continued…

Table 1: Chronology of Site Events *(continued)*

Operable Unit IV	
RA for fence around Building 650 Sump outfall area soil	1995
ROD signed	1996
Completed constructing AS/SVE remediation system	1997
Petition approved for shutdown of AS/SVE remediation system	2000
Five-Year Review submitted to EPA and NYSDEC	2002
Petition for closure of AS/SVE Remediation System approved by EPA and NYSDEC; system dismantled	2003
Final Five-Year Review issued	2003
Operable Unit V	
RA for Imhoff Tanks	1995
ROD signed for Sewage Treatment Plant (STP)	2002
Completed excavation: STP soils; Completion Report issued	2003
RA for Peconic River sediment excavation on site; Completion Report issued	2004/2005
RA for Peconic River sediment excavation off site; Completion Report issued	2004/2005
ROD signed for Peconic River	2005
Closeout Report for Peconic River Phase 1 and 2 Remediation submitted to regulators for review	2005
Operable Unit VI	
RA for public water hookups	1996–1997
ROD signed	2001
Completed constructing EDB groundwater treatment system off site	2004
Brookhaven Graphite Research Reactor	
RA for BGRR primary cooling fans and equipment	1999
RA for pile fan sump	1999–2000
RA for above-grade ducts	2000–2002
RA for canal house and water treatment house	2001–2002
RA for coolers and filters	2002–2003
RA for BGD primary liner	2004
RA for fuel canal and subsurface soils	2005
ROD signed	2005

Notes
AOC = Area of Concern
AS/SVE = Air Sparging/Soil Vapor Extraction
BLIP = Brookhaven Linac Isotope Producer
BGD = below-ground duct
CERCLA = Comprehensive Environmental Response, Compensation and Liability Act
EPA = U.S. Environmental Protection Agency
ESD = Explanation of Significant Differences
FS = Feasibility Study
HWMF = Hazardous Waste Management Facility
IAG = Interagency Agreement
NYSDEC = New York State Department of Environmental Conservation
RA = Removal Action
RI = Remedial Investigation
ROD = Record of Decision
STP = Sewage Treatment Plant
USTs = underground storage tanks
WCF – Waste Concentration Facility

Table 2. Operable Unit (OU) AOCs

Category	AOC #	Description and Status
OU I (ROD approved)	AOC 1 (A,C,D,E,F,G,H,I)	Hazardous Waste Management Facility – complete except for Waste Loading Area
	AOC 1B	Spray Aeration Site – removal action complete
	AOC 2 (A,B,C,D,E,F)	Former Landfill Area – complete
	AOC 3	Current Landfill – complete
	AOC 2 and 3	Landfills Closure – removal action complete
	AOC 6	Buildings 650 Sump and Sump Outfall – complete
	AOC 8	Upland Recharge Area/Meadow Marsh – complete
	AOC 10A	Waste Concentration Facility – Tanks D-1, D-2, and D-3 – removal action complete
	AOC 10B,C	Waste Concentration Facility – Underground pipelines and Six A/B USTs - complete
	AOC 12	Underground Storage Tanks at Bldg. 445 – removal action complete
	AOC 23	Off-Site Tritium Plume (southern component) – complete
	Sub AOC 24E	Recharge Basin HS, Outfall 005 – complete
	Sub AOC 24F	New Stormwater Runoff Recharge Basin – complete
OUs II/VII (addressed in OU I ROD; approved)	AOC 10A,B,C	Waste Concentration Facility (Building 811) – complete
	AOC 16 (A,B,C,D,E,F,G,H,I,J, L,M,N,O,P,Q,S)	Aerial Radioactive Monitoring System Results – complete
	AOC 17	Area Adjacent to Former Low-Mass Criticality Facility – complete
	AOC 18	AGS Scrapyard ("Boneyard") – complete
	AOC 20	Particle Beam Dump, north end of Linac – complete
OU III (ROD approved)	AOC 7	Paint Shop – groundwater monitoring underway
	AOC 9	BGRR (groundwater) – treatment system operating
	AOC 10	Waste Concentration Facility (groundwater) – treatment system operating
	AOC 11	Building 830 Pipe Leak –complete; groundwater monitoring underway
	AOC 12	Underground Storage Tanks at Bldg. 830 – removal action complete
	AOC 13	Cesspools – removal action complete
	AOC 14	Bubble Chamber Spill Areas – groundwater monitoring underway
	Sub AOC 15A	Supply/Potable Wells 1, 2, 3, 4, 6, 7, 10, 11, 12
	Sub AOC 15B	Monitoring Well 130-02 – treatment system operating
	AOC 18	AGS Scrapyard (groundwater) – groundwater monitoring underway
	AOC 19	TCE Spill Area, Building T-111 – groundwater monitoring underway
	AOC 20	Particle Beam Dump, north end of Linac (includes Basin HT) – monitor and maintain per SPDES permit and *Natural Resource Management Plan* (NRMP)
	AOC 21	Leaking sewer pipes (sitewide, not investigated under other OU study areas) – groundwater monitoring underway
	AOC 22	Old Firehouse – no further action, per ROD
	Sub AOC 24A	Process Supply Wells 104 and 105 – treatment systems operating, groundwater monitoring underway
	Sub AOC 24B	Recharge Basin HP, Outfall 004 – monitor & maintain per SPDES permit & NRMP
	Sub AOC 24C	Recharge Basin HN, Outfall 002 – monitor & maintain per SPDES permit & NRMP

continued…

Table 2. Operable Unit (OU) AOCs *(continued)*

Category	AOC #	Description and Status
	AOC 25	Building 479 PCB soil removal complete, and groundwater monitoring underway
	AOC 26	Building 208 – removal action complete
	AOC 26A	Building 208 (groundwater) - groundwater monitoring underway
	AOC 26B	Former Scrapyard/Storage Area south of Bldg. 96 – treatment system operating
	AOC 27	Building 464 mercury soil removal complete, groundwater monitoring underway
	AOC 29	Spent fuel pool in HFBR and associated groundwater plume of tritium – treatment system on standby; groundwater monitoring underway
OU IV (ROD approved)	AOC 5 (A,B,C,D)	Central Steam Facility – treatment system decommissioned
	AOC 6	Reclamation Facility Interim Action – complete
	AOC 12	Underground Storage Tanks at Bldg. 650 – removal action complete
	AOC 21	Leaking Sewer Pipes (in study area) – complete
	Sub AOC 24D	Recharge Basin HO, Outfall 003 – complete
OU V – STP (ROD Approved)	AOC 4 (A,B,C,D,E)	Sewage Treatment Plant - complete
	AOC 21	Leaking sewer pipes (in the study area) – complete
	AOC 23	Off-site tritium plume (eastern component) – groundwater monitoring underway
OU V – Peconic River (ROD Approved)	AOC 30	Peconic River – cleanup on and off of BNL property complete
OU VI (ROD approved)	AOC 28	EDB groundwater contamination – treatment system operating
BGRR (ROD Approved)	AOC 9A	Canal – complete
	AOC 9B	Underground duct work – complete
	AOC 9C	Spill sites – underway
	AOC 9D	Pile Fan Sump – complete
g-2 and BLIP ROD	AOC 12	Underground Storage Tanks, Bldgs. 462, 463, 527, 703, 927, 931B – complete
	AOC 16K	Aerial Radioactive Monitoring System results – BLIP, Building 931B – removal action complete
	AOC 16R	Aerial Radioactive Monitoring System results – Nuclear Waste Management Facility, Building 830 – complete
	AOC 16T	Aerial Radioactive Monitoring System results - g-2 Source Area andTritium Groundwater Plume – Focused Feasibility Study under regulator review

Notes
AGS = Alternating Gradient Synchrotron
AOC = Area of Concern
BGRR = Brookhaven Graphite Research Reactor
BLIP = Brookhaven Linac Isotope Producer
HFBR = High Flux Beam Reactor
NRMP = Natural Resource Management Plan
ROD = Record of Decision
SPDES = State Pollutant Discharge Elimination System VOC = Volatile organic compounds

Because of chemical contamination in the Upper Glacial aquifer, public water hookups were provided by DOE for homes in the area south of BNL. However, eight known homeowners have elected not to connect to public water and continue to operate private wells. Annually, DOE formally offers those homeowners free testing of their private drinking water wells.

3.4 History of Contamination

Much of the environmental contamination at BNL is associated with past accidental spills and historical storage and disposal of chemical and radiological materials. These past operations, some of which may date back as far as the Army days, have caused soil and groundwater contamination that can be categorized into four main areas. These areas are 1) the groundwater contamination (primarily volatile organic compounds [VOCs]), ethylene dibromide [EDB], strontium-90 [Sr-90], and tritium), 2) soils contamination (primarily polychlorinated biphenyls [PCBs], metals, cesium-137 [Cs-137] and Sr-90) and landfills, 3) the Peconic River sediment contamination (primarily metals, and PCBs) and 4) the BGRR (primarily radioactivity). Contamination in the Peconic River and VOC groundwater contamination have extended off the BNL property. The most significant environmental concern is that the Lab lies above a sole-source aquifer that is used for drinking water purposes both on and off site. Brief descriptions of the nature of contamination associated with each OU and the BGRR covered under this Five-Year Review are as follows:

- OU I – Former landfills, disposal pits, and soils contaminated with metals such as mercury and lead, and radionuclides including Cs-137 and Sr-90; above- and below-ground leaking storage tanks; and VOC-contaminated groundwater such as 1,1-dichloroethane, on BNL property
- OU II/VII – Radiologically-contaminated soils on BNL property such as Cs-137. The AOCs in this OU were documented under the OU I and III RODs (except for BLIP [AOC 16K] which will be documented in a separate ROD)
- OU III – Groundwater contaminated with VOCs such as carbon tetrachloride, 1,1,1-trichloroethane (TCA), and tetrachloroethylene (PCE), and radionuclides such as tritium and Sr-90 on BNL property; and VOC-contaminated groundwater off of BNL property including PCE and carbon tetrachloride
- OU IV – Soil and groundwater contaminated with VOCs such as toluene and ethylbenzene, and semivolatile organic compounds (SVOCs) from former oil/solvent tank spill on BNL property
- OU V – Radiologically and metal-contaminated soil at the STP such as Cs-137, mercury, and silver; metal (mercury, silver, copper) and PCB-contaminated sediment in the Peconic River; and VOC contaminated groundwater including trichloroethene (TCE) on and off of BNL property
- OU VI – EDB-contaminated groundwater off of BNL property
- BGRR - Radiologically-contaminated soils, sumps, ducts, piping, and standing water including Cs-137 and Sr-90; and Sr-90 groundwater on the BNL site

Although not included under this Five-Year Review, another decision document will be prepared for the HFBR.

3.5 Initial Response

In 1980, the BNL site was placed on the NYSDEC list of Inactive Hazardous Waste Sites. In 1989,

BNL was also included on the EPA National Priorities List because of soil and groundwater contamination. Subsequently, EPA, DEC, and DOE entered into a Federal Facilities Agreement (also referred to as the Interagency Agreement, or IAG). While not formal IAG partners, the Suffolk County Department of Health Services (SCDHS) and the New York State Department of Health are also actively involved with BNL cleanup decisions. The IAG became effective in 1992, and it identified AOCs that were grouped into OUs to be evaluated for response actions. The IAG established the framework and schedule for characterizing, assessing, and remediating the site in accordance with the requirements of CERCLA. There are 30 AOCs and six OUs at the BNL site.

As noted in Table 1 in Section 2.0 above, prior to the approval of the RODs DOE used its removal action authority in many situations to help reduce risks to human health and the environment. In most cases, these actions were taken to address source areas of contamination. These activities include the closure/capping of landfills, fencing, tank removals, soils remediation, groundwater treatment, public water hookups, STP remediation, Peconic River sediment remediation, and response actions at the BGRR. In several cases, the removal action ended up being the final remedial action. These actions are documented in the RODs.

3.6 Basis for Taking Action

Summarized below for each OU are the nature of the contamination as well as the risks to human health and the environment.

Operable Unit I. Radioactively contaminated soil is the principal threat. In addition, several Removal Actions were conducted to address buried waste at several AOCs.

Soils: The former HWMF (AOC 1) contains most of the radioactively contaminated soil at BNL. The predominant radionuclide is Cs-137, which is the primary source of risk from direct exposure. Sr-90 is also present, and most of the contamination is at or near the surface although in some locations it extends to 12 feet below grade. Other contaminated soil areas include the Waste Concentration Facility (WCF, AOC 10) (which also contained leaking tanks), Building 650 sump and sump outfall (AOC 6), and several areas throughout the site that were the result of contaminated soils once used for landscaping purposes. The Former (AOC 2), Interim (AOC 2D), and Current (AOC 3) landfills, as well as the Glass/Chemical/Animal Holes (AOC 2B and 2C), received waste generated at BNL between 1917 through 1990. These disposal areas were unlined and had a direct impact on groundwater quality prior to their being capped or excavated in the mid 1990s. Contaminants at the Former Landfill Area include VOCs, metals such as mercury, and Sr-90.

The ash pits (AOC 2F), which once received ash and slag from a solid-waste incinerator located on the BNL site, have lead concentrations above cleanup goals. The Upland Recharge/Meadow Marsh Area (AOC 8) contained sediment with low levels of pesticides and metals below cleanup standards for human health but presented an exposure risk to eastern tiger salamanders, an endangered species in New York State.

Groundwater: The groundwater beneath the Former Landfill area contains VOCs and Sr-90, while the Current Landfill contains VOCs. Volatile organic compound contamination from these areas has migrated beyond the site's boundary.

Operable Unit II/VII. The principal threat is from radioactively contaminated soils.

Soils: Cs-137 is the major radiological contaminant of concern in soil where it can exceed specified risk or radiation dose limits. Cs-137 was found in the WCF soils as well as several areas identified from the aerial radioactive monitoring system results (i.e., landscaping soils [AOC 16S]). During the remedial investigation, no soil contamination at the landscape soils were found more than 2 feet below grade. Sr-90 soil contamination was found deeper than two feet at the WCF, as was tritium contamination in soil at the BLIP.

Groundwater: The BLIP (AOC 16K) contains an area of soil and groundwater contamination. Research operations have resulted in the activation of soil used for shielding. The primary contaminants of concern at this area are tritium and sodium-22. The threat results from the infiltration of rainwater through the contaminated soils, and the leaching of tritium and sodium-22 into the groundwater at concentrations that exceed drinking water standards.

Operable Unit III. Groundwater contamination is the most significant concern; however, there are a few minor soil AOCs.

Groundwater: The groundwater beneath BNL and beyond the Laboratory's boundary is a sole source of drinking water, therefore groundwater contamination is considered the greatest potential risk to human health and the environment. Groundwater on and off of BNL property is contaminated with VOCs such as TCA, PCE, and carbon tetrachloride. Tritium and Sr-90 are also present above the drinking water standards on the BNL site. There is no radiological contamination off of BNL property that exceeds drinking water standards. The potable drinking water supply wells on and off of the BNL site are currently not impacted, nor are they expected to be impacted from the contamination. There are eight known homeowners who continue to use their private wells for drinking water purposes; however, DOE offers free annual testing of their well water.

Soils: PCB-contaminated soils above the New York State Technical and Administrative Guidance Memorandum (TAGM) cleanup levels were found at the Building 96 former Scrapyard (AOC 26B). Other smaller soil-contaminated areas included mercury at Building 464 (AOC 27) and PCBs at Building 479 (AOC 25).

Operable Unit IV. Soil and groundwater are the concerns.

Groundwater: VOCs and SVOCs such as benzene, toluene, and ethylbenzene from an historical oil/solvent spill contaminated the groundwater at this OU. BNL potable wells are located upgradient of this area. Strontium-90 was released to groundwater at the Building 650 Sump Outfall and the plume is located in the central portion of the site.

Soil: VOCs and SVOCs are also present in the soils from the spill. Radiological contamination has been identified at the Building 650 Sump Outfall.

Operable Unit V. Radioactively and metal-contaminated soil, and metal and PCB-contaminated river sediment are the principal threats.

Soil/Sediment: The STP berms (AOC 4) presented concern due to potential impacts to future on-

site residents from Cs-137 and mercury. In addition, concentrations of mercury and PCBs in fish may have posed a health hazard to people consuming fish taken from certain locations on the Peconic River (AOC 30). Sediment within certain depositional areas of the Peconic River was contaminated with mercury, silver, and copper, and posed a potential ecological concern. Surface sediment in depositional areas up to 1.5 miles downstream of the STP contained PCB aroclor-1254. Trace amounts of Cesium-137 were co-located in the sediment, but did not drive the risk.

Groundwater: The primary contaminants in the groundwater on and off of the BNL site include trichloroethene (TCE) and tritium. Tritium has not been detected above the drinking water standards, and TCE concentrations are slightly above the standards.

Operable Unit VI. Groundwater contamination is the primary threat.

Groundwater: The pesticide EDB is the contaminant of concern (AOC 28). It has been found in groundwater on and off of BNL property significantly above the drinking water standard of 0.05 µg/L.

BGRR

Structures and Soils: There are several radiologically contaminated structures at various locations within the BGRR complex (AOC 9). These include the graphite pile and surrounding biological shield, contaminated concrete within the fuel-handling system's deep pit and fuel canal (AOC 9A), and contaminated steel and concrete within the belowground ducts (BGD, AOC 9B). Additionally there are isolated pockets of contaminated soils adjacent to the BGD secondary cooling air bustle and expansion joints, fuel canal outer walls and construction joint, the reactor building pipe trench, and the reactor building drains. Most nonradiological hazardous materials associated with the BGRR was removed through previous interim stabilization measures. Isolated pockets of nonradiological hazardous material contamination are present within the reactor building pipe trench, and within embedded drain lines. Hazardous materials intrinsic to construction materials, such as floor tiles, paint, and insulating materials, remain within the reactor building.

Groundwater: Groundwater contaminated with Sr-90, included under OU III, is present beneath the BGRR complex, at concentrations significantly above the 8 pCi/L drinking water standard. The Sr-90 contamination has not been detected off of the site above the standard.

4.0 Remedial Actions

4.1 Remedy Selection

As of the date of this report, seven Records of Decision have been signed at BNL. The first was signed in 1996 and the last two were signed in early 2005. The seven RODs are:

1. OU I - Radiological contaminated soils on the BNL site
2. OU III - Groundwater on and off of the BNL site
3. OU IV - Soil and groundwater on site
4./5. OU V - STP and the Peconic River (two RODs)
6. OU VI - EDB in groundwater off of the BNL site
7. BGRR - Radiological contaminated structures and soil on site

Individual site locations are indicated in Figure 2. A ROD for the remaining OU, the g-2 Tritium Plume, BLIP, and USTs (AOCs 16T, 16K, and 12), is still pending and is due for submittal to the regulators in the fall of 2006. Brief descriptions of the ROD remedial action objectives and the major remedy components appear below.

Operable Unit I ROD, signed August 1999 (BNL 1999)

- Objectives are to prevent or minimize:
  - Leaching of contaminants (radiological and chemical) from soil into the groundwater
  - Migration of contaminants present in surface soil via surface runoff and windblown dust
  - Human exposure including direct external exposure, ingestion, inhalation, and dermal contact, and environmental exposure to contaminants in the surface and subsurface soils
  - Uptake of contaminants present in the soil by ecological receptors
- OU I Remedy components:
  - Excavate soil and sediment that are radiologically and chemically contaminated above the selected cleanup goals at the former HWMF, WCF, Building 650 sump and sump outfall, and the Chemical/Animal/Glass Holes, and dispose of off the BNL site at an approved facility. Reconstruct wetlands at the former HWMF.
  - Remove out-of-service facilities, tanks, piping, and equipment at the former HWMF and WCF.
  - Install soil caps to address metal contamination at ash pits.
  - Excavate chemically contaminated sediment from the Upland Recharge/Meadow Marsh Area and dispose of off the BNL site at an approved facility. Reconstruct wetlands and monitor.
  - Implement long-term institutional controls and monitoring to ensure that planned uses are protective of public health.
  - All of the previous removal actions that were implemented, such as landfill capping, waste and soil excavation, groundwater pump and treat systems, were selected as final remedies under the ROD.

Groundwater contamination associated with the Former Landfill Area and off-site groundwater associated with other Operable Unit I AOCs was addressed in the OU III ROD (BNL 2000a). An evaluation of remedial alternatives for contaminated soil and groundwater associated with the BLIP facility (AOC 16K) was completed. The final remedy for contaminated soils at BLIP will be documented in a ROD scheduled for submittal to the regulators in the fall of 2006.

Operable Unit II Decisions

Remedial actions for the OU II AOCs are documented in the OU I ROD (BNL 1999) and OU III ROD (BNL 2000a).

Operable Unit III ROD, signed June 2000 (BNL 2000a)

- Objectives are to:
  - Meet the drinking water standards (i.e., maximum contaminant levels [MCLs]) in groundwater for VOCs, Sr-90, and tritium.

- Complete cleanup of the groundwater in a timely manner. For the Upper Glacial aquifer, this goal is 30 years or less.
- Prevent or minimize further migration of VOCs, Sr-90, and tritium in groundwater.

- OU III Remedy Components:
  - For VOCs – Install treatment systems on and off of BNL property at the Long Island Power Authority (LIPA) right-of-way, North Street, Airport, North Street East, Industrial Park East, Middle Road, and western south boundary. All of the previously implemented VOC removal actions (including treatment systems at the south boundary and Industrial Park) were selected as final remedies under the OU III ROD.
  - For tritium (AOC 29) – Institute contingency plans to reactivate the Princeton Avenue pump and recharge system, and low-flow groundwater extraction of high tritium concentrations with approved off-site disposal of the water.
  - For Sr-90 - Install treatment systems using ion exchange at the Chemical Holes and the BGRR/WCF plumes. Prior to implementation, perform a pilot treatability study to evaluate the effectiveness of extraction and treatment, and modify the remedy, if needed.
  - Magothy aquifer – Perform additional characterization and determine the need for a remedy. If a remedy for the Magothy is necessary, either the OU III ROD would be modified or another decision document would establish the selected action.
  - The previous removal action that was implemented for public water hookups was selected as a final remedy under the ROD.
  - Groundwater monitoring program to monitor and verify the cleanup over time.
  - Source Areas - Source removal system at Building 96 for VOCs in groundwater and PCBs in soil, remediation of groundwater at the carbon tetrachloride spill area, and removal of Building 830 USTs (AOC 12).
  - Deferred Decisions – The final remedy for potential source areas such as the Building 96 geophysical anomalies (AOC 26B) will be document in a subsequent ROD (see OU III ESD below). The final remedy for AOC 9D, the Pile Fan sump, was documented in the BGRR ROD.

<u>Operable Unit III Explanation of Significant Differences, signed May 2005 (BNL 2005a)</u>

- Remedy Components:
  - Magothy aquifer - Add two Magothy aquifer extraction wells off of BNL property in addition to the three wells already installed. Meet drinking water standards within 65 years.
  - Sr-90 – Continue to operate the existing pilot study at the Chemical Holes and meet the drinking water standards within 40 years. Install an ion exchange treatment system for the BGRR/WCF plume, and meet the drinking water standards within 70 years.
  - Building 96 Scrapyard – No further action for the geophysical anomalies.
  - Institute long-term institutional controls and monitoring to ensure that planned uses are protective of public health.

Operable Unit IV ROD, signed March 1996 (BNL 1996)

- Objectives are to restore the groundwater quality at the most contaminated portion of the AOC 5 plume to MCLs or background levels, and prevent or minimize:
  - Leaching of contaminants (radiological and chemical) from the soils into the groundwater
  - Volatilization of contaminants from surface soils into the ambient air
  - Migration of contaminants present in surface soil via surface runoff and windblown dust
  - Human exposure including ingestion, inhalation, and dermal contact, and environmental exposure to contaminants in the surface and subsurface soil and groundwater
  - Uptake of contaminants present in the soil and/or groundwater by plants and animals

- OU IV Remedy Components:
  - Treat chemically contaminated soil in the vadose zone of the spill area (AOC 5A) and the fuel unloading area (AOC 5D) using soil vapor extraction.
  - Treat groundwater at the most contaminated portion of the spill area using soil vapor extraction and air sparging.
  - Use an engineering enhancement option for the groundwater if soil vapor extraction and air sparging alone will not achieve the desired performance levels.
  - As an Interim Action, install a fence around the radiologically contaminated soil at Building 650 Sump and Sump Outfall area with institutional controls and monitoring. The final remedy for these soils is documented in the OU I ROD.

Operable Unit V Sewage Treatment Plant ROD, signed January 2002 (BNL 2001a)

- Objectives are to protect public health and the sole source aquifer, continue to monitor the groundwater, and to prevent or minimize:
  - Migration of contaminants present in surface soil via surface runoff, windblown dust
  - Human and environmental exposure to contaminants in surface and subsurface soil
  - Potential for uptake of contaminants present in the soil by ecological receptors
  - Potential for migration of contaminants (radiological and chemical) from the soil to groundwater
  - Reduce the levels of contamination in the sand filter beds (AOC 4B)/berms and adjacent areas

- OU V STP Remedy Components:
  - Excavate radiologically and chemically contaminated soil at the sand filter beds and berms, firing range berms, and the sludge drying beds, and dispose of off of BNL property at an approved facility.
  - Remove sludge from manholes along a retired section of the sanitary sewer line leading to the STP.
  - Monitor the groundwater for VOCs and tritium.
  - A previously implemented removal action for the Imhoff Tank is selected as the final remedy (AOC 4C).

- Implement institutional controls on BNL property such as preventing the installation of pumping wells that may interfere with groundwater monitoring. Implement Suffolk County's Sanitary Code regarding limitations of private well installations.
- 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.

Operable Unit V Peconic River ROD, signed January 2005 (BNL 2004a)

- Objectives are to:
  - Reduce site-related contaminants (e.g., mercury) in sediment to levels that are protective of human health.
  - Reduce or mitigate, to the extent practicable, existing and potential adverse ecological effects of contaminants in the Peconic River.
  - Prevent or reduce, to the extent practicable, the migration of contaminants off the BNL property.

- OU V Peconic River Remedy Components:
  - The response actions selected in the removal actions for sediment on BNL property and off of BNL property constitute the final remedy for the Peconic River. These include removal and disposal of mercury-contaminated sediment above agreed upon cleanup levels from designated depositional areas on and off of BNL property.
  - Implement a monitoring program to demonstrate the effectiveness of the cleanup. Near-term monitoring results will establish the basis for the long-term monitoring program. The program includes monitoring for methyl mercury in the water-column, sediment sampling, and fish sampling on and off of BNL property.

Operable Unit VI ROD, signed March 2001 (BNL 2000b)

- Objectives are to:
  - Meet the drinking water standards (i.e., MCLs) for EDB in groundwater (0.05 µg/L)
  - Complete cleanup of the groundwater in a timely manner. For the Upper Glacial aquifer, this goal is 30 years or less.
  - Prevent or minimize further migration of EDB in groundwater vertically and horizontally.
- OU VI Remedy Components:
  - Install a treatment system to extract EDB from the groundwater with subsequent treatment via activated carbon filtration.
  - The previous removal action that was implemented for public water hookups was selected as a final remedy under the ROD.
  - Install groundwater monitoring program to monitor and verify the cleanup over time.
  - Implement institutional controls on the BNL property to prevent use of contaminated groundwater in the OU VI area, as well as continued implementation of Suffolk County Sanitary Code Article 4 that prohibits the installation of additional residential wells where public water mains exist.

BGRR ROD, signed March 2005 (BNL 2005b)

- Objectives are to:
  - Ensure protection of human health and the environment, without undue uncertainties, from the potential hazards posed by the radiological inventory that resides in the BGRR complex.
  - Use the As Low As Reasonably Achievable (ALARA) principle, while implementing the remedial action.
  - Following completion of the remedial activities, implement long-term monitoring, maintenance, and institutional controls to manage potential hazards to protect human health and the environment.
- BGRR Remedy Components:
  - Remove the BGD primary liner.
  - Remove a portion of the fuel canal outside the structural footprint of the reactor building. Remove accessible subsurface contaminated soil in the vicinity of the fuel canal, BGD expansion joint #4, and the secondary cooling air bustle.
  - Isolate the BGD and demolish the instrument house.
  - Install water infiltration control and monitoring system for remaining structures and subsurface contaminated soil.
  - Remove the graphite pile and biological shield.
  - Complete final status surveys to document that cleanup objectives are met and to document final conditions.
  - Develop and implement land use and institutional controls that include routine inspection and surveillance of the BGRR complex, maintenance and upkeep of Building 701 and surrounding water infiltration control system, and reporting requirements to ensure that planned uses are protective of public health.
  - Submittal of an annual certification to NYSDEC that institutional and engineering controls are in place, are unchanged from the previous certification and nothing has occurred that would impair the ability of the control to protect public health and the environment.
  - All of the previous removal actions that were implemented prior to the ROD signing, such as removal and disposition of accumulated contaminated water, pile fan sump and soils, above ground ducts, canal and water treatment house, accessible contaminated soils, and exhaust cooling coils and filters, were selected as final remedies under the ROD.

4.2 Remedy Implementation

With the exception of the OU I former HWMF Waste Loading Area and the BGRR, all soil and groundwater remedies for the seven signed RODs at the site have been implemented. This includes the excavation and approved off-site disposal of all contaminated soil, sediment, and tanks, as well as the installation and operations initiated for all groundwater treatment systems. A chronology of the previous removal actions undertaken for each OU, and post-ROD remedial actions, are presented in Table 1 (see Section 2.0). A brief summary of the status of remedy implementation since the signing of each ROD is identified below:

Operable Unit I: Excavation and off-site disposal of radiological contaminated soil was initiated in 2000 with the landscape soil (approximately 2,800 cubic yards), followed by the Building 650

Sump and Sump Outfall (approximately 1,800 cubic yards), and Upland Recharge/Meadow Marsh (approximately 500 cubic yards). In 2005, removal of the former HWMF (approximately 13,000 cubic yards), Building 811 soil (approximately 4,000 cubic yards), and former Chemical Holes residual surface soil (approximately 4,000 cubic yards) was completed. Of the total contaminated soil volume, approximately 24,000 cubic yards is being disposed of at Envirocare of Utah, and 2,500 cubic yards were disposed of at Niagara Falls Landfill Facility. (Note that at the Chemical/Animal/Glass Holes an additional approximately 11,000 cubic yards were excavated in 1997 as a removal action prior to the ROD being signed.) The ash pits were capped with a soil cover to prevent direct contact risks in 2003, and the removal and disposal of the Building 811 USTs was completed in 2005. The Oak Ridge Institute for Science and Education (ORISE), an independent contractor to DOE, verified the cleanup effort at these radiological contaminated soils areas. Closeout reports were prepared for the landscape soil, Building 650 and Sump Outfall, Upland Recharge/Meadow Marsh, the former HWMF, Building 811 soil, and an addendum to the existing Chemical Holes Closeout Report was also prepared.

As noted in the *Final Closeout Report for Area of Concern 16 Landscape Soils* (BNL 2001b), the excavation of the landscape soil in 2000 indicates that the potential exposure to workers and future site residents is much less than the 15 milliRem (mRem)/year criteria. The residual mean concentrations of Cs-137 are below the current residential goal of 7 picoCuries per gram (pCi/g). As a result, these areas do not require postings or further institutional controls.

Operable Unit III: Following approval of the OU III ROD in June 2000, eight groundwater treatment systems were designed and installed between 2000 and 2005 both on and off of the BNL property. The Sr-90 system for the BGRR/WCF plume was the last one installed in 2005. These treatment systems were installed to address VOC and Sr-90 groundwater contamination. The performance of these systems in meeting the overall groundwater cleanup goals is evaluated in the annual *BNL Groundwater Status Report*. Through 2004, approximately 4,800 pounds of VOCs were removed from the aquifer (approximately 20 percent of the overall mass removal goal). This includes approximately 300 pounds and 35 pounds from OU I and IV, respectively. In accordance with the ROD, several low-flow extraction events were performed between 2000 and 2001 for the high-concentration segment of the HFBR tritium plume. Approximately 100,000 gallons of tritium-contaminated water were pumped from the aquifer and disposed of off-site at an approved facility. Contingency remedies continue to remain in place for this tritium plume. The regulators approved Petitions for Shutdown of the cabon tetrachloride and Building 96 treatment systems in 2004 and 2005, respectively. These systems were subsequently turned off and placed in standby mode.

Between 1999 and 2005, approximately 2,200 cubic yards of PCB-contaminated soil from the Building 96 former Scrapyard area were excavated and disposed of off site. This was accomplished in accordance with the ROD to reduce the direct contact risk from this area.

In accordance with the OU III ESD approved in 2005, two additional Magothy aquifer groundwater extraction wells were installed to address VOC contamination at two locations beyond the site boundary.

Operable Unit IV: In accordance with the March 1996 OU IV ROD, a groundwater treatment system was installed in 1997 to remediate VOC and SVOC soil and groundwater contamination at a former oil spill area. A CERCLA Five-Year Review performed for OU IV in 2003 (BNL 2003a) found that the remedy was very effective in remediating soil and groundwater contamination. The system met its cleanup objectives and the regulators approved its dismantlement in 2003.

Operable Unit V: Following issuance of the STP ROD (BNL 2001a), the contaminated soil at the plant was excavated and disposed of off-site in 2003 and a closeout report was issued (BNL 2004d). Prior to issuance of the Peconic River ROD (BNL 2005b), the excavation of on-and off-site contaminated sediments in the River was performed under the authority of a Removal Action. The closeout report for the Peconic River Phases 1 and 2 (BNL 2005c) has been issued.

Operable Unit VI: In 2004, a groundwater treatment system was installed in accordance with the ROD and began operations to address the plume of EDB located beyond the site boundary. This is the last of the planned systems installed beyond the site property. Per the OU III and VI RODs, DOE continues to offer homeowners not connected to public water free annual testing of their private wells.

BGRR: All of the cleanup actions performed to date at the BGRR have been through removal actions. Prior to the ROD approval in 2005, recent canal cleanup activities were performed as a Removal Action. The remaining cleanup actions at the BGRR, such as removal of the pile and bioshield, and the final engineered cap, will be performed as remedial actions under the ROD (BNL 2005b).

Groundwater Monitoring: An essential component of the groundwater remediation program is continued monitoring of the groundwater to ensure the cleanup is progressing as planned. The effectiveness of the groundwater remediation systems performance is evaluated monthly, quarterly, and annually. Changes are made, as necessary, to the treatment systems and to the monitoring programs to help ensure meeting drinking water standards within 70 years for the BGRR/WCF Sr-90 plume, within 65 years for the Magothy aquifer, within 40 years for the Chemical Holes Sr-90 plume, and within 30 years in the Upper Glacial aquifer.

Property Access: Seven access agreements are currently in place with the county, town, local utility, college, and private landowners. These agreements enable BNL to perform groundwater remediation activities for contamination that has migrated beyond the property boundary of BNL. The terms of these agreements must be adhered to by BNL, such as maintaining adequate liability insurance, and in some cases, making annual monetary payments.

4.3 System Operations/Operation and Maintenance

All 16 planned groundwater treatment systems have been constructed. One system has met its cleanup goals and was dismantled (OU IV), three systems are in standby mode and will be restarted if needed (HFBR Tritium, Carbon Tetrachloride, and Building 96 systems), and 12 systems are actively operating on and off of BNL. The first systems became operational in January 1997, the last coming on line in mid 2005. Three additional groundwater extraction wells are currently in standby mode. The requirements for ongoing operation and maintenance (O&M) as well as performance monitoring frequencies of these systems are identified in the O&M manuals.

Routine surveillance and inspection of these systems is performed by BNL personnel. Maintenance on the systems and the treatment wells is performed using BNL resources as well as contracted well drilling support. Preventive maintenance is performed on each system, in addition to as-needed repairs.

Groundwater is extracted from a total of 57 wells. Average individual extraction well flow rates range from approximately 5 gallons per minute (gpm) for the Sr-90 systems to up to150 gpm for the VOC systems. System treatment for VOCs consists primarily of air stripping or carbon adsorption. Ion exchange is the treatment method for the Sr-90 groundwater contamination. To monitor system performance, the influent, midpoint (if appropriate), and effluent are routinely sampled by BNL personnel and sent to off-site analytical labs for analysis. Treated water from the systems is discharged to the Upper Glacial aquifer via recharge basins, injection wells, or dry wells. New York State Pollutant Discharge Elimination System (SPDES) discharge equivalency permit requirements are met. Problems experienced with the treatment systems, as well as adjustments made, include the following:

- Building 96 System: Condensate buildup (primarily in the winter) in the air piping that transfers the VOC-contaminated vapors to the carbon treatment vessels results in a buildup of water in the piping. Resolution: BNL installed a valve at a low point in the building to periodically collect the water for processing.
- Iron buildup on the screens of the extraction wells, recharge wells, and recirculation wells can cause high pressure or water level alarms and shut down the system. Resolution: BNL has increased the frequency of well redevelopment.
- Middle Road and Chemical Holes Systems: Two instances of building floods occurred due to inadequate automatic controls on the pumping system. Resolution: BNL installed additional controls such as high-level float switches wired directly to the electric panel, notification, and automatic shutdown for use of manual/hand system operation mode.
- Chemical Holes System: Frequent high-level, low-level, and pressure shutdown alarms in the Chemical Holes Sr-90 treatment system holding tanks and pumps result in automatic shutdown and excess downtime for the system. Resolution: BNL redesigned process piping to bypass the holding tanks, and uses only the extraction well pump to process the water.
- Chemical Holes System: Early breakthrough of the UOP A51 zeolite resin for the Chemical Holes Sr-90 treatment system resulted in significantly increased cost and waste generation. Resolution: BNL performed a column study that identified a more cost-effective, naturally occurring zeolite resin, clinoptilolite. The performance of this zeolite is currently being monitored.

The annual O&M costs for several of the treatment systems over the past 4 years are as follows:

Table 3: System O&M Costs for FY 2001 to 2004

	($ in K)				
System	FY 2001	FY 2002	FY2003	FY 2004	Comments
OU I South Boundary	160	185	151	133	Air stripping
OU III South Boundary	144	168	168	125	Air stripping. One well placed on standby 10/03.
OU III Industrial Park	394	256	317	237	Uses in-well air stripping with vapor phase carbon treatment, with recirculation wells.
OU III Middle Road	NA	225	145	120	Air stripping. Two wells placed on standby 10/03.
OU III Carbon Tetrachloride	295	422	205	111	Carbon treatment. FY02 included additional characterization. System pulse-pumped and

					placed in standby mode 8/04.
OU III Western South Boundary	NA	NA	129	80	Air stripping.

The largest components of the annual O&M cost for the treatment systems are electric, system sampling and analysis, maintenance, and spent carbon or ion exchange resin disposal. Fiscal year 2005 will be the first full year of O&M for the liquid-phase carbon treatment systems off of BNL property. First year costs for these systems are not shown since they are currently being reconciled due to the transition of charge accounts to BNLs Long-Term Response Actions organization.

5.0 Progress since the Last Review

This is the first Five-Year Review for the BNL site that covers all the OUs. A previous Five-Year Review (BNL 2003a) focused specifically on OU IV. The protectiveness statement from the OU IV Five-Year Review is as follows:

> *"The remedies have been, and are expected to be, protective of human health and the environment upon attainment of soil and groundwater cleanup goals, remediation and natural attenuation. In the interim, exposure pathways that could result in unacceptable risks are being controlled and institutional controls are preventing exposure to, or the ingestion of, contaminated soil and groundwater. All threats at the site have been addressed through the installation of fencing and warning signs, and the implementation of institutional controls, however, long-term protectiveness of the remedial action will be verified by obtaining additional groundwater samples to fully evaluate potential migration of the strontium-90 plume downgradient from the source area. Current data indicate that the strontium-90 plume remains in OU IV and that the remedy is functioning as required to achieve groundwater cleanup goals."*

Table 4 shows the status of the actions from the 2003 OU IV Five-Year Review.

Table 4: Actions Taken Since the OU IV Five-Year Review

Recommendations/ Follow-up Actions	Responsible Party	Milestone Date	Action Taken and Outcome	Action Date
Obtain approval from EPA and NYSDEC on the petition for the Air Sparging/Soil Vapor Extraction (AS/SVE) system closure.	BNL	July 2003	Approval received and system was dismantled 12/03.	July 2003
Continue monitoring the radiologically contaminated groundwater near the Building 650 Sump and Outfall.	BNL	Ongoing	Monitoring continues. Results of monitoring data are in *2004 Groundwater Status Report*.	Ongoing
Continue monitoring select wells downgradient of the AS/SVE system and include in the EMP (*Environmental Monitoring Plan*) under the Sitewide and Facility Monitoring Programs.	BNL	Monitoring ongoing; 1/04 for EMP	Most monitoring changes have been implemented. The 1/06 EMP will document the changes.	December 2005
Complete excavation of radiologically contaminated pipe between Building 650 and the Sump Outfall (OU I).	BNL	July 2002	Excavation complete.	July 2002
Complete preparation of the Building 650 Sump and Outfall Closeout Report, submit to regulators (OU I).	BNL	July 2002	Closeout report issued to regulators.	July 2002

Recommendations/ Follow-up Actions	Responsible Party	Milestone Date	Action Taken and Outcome	Action Date
Complete characterization and remediation of the lead-contaminated soils at the stormwater outfall at the Central Steam Facility (not under CERCLA nor part of OU IV ROD).	BNL	NA	Report summarizing the characterization results and evaluating cleanup options submitted to regulators in 2/04. Response pending.	TBD

6.0 Five-Year Review Process

6.1 Administrative Components

The activities scheduled for conducting this Five-Year Review included regulator and community notification, site inspections, interviews with stakeholders and regulatory officials, development of the Five-Year Review Report including review by DOE, EPA, NYSDEC, and SCDHS, and a briefing on the results to the Community Advisory Council (CAC) and Brookhaven Executive Round Table (BER). The review was led by BNL's EWMSD Long-Term Response Actions Group. The Five-Year Review team consisted of:

- BNL staff – W. Dorsch, V. Racaniello, J. Burke, M. Hauptmann, T. Burke, R. Howe, L. Hill, S. Kumar, J. D'Ascoli, F. Petschauer, T. Daniels, and K. Robinson
- DOE staff – G. Penny, R. Rimando, J. Carter, and T. Kneitel
- Regulatory staff – D. Pocze (EPA), J. Lister (DEC), and S. Robbins (SCDHS)

The team included Hydrogeologists and Community Involvement Coordinators.

6.2 Community Notification and Involvement

A Communications Plan for the Five-Year Review was prepared and distributed to the project team, including the regulatory agencies, on March 15, 2005. The plan identifies specific outreach activities to be conducted, such as initial notification, interviews, report updates, and report issuance/notification.

An initial notification announcement was published in *Newsday* and *Suffolk Life* newspapers March 23, 2005 and March 30, 2005, respectively. It informed the public of the start of the review, as well as the purpose, schedule for completion, and how to contact DOE for more information. A copy of the announcements is available at http://www.bnl.gov/erd/5YearReview/InitialFive-YearPublicNotice.pdf. The CAC and BER were briefed on the start of the Five-Year Review on March 10, 2005 and March 23, 2005, respectively. The EPA Technical Assistance Grant (TAG) recipient for BNL, Neighbors Expecting Accountability and Remediation at Brookhaven National Laboratory (NEAR), was verbally informed of the review initiation. In addition, an announcement in the BNL weekly *Bulletin* and a BNL web site update were made to inform the BNL employees and the community that the Five-Year Review was being conducted (http://www.bnl.gov/bnlweb/pubaf/bulletin/2005/bb041505.pdf and http://www.bnl.gov/erd/).

Members of the CAC were polled during the May 12, 2005 meeting to get feedback on whether the Laboratory provided adequate information on the cleanup activities and if CAC members felt they had an effect on cleanup decisions. The results indicate that the CAC felt sufficiently informed of the cleanup progress and many believed the CAC had an impact on the cleanup. The survey is included as Attachment 5.

Prior to issuance of the Five-Year Review Report to the regulators for their review, a verbal update of the conclusions and recommendations was provided during an IAG teleconference on June 30, 2005. A briefing was also provided to the BER and CAC on July 13, and 14, 2005, respectively.

Following regulator review/concurrence and EPA concurrence on the final protectiveness determination, the community will be notified that the Five-Year Review was completed and it will be made available to the public. A public notice will be issued in *Newsday* and *Suffolk Life* at that time. The notice will include a brief summary of the results, the protectiveness statements, post-ROD information repository locations where the report is available for viewing, and the timeframe of the next Five-Year Review. These repositories are:

- BNL Research Library, Upton, NY
- EPA Region II Office, New York City, NY

The CAC and BER will be briefed on any changes to the report's conclusions and recommendations as a result of regulator review. The Report (or a summary of the Report) will also be added to the BNL website.

6.3 Document Review

The Five-Year Review consisted of a review of relevant documents including the following:

- Records of Decision for OUs I, III, IV, V (two), VI, and BGRR
- *OU III ESD* (BNL 2005a)
- Annual groundwater status reports (e.g., BNL 2005d)
- Annual and five-year landfill reports (e.g., BNL 2001c and BNL 2002)
- Closeout/Completion reports for soil (BNL 2005e) and BGRR (BNL 2005b) cleanup projects
- *OU IV Five-Year Review Report* (BNL 2003a)
- O&M manuals for the groundwater treatment systems
- *BNL Land Use Controls Management Plan* (BNL 2005g)
- *EPA Five-Year Review Guidance* (EPA 2001)

As noted in Section 4.1 above, the remedial action objectives for the projects are identified in the RODs and the OU III ESD.

6.4 Data Review

This section provides a brief summary review of analytical data and trends for each OU and the BGRR over the past 5 years. Trends for key groundwater monitoring wells by plume over the last several years are provided in Attachment 1. A detailed discussion of the status of the groundwater plumes and the progress of the 16 groundwater remediation systems is provided in the *2004 BNL Groundwater Status Report* (BNL 2005d—see Attachment 2 for the CD version or http://webeims.b459.bnl.gov/gw_home/gw_home.asp).

In 2004, 652 pounds of VOCs were removed from the aquifers by the treatment systems. To date, approximately 4,800 of the estimated 25,000 to 30,000 pounds of VOCs in the aquifer have been removed, and over 8 billion gallons of groundwater have been treated. The startup of the OU III Chemical Holes Sr-90 system in 2003 has resulted in 1.27 milliCuries (mCi) of Sr-90 being removed from the Upper Glacial aquifer.

Figure 3 identifies the location of the 16 groundwater treatment systems. Table 5 provides a summary of the treatment system status through 2004.

Table 5: Groundwater Treatment System Status

Operable Unit and System	Type	Target Contaminant	No. of Wells	Years of Operation	Recharge Method	Lbs VOCs removed (2004 / Cumulative)
Operable Unit I						
South Boundary	P & T (AS)	VOC	2	8	basin	16 / 313
Operable Unit III						
South Boundary	P & T (AS)	VOC	7	7	basin	172 / 2,276
HFBR Pump and Recharge	Pump and recirculate	Tritium	3	Standby: 7	basin	NA / 180
Industrial Park	Recirc./in-well (AS/carbon)	VOC	7	5	in-well	80 / 838
*Carbon Tet	P & T (carbon)	VOC	3	Standby: 5	basin	7 / 348
**Building 96	Recirc. well (AS/carbon)	VOC	4	Standby: 4	in-well	12 / 67
Middle Road	P & T (AS)	VOC	6	3	basin	156 /520
Western South Boundary	P & T (AS)	VOC	2	2	basin	10 / 32
Chemical Holes	P & T (IE)	Sr-90	1	2	dry well	0.388*** / 1.27***
North Street	P & T (carbon)	VOC	2	1	wells	115 / 115
North Street East	P & T (carbon)	VOC	2	1	wells	5 / 5
LIPA/Airport	P & T and recirc. (carbon)	VOC	9	1	wells and in-well	62 / 62
Industrial Park East	P & T (carbon)	VOC	2	1	wells	17 / 17
BGRR/WCF	P & T (IE)	Sr-90	5	NA	dry wells	NA
Operable Unit IV						
AS/SVE	AS/SVE	VOCs	-	-	-	35
Operable Unit VI						
EDB	P & T (carbon)	EDB	2	1	wells	<1**** / <1****

Notes:
AS = air stripping
AS/SVE = air sparging/soil vapor extraction
BGRR/WCF = Brookhaven Graphite Research Reactor/ Waste Concentration Facility
EDB = ethylene dibromide
HFBR = High Flux Beam Reactor
IE – ion exchange
LIPA = Long Island Power Authority
NA = not applicable
P & T = pump-and-treat
Sr-90 = strontium-90
* This system was shut down August 1, 2004 and placed in standby mode.
** This system was shut down June 1, 2005 and placed in standby mode.
*** Sr-90 removal is expressed in mCi.
**** EDB was not detected in the system influent in 2004. Other low-level VOCs, not attributable to BNL, were detected, but the results may be due to analytical lab contamination.

Operable Unit I

Soils: From 2000 through 2005, radioactively contaminated soils exceeding the selected cleanup levels have been excavated from the various OU I source areas such as landscape soils, Building 650 Sump and Sump Outfall, Upland Recharge/Meadow Marsh, the former HWMF, Building 811, and disposed of at an appropriately licensed facility. The BNL soil cleanup levels for principal radiological contaminants, based on the selected land use for each area, are provided in Table 6.

Table 6: BNL OU I Soil Cleanup Levels

Radionuclide	Soil Cleanup Level (pCi/g) Residential Land Use	Industrial Land Use
Cesium-137	23	67
Strontium-90	15	15
Radium-226	5	5

Note: A post cleanup dose assessment is required to determine compliance with the 15 mrem/year total dose limit.

The Building 650 Sump and Sump Outfall soil excavation met the cleanup level of 23 pCi/g for Cs-137 that allows for residential land use following 50 years of institutional control. Building 811 excavation is also expected to meet the 23 pCi/g level. The former HWMF (except for the future excavation at the Waste Loading Area) met the cleanup level of 67 pCi/g that allows for industrial land use following 50 years of institutional control, and residential land use following 100 years of institutional controls. Confirmatory documentation data that the Building 650 remediation met the cleanup level is provided in the closeout report. The *Final Closeout Report for the Meadow Marsh Operable Unit I Area of Concern 8* (BNL 2004b) and the *Final Closeout Report for the Ash Pit Operable Unit I Area of Concern 2F* (BNL 2004c) document the completion of response actions for these areas.

The Merrimack holes at the former HWMF are a series of horizontal circular waste storage holes inside a concrete shielding wall in the northeast portion of the yard (not in the Waste Loading Area). The holes are empty of waste, and one is undergoing final cleanout of minor surface contamination. According to the former HWMF Design Implementation Plan, the hole did not have contamination levels exceeding the cleanup goals, and therefore did not need to be removed. The clean out of the minor surface contamination is being performed as a closeout item from the BNL Exit Readiness Review that was conducted to transfer ownership of the facility from the BNL ER Projects Directorate to the Environmental and Waste Management Services Division. The decontamination of that Merrimack hole is expected to be completed in July 2006.

Disposal Pits: The Chemical/Animal/Glass Holes were successfully excavated in 1997, disposed of at an appropriately licensed facility, and a closeout report that included confirmatory sampling data was issued at that time. Some of the contaminated soil was stockpiled and maintained in the area for several years prior to off-site disposal. Following final disposal of the soil stockpiles, residual mercury-contaminated surface soil remained at the Chemical Holes area. This remaining soil was excavated and properly disposed of off-site at an appropriately licensed facility in summer 2005. Confirmatory soil sampling was performed and the results were documented in an addendum to

the existing Chemical Holes Closeout Report in mid 2005 (BNL 2005i). The addendum documents that all waste excavated from the pits were disposed of and the area restored.

Landfills: The landfill areas were capped between 1995 and 1997. Monitoring data presented in the *Current Landfill Area Five-Year Evaluation Final Report* (BNL 2001c) and the *Former Landfill Area Five-Year Evaluation Report* (BNL 2002) indicate that, in general, contaminant concentrations have decreased following the capping of the landfills. Since then, groundwater monitoring data presented in the annual landfill reports continue to support this conclusion, and landfill controls continue to be effective. As part of the compliance monitoring for the Current Landfill, annual surface water and sediment sampling of the adjacent Wooded Wetland has been performed since 1999. Data from 1999 through 2004 indicate that risk to the adult eastern tiger salamanders from inorganic contaminants that may be in the sediment at this area is unlikely in four out of five years. 2001 monitoring data indicated a potential risk. Surface water results for inorganics generally indicate that there is a potential risk to larval salamanders from iron and aluminum concentrations.

Groundwater: Over the past 5 years, the OU I pump and treat system continued to maintain hydraulic control of contaminants originating from the Current Landfill and former HWMF, and prevented further contaminant migration across a portion of the site's southern boundary. As expected, the VOC mass removal has been steadily declining over the last several years, as indicated by low influent VOC concentrations. However, monitoring well data suggest that higher concentrations of VOCs are moving toward the capture zone of the system.

Operable Unit II

The remedial actions for the OU II AOCs are documented in the OU I and OU III RODs.

As a result of the silica grout injection process that took place at the BLIP facility during a Removal Action in 2000, data suggest that tritium in the soil pore water near the target vessel was displaced by the grout. Tritium concentrations in the groundwater downgradient of this facility subsequently increased to a high of 61,000 pCi/L in 2001. As required in the *BLIP Closeout Report Removal Action AOC 16K* (BNL 2001d), groundwater monitoring at this facility has continued. Over the past several years, the concentrations of tritium in the groundwater have been generally declining but have periodically increased due to natural increases in water table elevation that occurred between November 2002 and July 2003. Furthermore, the amount of tritium remaining in the vadose zone close to the water table is expected to decline over time due to the flushing mechanism from the rise and fall of the water table and by natural radioactive decay. As an added measure of protection, the Medical Department and Collider–Accelerator Department constructed a new protective cap over the Linac to BLIP spur in late 2004. The final remedy for the BLIP will be documented in a subsequent ROD.

Operable Unit III

Soil: Contaminated soil excavated during previous removal actions, such as the cesspools, Building 830 USTs, Building 479 PCBs, and Building 464 mercury has met cleanup goals. This was confirmed via endpoint samples, and the results were documented in the closeout or completion reports. Continued monitoring of the soil is not necessary. Excavation and off-site disposal of PCB-contaminated soil at the Building 96 former Scrapyard began in 2000 and

concluded in early 2005. Overall, approximately 2,200 cubic yards of soil were excavated at the Building 96 area. A summary of the excavations and the results of the confirmatory sampling results is provided in the *OU III Building 96 PCB Soil (AOC 26B) Excavation Closeout Report* (BNL 2005e). The PCB cleanup goals (from the NYSDEC TAGMs), as called for in the OU III ROD, were 1 part per million (ppm) for surface without cover material, and 10 ppm for surface or subsurface soils backfilled with at least 1 foot of clean cover material. Continued monitoring of the soil is not necessary, although surveillance (i.e., visual inspection) of the backfilled areas will continue.

Groundwater: Fourteen of the 16 planned groundwater treatment systems are included under OU III. The other two systems were installed under OU I and OU VI. Three of the OU III systems are in standby mode (HFBR Tritium Pump and Recharge, the Carbon Tetrachloride Pump and Treat, and the Building 96 Pump and Treat System, which was shutdown on June 1, 2005), since they met the criteria for shutdown. They will continue to be maintained and monitored, and will be restarted if necessary.

A review and evaluation of the performance data for the treatment systems is conducted monthly for most of the systems and quarterly for all the systems, as well as annually for all systems. A review and evaluation of all the groundwater plumes' monitoring data collected for the year, as well as data trends for prior years, is also performed annually. As noted above, trends for key groundwater monitoring wells are provided in the *2004 BNL Groundwater Status Report* (BNL 2005d) (Attachment 2 or http://webeims.b459.bnl.gov/gw_home/gw_home.asp).

Over the past 5 years, significant progress has been made in preventing and minimizing the migration of VOCs, tritium, and Sr-90 contamination in the groundwater. The configuration and operation of the groundwater remediation systems on and off of BNL property are successfully reducing the sources of contamination as well as cleaning up the downgradient portion of the plumes. A comparison of the extent and magnitude of the OU III VOC plume over time is presented in Figure 4. Projections of the remediation timeframe for the plumes is performed periodically. The cleanup objective of meeting MCLs in the Upper Glacial aquifer within 30 years is currently on track.

In 2004, significant progress was made toward remediation of the Magothy aquifer VOC contamination. In addition to the three Magothy aquifer remediation wells previously installed, two additional extraction wells were installed off site to actively remediate high concentrations of VOCs. Per the OU III ESD, the cleanup goal for the Magothy aquifer is to meet MCLs within 65 years. Through 2004, significant VOC mass removal has been evidenced at the Stratler Drive extraction well.

Additional OU III highlights based on groundwater data collected include the following.

- Because VOC concentrations in three of the four Building 96 recirculation wells remained low in 2004 (below 30 µg/L total volatile organic compounds [TVOCs]), they were shut down and placed in standby mode in mid 2004. (Note: TVOC is a summation of individual VOC concentrations. Since most of the groundwater plumes consist of several individual VOCs, for purposes of reporting, groundwater modeling, and treatment system operations management, TVOCs are used. However, when an evaluation of whether the cleanup goals

for the groundwater have been met, the focus is on meeting the standards for the individual VOC). In addition, two applications of the oxidizer potassium permanganate were applied in December 2004/January 2005 and April 2005 to degrade the persistent high PCE groundwater contamination in the shallow silt zone source area. Good progress in PCE remediation has been observed, and additional potassium permanganate applications will continue as needed until the cleanup goals, as identified in the *OU III Building 96 Groundwater Treatment System Shutdown Petition (AOC 26B)* (BNL 2005f), are met.

- During 2004, the maximum tritium concentration in wells on the HFBR lawn was 378,000 pCi/L. This indicates that tritium continues to be flushed out of the unsaturated zone by natural water table fluctuations. The highest tritium concentration observed in the downgradient portion of the plume was 55,000 pCi/L. The plume continues to attenuate as expected, and no contingency limits were exceeded that would require pumping to resume. A comparison of the extent and magnitude of the HFBR Tritium plume over time is presented in Figure 5.
- During pre-design groundwater data collection in 2003 for the BGRR/WCF plumes, Sr-90 was detected at concentrations higher than previously identified. This, in combination with lessons learned during the operation of the Chemical Holes Pilot Study, resulted in the need for a change to the Sr-90 remedy in the OU III ROD. The ESD, approved in 2005, still calls for active treatment of the Sr-90 contaminated groundwater, but the time to meet MCLs was extended to within 70 years for the BGRR/WCF plumes and 40 years for the Chemical Holes plume.
- Two Middle Road wells and one South Boundary extraction well, EW-4/EW-5 and EW-12, respectively, were placed on standby in October 2003 due to continued low VOC concentrations.
- There have been no exceedances of any system equivalency permit liquid or air discharge levels except for occasional low pH levels in the effluent that is naturally occurring in this area.

Operable Unit IV

Soil: Remediated radiological contaminated soil at the Building 650 Sump Outfall is included under OU I.

Groundwater: The treatment system was dismantled in 2003, and groundwater monitoring continues to show a decline in VOC concentrations, with concentrations barely above the drinking water standards.

Operable Unit V

Soil/Sediment: In 2002 and 2003, soil exceeding the mercury and Cs-137 selected cleanup levels defined in the ROD was excavated from the sludge drying beds, sand filter berms, firing range berms, and sewer lines. The cleanup levels are less than 2 ppm for mercury and an average of 23 pCi/g for Cs-137, with no areas greater than 69 pCi/g. The 2 ppm value is based on both ecological and human health considerations. Based on confirmatory sampling, all areas met the prescribed cleanup levels, thereby minimizing the potential for migration of contaminants from the surface soil to groundwater. The results are documented in the *Final Completion Report Remedial Action*

AOC 4 STP, Sludge Drying Beds and Sand Filter Beds/Berms, AOC 21 Abandoned Former Sewer Lines (BNL 2004d).

Excavation of the metal and PCB-contaminated sediment in the Peconic River on and off of BNL property was initiated in May 2004 and completed in April 2005. The goal was that all mercury concentrations in the remediated areas would be less than 2 ppm following the cleanup (the 2 ppm is a value negotiated among the regulators for this site and is based on both ecological and human health considerations). Based on confirmatory sampling, these cleanup levels were met. The closeout report for Phases 1 and 2 was issued to the regulatory agencies. A monitoring program is being implemented to demonstrate the effectiveness of the cleanup. This includes near-term monitoring to establish the basis for a long-term monitoring program. The OU I Soils and OU V Long-Term Monitoring and Maintenance Plan was submitted to the regulators for review in mid 2005, and issued as final in May 2006 (BNL 2006).

Groundwater: Active treatment of the contaminated groundwater was not required by the ROD. However, the groundwater continues to be monitored. Since 1999, TVOC concentrations continue to remain low, typically less than 35 µg/L. Tritium has consistently remained well below the drinking water standard of 20,000 pCi/L. See Attachment 1 for historical VOC and tritium trends.

Prompted by the detection of perchlorate in a SCDHS monitoring well located east of BNL, the Laboratory sampled select OU V and STP monitoring wells for this compound during 2004. Perchlorate was detected in four of the OU V wells, but levels were below the New York State Department of Health Action Level of 18 µg/L in drinking water supply wells. BNL has added routine perchlorate analyses for eight OU V wells in 2005. SCDHS performed additional monitoring for perchlorate off of the BNL site. Information on perchlorate is available at http://www.epa.gov/fedfac/pdf/perchlorate_guidance.pdf and http://www.epa.gov/fedfac/documents/perchlorate_qa.htm.

Operable Unit VI

Groundwater: Monitoring groundwater over the past five years has shown generally consistent EDB concentrations. The plume is now located completely beyond the BNL boundary with the highest EDB concentration of 7.6 µg/L, exceeding the 0.05 µg/L drinking water standard. A groundwater treatment system was installed and began operation in late 2004. Although no EDB was detected in the influent in 2004, some low-level VOCs were detected but are not attributable to BNL.

BGRR

Structures and Soil: Completion and closeout reports document the final status of the various removal action cleanup activities since 1999 at the BGRR. The pile fan sump, piping, and associated soils were successfully removed, and the associated soils remediated to the following: Dose rate of less than 15 mRem/yr, Cs-137 less than 23 pCi/g, and Sr-90 less than 15 pCi/g. When multiple radionuclides were detected, the sum of the fractions was used to insure the maximum total dose limit of 15 mrem/yr is not exceeded. Soil samples were collected in the areas adjacent to the above ground ducts, and verified residential release criteria were met. The removal of the spent fuel canal was completed in April 2005, and a closeout report was issued

Groundwater: Monitoring of the BGRR Sr-90 groundwater plume over the past five years has consistently shown Sr-90 concentrations significantly above the 8 pCi/L drinking water standard. Supplemental characterization efforts in the fall of 2003 to support the design of a groundwater treatment system identified Sr-90 up to 3,150 pCi/L. The previous high concentration of Sr-90 was 566 pCi/L. To address the high concentrations of Sr-90, a groundwater treatment system was installed in late 2004. The system began operations in June 2005.

Groundwater Monitoring

The *2004 BNL Groundwater Status Report* (BNL 2005d) identifies changes to the well monitoring network at BNL (see Section 5.0 of http://webeims.b459.bnl.gov/gw_home/gw_home.asp). The changes include the installation of additional temporary and permanent monitoring wells, and modifications to monitoring frequency and analytical parameters.

6.5 Inspections

Representative site inspections took place between March 10, 2005 and May 24, 2005 for the landfills, soils, BGRR, Peconic River, and groundwater. Representatives from BNL and DOE attended, and the regulatory agencies were offered the opportunity to participate. Inspections for the Building 96 PCB Soil Cleanup and the Chemical Holes were performed in October and November 2005. The purpose of the inspections was to assess the protectiveness of the various sites, including operating treatment systems and controls. No significant issues were identified during the site inspections, but some follow-up recommendations were identified. The completed inspection checklists are included in Attachment 3. Five of the 16 groundwater treatment systems were not formally inspected at this time; however, all of the systems are routinely inspected as part of the ongoing O&M. In addition, Tier 1 assessments, that evaluate primarily safety and operational concerns, are performed on all of the systems at least annually. The more significant recommendations are included in Section 9, Table 7.

6.6 Interviews

Interviews consisted of discussions with the EPA, DEC, SCDHS, and DOE representatives. Questions from the list below were asked during the interview; however, each representative was not asked all of the questions on the list. Potential interview questions included:

- What is your overall impression of the cleanup at BNL?
- Are there any specific aspects of the cleanup that you feel should be of particular focus during the review?
- Do you feel well informed about BNL's cleanup activities and progress?
- Do you believe the public is sufficiently informed of the cleanup progress?
- Do you believe the remedies are functioning as expected by the RODs?
- Are you aware of any particular component of the cleanup decisions that pose a higher degree of difficulty in achieving?
- Are you aware of any recent or upcoming changes to federal or New York State laws, regulations, or cleanup standards that may impact protectiveness of human health and the environment at BNL?

- Do you believe there are current opportunities to optimize operations and maintenance, or sampling efforts at BNL that could result in cost savings or improved efficiency?
- What do you think are the biggest risks to achieving the soil and groundwater cleanup objectives at BNL?
- Do you feel confident that BNL and DOE will continue to actively manage the long-term cleanup operations for the site, including maintaining appropriate institutional controls?
- Do you have any comments, suggestions, or recommendations regarding BNL/DOE management of the cleanup?

The following individuals were specifically contacted for interviews concerning the BNL site:

- Mr. Douglas Pocze – EPA Region 2
- Ms. Mary Logan – EPA Region 5 (formerly of EPA Region 2)
- Mr. James Lister, NYSDEC
- Mr. Andy Rapiejko, SCDHS
- Mr. Martin Trent, SCDHS
- Ms. Gail Penny, DOE

Most people interviewed thought the cleanup is going well and that communication with the regulators and the community is good. Concerns identified with groundwater cleanup were: ensuring that the cleanup goals are met as projected by the model; evaluate actual progress made compared to model projections; and make changes to the systems as necessary to meet the goals. The former EPA Project Manager has confidence that DOE will continue to manage and fund the long-term cleanup. However, the current EPA Project Manager is not confident that the cleanup will continue to be managed properly, and feels that this is an agency-wide concern for federal facilities. The NYSDEC representative had similar concerns but remained hopeful. Suffolk County is concerned about the loss of institutional knowledge during the transfer from the Environmental Management Directorate (ERD) to the Long-Term Response Actions Group at BNL. DOE and the county requested that the Five-Year Review include focus on institutional controls and residual contamination. The interview summaries are included under Attachment 4.

7.0 Technical Assessment

7.1 Operable Unit I

OU I Question A: Is the remedy functioning as intended by the decision documents?

OU I Remedial Action Performance

- Based on a review of the closeout reports completed for the soil/disposal pit cleanups and wetland restoration, site inspections, and regulatory interviews, the remedies were implemented in accordance with the OU I ROD and the soil cleanup levels were met. This has achieved the objectives of preventing human exposure including direct external exposure, ingestion, inhalation, and dermal contact, as well as environmental exposure to contaminants. Reconstruction of the Upland Recharge/Meadow Marsh area wetlands was successfully implemented, and has minimized uptake of contaminants in the soil/sediment by ecological receptors, including the eastern tiger salamander. Aquatic vegetation plants have been established at an 85 percent or better success rate at this area. Native grasses adjacent to the pond were replanted in the spring of 2004 using a seed drill, and rip-rap was installed in 2004 on the pond slopes to prevent erosion. Reconstruction of the former HWMF wetlands was performed in mid 2005. For the soil excavation remedies completed, such as the former HWMF, Building 811, and the former residual surface soils at the Chemical Holes, the work was performed in accordance with the ROD, applicable design documents, and Remedial Action Work Plans. The soil cleanup levels defined in the ROD have been met for these areas. Construction activities also adhere to project-specific BNL Work Permits to ensure the work is carried out safely and that controls are in place.
- The landfill areas were capped in accordance with the ROD and the NYS Part 360 requirements. The buried waste is contained, and the caps have achieved the objective to minimize the further leaching of contaminants from the soil into the groundwater. The soil cover placed on the ash pit prevents direct contact with the metals in surface soils and migration from wind blown dust.
- The OU I groundwater pump and treat system has been functioning since 1997 as intended by the ROD. The system is on track to reach the overall groundwater goals of meeting MCLs within 30 years in the Upper Glacial aquifer. However, the 2002 and 2003 *BNL Groundwater Status Reports* raised concerns over the rate of cleanup of the aquifer relative to the cleanup goals. These reports concluded that some portions of the targeted cleanup area did not appear to be progressing as quickly as simulated in the groundwater modeling performed during the design of the system. As a result, two temporary wells were drilled in 2004 to assess the model predictions.

The refined groundwater model suggested that by 2011, active pump and treat activity at OU I will have reduced the peak TVOC concentrations to approximately 90 µg/L, and limited these contaminant zones to a very small area of the Upper Glacial aquifer within the BNL property limits. This remaining contamination is predicted to naturally attenuate to levels below MCLs by 2025, which is within the cleanup goal time period in the ROD. The model also reasonably matches concentrations at six select monitoring wells over an 8-year period. Figure 6 shows good overall correlation between the 2004 actual plume data compared to the modeled predictions.

OU I System Operations/O&M

- O&M of the landfill caps are performed as required by the O&M manuals. O&M of the cap and drainage structures have been effective. A few small areas of the Current Landfill showed evidence of burrowing by small animals. The burrows did not penetrate beyond the soil layer, therefore, are they do not affect the protectiveness of the cap. The burrows were filled in and repaired. Also, one of the gates at the landfill needed to be repaired so it can be properly locked. Monthly inspections will continue to ensure that the cap is effectively maintained and repaired as necessary.
- The OU I Soils and OU V Long-Term Monitoring and Maintenance Plan, that consolidates the monitoring and maintenance requirements identified in separate documents, was submitted to the regulators in July 2005 and issued as final by BNL in May 2006 (BNL 2006).
- Sampling of the Wooded Wetland surface water and sediment since the 1999 OU I Ecological Risk Assessment has provided consistent data to help evaluate any potential impacts to the tiger salamander and its habitat. Continued routine monitoring of this area is included in the *BNL Environmental Monitoring Plan.* Because the data has shown consistently low sediment and surface water metal concentrations when compared to maximum benchmark sediment concentrations, critical concentration values for surface water, and BNL background concentrations for sediment and surface water, the need to continue the annual sampling beyond 2005 should be evaluated. Monitoring of the tiger salamander's use of the wetland will continue as identified in the BNL Natural Resource Management Plan (as well as the OU I Soils and OU V Long-Term Monitoring and Maintenance Plan).
- The OU I treatment system operated without any significant down time or maintenance issues over the past eight years, and the system effluent has consistently met the discharge requirements. The O&M manual identifies required preventative maintenance tasks, and there do not appear to be any issues that would impact continued operations or the effectiveness of the remedy. The O&M manual is currently being updated to reflect detailed exit strategy criteria for system shutdown.

OU I Costs of System Operations/O&M

- Over the past four years, the average annual O&M cost for the OU I treatment system was approximately $160K. The estimated annual cost from the 1996 Action Memorandum was approximately $190K.

OU I Implementation of Institutional Controls and Other Measures

- *The Land Use Controls Management Plan* (LUCMP, BNL 2005g) provides an overview of land use and other controls that are deployed at BNL to prevent exposure to residual environmental contamination, and to ensure the long-term effectiveness of the remedies. This plan is a living document and is periodically updated and reviewed by the regulators to stay current with evolving management techniques.
- Several existing BNL procedures have been modified to ensure that proposed land and facility use activities are consistent with defined land use and institutional controls. They require a review for the new or changed use of a BNL facility or land parcel and for conducting work on BNL property. The procedures, along with a web-based land

use/institutional control (LU/IC) database that includes geographic data on the cleanup areas, and fact sheets, ensure that facilities or parcels of land on the BNL site evaluated for future use are the most appropriate and that any potential conflicts with land use and institutional controls are identified and resolved prior to any subsequent facility and/or land use decisions. The LU/IC website is currently being updated to enhance the site-specific institutional controls for each area. The database will be available for regulator review at http://luic.bnl.gov/website/landcontrols/. An uncontrolled copy of the area of concern factsheets, that identify specific institutional controls, are included in Attachment 6.

- The land use and institutional controls that are in place and maintained for OU I include:
  - Postings to communicate potential hazards and aid in controlling access at areas such as Building 650 Sump Outfall, Upland Recharge/Meadow Marsh pond, and former HWMF. Following a facility walk-through by BSA and DOE, the prior outdated postings at the FHWMF were removed and replaced with point of contact signage prior to entry. A separate radiological posting was added to the Waste Loading Area portion of the FHWMF. The need for point of contact signs at some of the other post soil cleanup areas is currently being evaluated.
  - Prohibitions on excavation activities in designated residual contaminated soil areas, and disturbance and erosion of the landfill and ash pit caps. The cap and the surrounding area were undisturbed.
  - Fencing around cleanup areas such as the Current Landfill, former HWMF, and Building 811 WCF to aid in controlling physical access. As noted in the System Operations/O&M section above, even though the gate to one the Landfills was broke, there did not appear to be any disturbance noted during the monthly inspections.
  - Maintenance of landfill engineered caps to prevent continued groundwater contamination and covers over residual soil contamination to aid in preventing the direct exposure of such contamination to site workers, visitors, and wildlife.
  - Several wetland areas that may contain protected habitats are adjacent to the former HWMF. NYSDEC regulations regulate all work within 100 feet of wetlands with confirmed protected species habitats. Any work activities within 100 feet of a wetland requires DOE and NYSDEC notification and approval.
  - BNL limits activities within 850 feet of wetlands with confirmed protected species habitats.
  - Restrictions/controls on the pumping and recharge of groundwater on the BNL site until cleanup levels are achieved. This will help maintain consistent groundwater flow directions.
  - Groundwater monitoring to track contaminant plumes as well as reporting in the Annual Groundwater Status Report.

  No activities were observed at OU I that would have violated these institutional controls.

OU I Monitoring Activities

- The monitoring data obtained from the treatment system as well as the data from the plume monitoring wells provide the basis to evaluate system performance and effectiveness. The monitoring wells are categorized as background, core, perimeter, or bypass wells. Identification of the wells sampled and their monitoring frequency is updated annually and

presented in the *BNL Environmental Monitoring Plan*. The monitoring data are reported in the *BNL Groundwater Status Report*.

- Confirmatory monitoring data are collected following the completion of soil excavation projects. These data are used to confirm that the designated cleanup levels have been met and the excavation can be backfilled. In addition, for radiological soil cleanups, ORISE has performed independent sampling of the excavated areas to confirm that defined cleanup levels have been achieved.

OU I Opportunities for Optimization

- Five years' worth of sediment and surface water data have been collected and evaluated from the Wooded Wetland area. The results have consistently shown null to minor impact to the eastern tiger salamander habitat from potential leachate from the Current Landfill. It is recommended that an evaluation be conducted to reduce the sampling frequency following the 2005 sample period.
- All existing plume core wells for the OU I groundwater treatment system show TVOC concentrations less than 50 µg/L (the capture goal of the system). Furthermore, the system influent concentrations have been less than 12 µg/L for 2004. Consequently, it is recommended to implement reductions in system operations, and to pulse the treatment system wells to optimize system performance.

OU I Early Indicators of Potential Issues

There do not appear to be any problems or issues at this time that could place protectiveness of the remedies at risk.

OU I Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?

OU I Changes in Standards and To Be Considereds (TBCs)

- The standards or TBCs in the OU I ROD have not changed nor do they call into question the protectiveness of the remedy. Except for arsenic (discussed below), radiological soil cleanup levels and the MCLs for drinking water are unchanged since 1999. Attachment 7 provides the cleanup levels for the OU I primary contaminants of concern.
- Note that the drinking water standard for arsenic changed in 2001 from 50 µg/L to 10 µg/L. Arsenic was detected above the standard in three of the ten downgradient Current Landfill monitoring wells. However, the remedy for OU I is not affected since the arsenic levels are low. The highest historical arsenic level in these wells was 35 µg/L in May 2004. The next highest level in another well was 14 µg/L. Monitoring for arsenic will continue.

OU I Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics, and Risk Assessment Methods

- There have been no changes in the physical conditions within OU I or in the use of the site that would reduce the protectiveness of the remedies or require updates to the risk assessment. The exposure assumptions used in the original risk assessment are consistent with current land use.

- No new contaminants or sources of contamination have been identified within OU I, and no unanticipated toxic byproducts have been detected.
- A preliminary initial screening of the OU I groundwater VOC plume was performed to evaluate the potential for soil vapor intrusion. Groundwater contamination immediately beneath the Current Landfill is shallow and exceeds MCLs for several VOCs. However, inhabited buildings are not located near this plume. The closest office building to this plume is approximately 1,000 feet upgradient of the contaminant plume. Therefore, the subsurface vapor to indoor air pathway is incomplete, and no further evaluation is needed. The downgradient portion of the plume is deeper and has a clean layer of groundwater above. Therefore the contaminants are not present in the uppermost portion of the groundwater (i.e., water table) to present a soil gas concern. Attachment 8 presents the soil vapor intrusion screening for the plume.
  In the event that further construction is planned at BNL within the area of the OU I VOC groundwater plume, BSA will re-evaluate any potential issues and, if necessary, undertake appropriate measures to address them. Any construction projects to be undertaken at the Lab are reviewed for environmental, security, safety and health concerns in the conceptual design or early planning phase. BSA procedure, EP-ES&H-500, Project Environmental, Security, Safety and Health Review, includes an ES&H 500A Evaluation Form that requires any potential issues, such as potential soil vapor gas intrusion, be identified, documented, and mitigative actions taken, if necessary. In addition, the LUCMP and the Groundwater plumes factsheet will be revised to reflect the potential for soil vapor intrusion should new buildings be proposed.

OU I Expected Progress in Meeting RAOs

- Projects completed to date within OU I continue to meet the remedial action objectives identified in the OU I ROD, based on post-excavation confirmatory soil sampling results, continued monitoring of the surface waters and sediment, groundwater monitoring downgradient of potential source areas, and visual inspections of remediated areas.
- The future soil excavation at the former HWMF Waste Loading Area is expected to adhere to the ROD cleanup levels and meet the overall ROD objectives.
- The OU I groundwater treatment system is on schedule for meeting the ROD cleanup goal of reaching MCLs in the Upper Glacial aquifer is within 30 years (by 2025 for the OU I plume). As mentioned previously, the system is on track for planned shutdown by 2011, followed by continued monitoring. The system has already removed more mass of VOCs from the aquifer than previously projected.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

- There is no additional information that calls into question the protectiveness of the remedies at OU I.
- Although BNL now maintains a more comprehensive list of protected species (i.e., species of concern) for the site, they are not at risk from contamination.

7.2 Operable Unit II

The AOCs in this OU are documented in the OU I and OU III RODs, except for BLIP, which will be documented in a subsequent ROD. The following questions relate to remedial actions taken at the BLIP facility:

OU II Question A: Is the remedy functioning as intended by the decision documents?

- Silica grout was injected into the activated soil at the BLIP facility in 2000. This Removal Action was an additional protective measure to further reduce the permeability of the activated soil. Moreover, it would reduce the potential impact of rainwater leaching radionuclides into the groundwater, should the primary storm water controls fail. The Removal Action also included stormwater drainage improvements and maintenance, installation and maintenance of the gunite cap, and continued groundwater monitoring.
- As reported in the *BLIP Closeout Report Removal Action AOC 16K* (BNL 2001d), the injection of the silica grout at BLIP can be characterized as successful; however, its deployment was not. The objectives of minimizing threats to human health, migration of contaminants to the groundwater, and migration from operations of the facility in the future appear to have been met. However, the displacement of contaminated soil pore water during the injection caused a short-term impact to the groundwater. As a result, the goal of improving the control of the activation area "without harm to the environment" was not achieved. As discussed in Section 6.4 above, the concentrations of tritium in the groundwater have been generally declining over the past several years and are expected to dissipate.
- The stormwater diversions and cap inspection and repair are included under BNL's Preventative Maintenance Program. The gunite cap, paved areas, and roof drains at BLIP are in good condition and are effectively controlling stormwater infiltration. Although direct inspection or maintenance of the silica grout is not possible, it is expected to be in good condition and would be effective in preventing significant leaching of tritium from the activation zone.
- Quarterly groundwater monitoring in the immediate vicinity of BLIP continues per the *BNL Environmental Monitoring Plan*, and the results are reported to the facility operator on a routine basis and in the annual *Groundwater Status Report*.
- The final remedy for the BLIP project will be documented in a subsequent ROD, scheduled for submittal to the regulators in September of 2006.

OU II Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?

- The Removal Action objective to prevent further migration of radionuclides from the activated soil to the groundwater is still valid. There have been no changes to the exposure assumptions or the drinking water standards.
- There have been no physical changes to the BLIP area except as an added measure of protection, a new protective concrete cap over the Linac-to-BLIP spur was constructed in late 2004. The spur is where the beam line from Linac is kicked into the Linac to BLIP beam line. As part of an effort to investigate potential upgradient sources of tritium, soil samples obtained in 2003 along the BLIP spur identified low levels of sodium-22

activation. In accordance with BNLs Accelerator Safety Subject Area, if potential leachate concentrations can exceed five percent of the drinking water standard, the beam loss area must be capped. As a result, the concrete cap was installed in November 2004.

OU II Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

There is no additional information that calls into the question the protectiveness of the remedy at BLIP.

7.3 Operable Unit III

OU III Question A: Is the remedy functioning as intended by the decision documents?

OU III Remedial Action Performance

- The OU III groundwater plumes have been defined, and continue to be monitored via a comprehensive network of monitoring wells on and off of the BNL property. Plume maps are updated on at least an annual basis.
- Remediation of the OU III plumes has been underway since 1997. Eleven systems are in operation and are capturing the plumes as intended by the OU III ROD, thereby preventing and minimizing migration of contaminants. The last treatment system was installed in late 2004, and is used to address the Sr-90 plumes at the BGRR/WCF. Operations for this system began in June 2005.
- The groundwater remediation program is on track to reach the overall groundwater cleanup objectives as defined by the OU III ROD as modified by the OU III ESD. These objectives are:
    - Meet MCLs for VOCs and tritium in the Upper Glacial aquifer within 30 years
    - Meet MCLs for Sr-90 at the former Chemical Holes plume and the BGRR/WCF plumes within 40 years and 70 years, respectively
    - Meet MCLs for VOCs in the Magothy aquifer within 65 years

- Three groundwater systems met their cleanup goals and were placed in standby mode. These are the HFBR Tritium Pump and Recharge System (2000), the Carbon Tetrachloride Treatment System (2004), and the Building 96 Treatment System (2004/2005). Should contamination significantly rebound, the systems can be restarted.
- Operations data obtained during the 2003 Chemical Holes Sr-90 treatment system Pilot Study and subsequent 2004 operations helped to define the final remedy for the BGRR/WCF Sr-90 treatment system.
- Cleanup of the Magothy aquifer was significantly enhanced in 2004 with the installation of two additional extraction wells off of the BNL property (at the LIPA/Airport and Industrial Park East treatment systems) to address the high concentrations of VOCs.
- A detailed discussion of the progress of the OU III groundwater remediation is available in the *2004 Groundwater Status Report* (BNL 2005d) (see Attachment 2 for the CD or http://webeims.b459.bnl.gov/gw_home/gw_home.asp).
- Ten homeowners within the designated public water hookup area declined the free DOE hookup offer in 1996-1997 and continued to use their private wells for drinking purposes. That number was reduced to seven homeowners in 2005 and six in early 2006. In mid

2006, two additional homes were identified that were previously thought to be connected to public water. This brings the number of homes not connected to public water to eight. DOE continues to offer these homeowners free annual water testing. The response rate to the annual letters sent to the homeowners over the several years has been low, between one to two taking DOE up on the offer each year. The well results have been below the New York State Department of Health drinking water standards, except for iron in one case. Iron is not normally considered harmful to health, but can cause off-taste, odor or staining problems. In this case, the County recommended connection to a public water supply wherever possible.

- Excavation and off-site disposal of PCB-contaminated soil at Building 96 was performed in accordance with the ROD. The designated soil cleanup levels were met. Also, as required by the ROD, the final remedy for the potential source such as the Building 96 anomalies was documented in a subsequent decision document, the *OU III Explanation of Significant Differences* (BNL 2005a). The remedy called for no further action.

OU III System Operations/O&M

- The VOC treatment systems operated without any significant downtime or other operational issues over the past eight years, and treatment system discharges have consistently met the state equivalency discharge requirements (although there have been a few minor pH excursions due to the natural groundwater conditions). The systems are physically inspected, typically on a daily basis. However, the frequency of physical inspections will generally be reduced starting in 2005 due to the positive operating history, the increase in the number of systems off of BNL property, and the availability of wireless system monitoring/alarms.
- As noted in Section 4.3 above, the process piping is being redesigned to bypass the holding tanks and use only the extraction well pump to process the water, to reduce the frequency of system downtime for the Chemical Holes Sr-90 system.
- The systems' O&M manuals identify required preventative maintenance tasks. There do not appear to be any issues that would impact continued operations or the effectiveness of the remedy. The BNL Preventive Maintenance Program helps to eliminate unnecessary system shutdowns due to routine wear and tear on equipment. The O&M manuals for the Industrial Park System and the Chemical Holes Sr-90 system are currently being updated to reflect more recent exit strategy criteria for system shutdown.
- An evaluation of the operations of each of the treatment systems is performed on a varying time scale: monthly during preparation of the discharge monitoring reports, during preparation of the quarterly operation reports, and annually in the Groundwater Status Report. These evaluations include review of the extraction well and system influent data, treatment system midpoint data, if appropriate, and the effluent data.
- Maintenance of the system recharge basins, such as periodic scraping to remove sediment buildup, is performed in accordance with the *Natural Resource Management Plan for Brookhaven National Laboratory* (BNL 2003b) to ensure protection of potential eastern tiger salamander habitats.

OU III Costs of System Operations/O&M

- The O&M costs over the past four years for several of the OU III treatment systems are

presented in Table 3 in Section 4.3. The annual costs are equivalent to, if not lower than, the original estimates. BNL has been able to operate these systems in a cost-efficient manner by optimizing the sampling programs and implementing lessons learned. The largest overall cost drivers for the systems are electricity and disposal or reuse of spent carbon and resins.

- BNL has successfully minimized costs for several systems by shutting off extraction wells when influent concentration data and groundwater contamination levels at a given location are very low. The extraction wells remain in standby mode and continue to be monitored. If necessary, the wells could be restarted.
- Due to the extensive use of activated carbon for the treatment of VOCs off of the BNL property, a large-scale waste services contract was awarded based on competitive bidding.
- Since the signing of the OU III ROD in 2000, two access agreements were negotiated with private property owners to allow treatment system operations on their property. In consideration for the agreements, payments of $84K per year will be made to the property owners for as long as the treatment systems are on their property.

OU III Implementation of Institutional Controls and Other Measures

- Institutional controls are in place at BNL to ensure the effectiveness of all groundwater remedies. The OU III groundwater land use and institutional controls continue to be maintained and effective in protecting human health and the environment. These controls include:
    - Groundwater quality is monitored in the vicinity of each treatment system to evaluate the system's performance and to detect any change in conditions that might result in the system not meeting its stated objective or threatening a water supply source. The details of this monitoring are prescribed in the *BNL Environmental Monitoring Plan.*
    - Extensive groundwater monitoring program to track contaminant plumes and reporting of the data.
    - Monitoring of BNL potable supply system and SCDHS monitoring of Suffolk County Water Authority (SCWA) well fields closest to BNL.
    - Remediation progress is reviewed annually as part of the Groundwater Status Report.
    - Five-Year reviews are performed, as required by CERCLA, until cleanup goals are met and to help determine the effectiveness of the groundwater monitoring program.
    - Controls are placed on the installation of new supply wells and recharge basins on BNL property.
    - Public water service has been offered in plume areas south of BNL.
    - Installation of new drinking water wells and other pumping wells where public water service exists is prohibited (Suffolk County Sanitary Code Article 4).
    - BNL maintains an internal Water and Sanitary Planning Committee to coordinate operational activities on the BNL site that may impact the flow of contaminated groundwater. The committee also tracks and evaluates changes in groundwater management activities off of the BNL site (i.e. SCWA and drainage changes planned in the vicinity of BNL) to determine if they will affect BNL groundwater remedies. There was a lapse for several months in 2005 where the pumping of supply wells was not optimal, thereby resulting in a shifting of plumes slightly to the

east. This situation is currently being corrected via formalization within the Labs policy and procedures. The Committee now meets on a monthly basis to discuss various issues.
    - Property access agreements for treatment systems off of BNL property are in place, and have not been violated. Deed restriction transfer with property ownership change will be completed in mid 2005.
    - The deeds for certain private properties beyond the BNL boundary are being updated to reflect the operation of the North Street, North Street East, and OU VI remediation systems.
    - The treatment systems installed off of the BNL site are fenced, with locked gates, locked buildings, and video surveillance with direct feed back to BNL police. No security violations have been identified by the police.

  As a result of routine and non-routine inspections and close oversight of the facilities, no activities were observed at OU III that would have violated these institutional controls.

- The Building 96 PCB-excavated soil area will be inspected every 6 months to verify that the cover material is staying in place and is not impacted by erosion, animal burrowing, or root intrusion. After seeding in 2005, the area was added to the BNL web-based database of contaminated soils map so that any proposed disturbance of the backfilled areas (i.e., digging, well installation, building construction) is controlled to prevent contact with the remaining low-level PCB-contaminated soil.

OU III Monitoring Activities

- Monitoring data obtained from the treatment systems, as well as the data from groundwater monitoring wells, provide the basis to evaluate the performance and effectiveness of the various systems. The data is reported in the Annual Groundwater Status Report.
- Changes to several of the OU III plume monitoring networks are being recommended in the *2004 Groundwater Status Report* (BNL 2005d). These modifications, which include the installation of additional permanent monitoring wells and temporary wells, will increase BNL's confidence in tracking the contaminant plumes and assessing remediation progress. The changes to the Middle Road, South Boundary, Chemical Holes, Former Landfill, and Industrial Park East plume monitoring programs are described in more detail in the *2004 BNL Groundwater Status Report*.

OU III Opportunities for Optimization

- As part of the *2004 BNL Groundwater Status Report*, optimization of several of the OU III groundwater treatment systems was recommended. These changes are based on an evaluation of treatment system and monitoring well VOC concentration trends. The proposed changes include:
    - In October 2005, begin pulse-pumping the two extraction wells at the Western South Boundary System due to the steadily decreasing influent concentrations of VOCs, and because six out of seven plume core wells have reached the cleanup objective of 20 μg/L TVOCs.

- Continue to maintain the Carbon Tetrachloride treatment system in standby mode, and restart extraction well(s) if necessary.
- In October 2005, shut down and place in standby mode Industrial Park system treatment well UVB-1 because VOC concentrations were below MCLs throughout 2004.
- In October 2005, begin pulse pumping of the five Airport treatment system extraction wells because no monitoring wells or extraction wells have VOC concentrations above MCLs.

OU III Early Indicators of Potential Issues

- There do not appear to be any problems or issues at this time that could place protectiveness of the remedies at risk.
- The remedy for the Building 96 groundwater treatment system, consisting of recirculation wells with air stripping treatment, assumed that there was no continuing source of VOC contamination. However, following system operations for two of the three proposed years of treatment and the installation of additional temporary monitoring wells, it was determined that a zone of high VOC contamination existed in a low permeability (silty) zone located in the subsurface within the source area. It was determined that continued pumping of the extraction well would not be effective at eliminating this source. As a result, the remediation approach was reevaluated in 2004. In December 2004/January 2005 and again in April 2005, the oxidizer, potassium permanganate, was injected into the silt zone to degrade the VOCs. Success was realized, however, spot injections of the oxidizer may continue as needed to reduce the high VOCs until they are reduced to lower concentrations. This approach is expected to maintain protectiveness and attain MCLs in the groundwater within 30 years.

OU III Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid?

OU III Changes in Standards and TBCs

- The standards or TBCs identified in the OU III ROD have not changed nor do they call into question the protectiveness of the remedy. Attachment 7 provides the cleanup levels for the OU III primary contaminants of concern. The PCB soil cleanup levels and MCLs for drinking water have remained the same since 1999.
- In 2000, a New York State guidance value for methyl-tertiary-butyl-ether (MTBE) was established at 10 µg/L. Then in December 2003, the New York State Department of Health (NYSDOH) adopted a 10 µg/L MCL for MTBE. Between September 2002 and April 2003, BNL detected MTBE in a monitoring well that serves as an outpost (or early warning) well for the SCWA William Floyd Well Field just west of the site. One of the detections exceeded the standard. However, SCDHS sampled the well in January and April 2003 and did not detect any VOCs, including MTBE. MTBE was not detected for the remainder of 2003 and all of 2004. The regulators were informed of the detections. The only known MTBE contamination at BNL is associated with the BNL Motor Pool Area and Service Station, but these areas are not believed to be the source of the MTBE detected in the outpost well. MTBE is not a contaminant of concern and does not affect the OU III remedy.

OU III Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics, and Risk Assessment Methods

- There have been no changes in the physical conditions within OU III or in the use of the site that would reduce the protectiveness of the remedies or render the initial risk analysis invalid. Also, the exposure assumptions have not changed since the ROD was signed in 2000.
- Ten homeowners within the designated public water hookup area declined the free DOE hookup offer in 1996–1997, and continued to use their private wells for drinking purposes. That number was reduced to seven homeowners in 2005, and six in early 2006. However, in mid 2006, two additional homes were identified, and brought the total that continue to use their well as their sole source of drinking water to eight. DOE continues to offer these eight homeowners free annual water testing.
- No new contaminants or sources of contamination have been identified within OU III, and no unanticipated toxic byproducts have been detected. BNL continues to analyze for vinyl chloride at the Building 96 potassium permanganate injection area to ensure it is not being created from the degradation of PCE.
- A preliminary initial screening of the OU III groundwater VOC plume was performed to evaluate the potential for soil vapor intrusion. Those OU III plumes located near and beyond the property boundary, or a distance from former source areas have a clean layer of groundwater above and are deeper. Therefore the contaminants are not present in the uppermost portion of the groundwater (i.e., water table) to present a soil gas concern. There are a couple of areas on BNL property where OU III VOC groundwater contamination is shallow and closer to former source areas, such as Building 96 and the Carbon Tetrachloride plumes. However, inhabited buildings are not located near the plumes. The closest building is the service station. Consequently, the subsurface vapor to indoor air pathway is incomplete, and no further evaluation is needed at this time. Attachment 8 presents the soil vapor intrusion screening for the OU III plumes.

  In the event that further construction is planned at BNL within the area of the OU III VOC groundwater plumes, BSA will re-evaluate any potential issues and, if necessary, undertake appropriate measures to address them. Any construction projects to be undertaken at the Lab are reviewed for environmental, security, safety and health concerns in the conceptual design or early planning phase. BSA procedure, EP-ES&H-500, Project Environmental, Security, Safety and Health Review, includes an ES&H 500A Evaluation Form that requires any potential issues, such as potential soil vapor gas intrusion, be identified, documented, and mitigative actions taken, if necessary. In addition, the LUCMP and the Groundwater plumes factsheet will be revised to reflect the potential for soil vapor intrusion should new buildings be proposed.

OU III Expected Progress in Meeting RAOs

- There are currently 12 groundwater remediation systems in operation under OU III, of which five began operation in 2004. As noted in Section 7.3, all the systems are on track for meeting the ROD and ESD cleanup goal of reaching MCLs in the aquifer and

preventing or minimizing plume growth. The *2004 BNL Groundwater Status Report* (BNL 2005d) evaluates each system's performance based on five major decisions identified from the BNL groundwater Data Quality Objective (DQO) process (see *BNL Environmental Monitoring Plan* [BNL 2003c] for discussions of the DQO process).

- As noted above, in the Early Indicators of Potential Issues section, there was a concern with whether the Building 96 groundwater treatment system would meet its cleanup objective in light of the continuing "silt zone" source area. However, with the revised remedial approach of using potassium permanganate injections, BNL is confident that the objectives will be met.
- There are no known issues with any of the property access agreements for the treatment systems off of BNL property, or institutional controls, which could jeopardize their future operation.
- BNL will carefully evaluate the performance and efficiency of the Sr-90 ion exchange treatment systems at the Chemical Holes and the BGRR/WCF plumes to ensure that they are on track to meet their objectives of meeting MCLs within 40 years and 70 years, respectively. Increasing Sr-90 concentration trends in several key sentinel monitoring wells will be evaluated, and if necessary, changes will be made. Changes could include installing additional monitoring wells and/or additional extraction wells. BNL will also remain alert to any new Sr-90 remediation techniques and technologies, as well as any operational efficiencies that might accomplish cleanup sooner with less waste generation.
- Based on post-excavation PCB confirmatory soil sampling results and visual inspections at Building 96 Scrapyard, this project has met the cleanup goals identified in the OU III ROD.

OU III Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No new technologies have been identified at this time for the treatment of Sr-90 contaminated groundwater. No newly identified ecological risks have been found within OU III, nor impacts from natural disasters. No additional information has come to light that calls into the question the protectiveness of the OU III remedies.

7.4 Operable Unit IV

OU IV Question A: Is the remedy functioning as intended by the decision documents?

Although the OU IV ROD states that a Five-Year Review of this remedial action is not necessary, the following items are provided as a summary.

- The OU IV remedial action objectives have been satisfied. The soil/groundwater treatment AS/SVE system met its cleanup objectives and the regulators approved its dismantlement in 2003. A fence was installed around Building 650 Sump Outfall in 1995. The excavation of the radiological contaminated soil in the Building 650 Sump, along with the discharge pipe and Sump Outfall, was included under the OU I ROD.
- The remediation has achieved the objectives of preventing or minimizing the leaching of contaminants from the soil into the groundwater, human exposure (including ingestion, inhalation, and dermal contact), and the uptake of contaminants present in the soil and groundwater by plants and animals.

- Groundwater monitoring for select wells downgradient of the former AS/SVE system continues, as well as monitoring for radionuclides at the Building 650 Sump and Sump Outfall per the *BNL Environmental Monitoring Plan.* The results are reported in the annual Groundwater Status Report.
- The AS/SVE-remediated area is classified for unrestricted industrial use.
- The lead-contaminated soil at the Central Steam Facility outfall is not identified in the OU IV ROD since it is not an AOC. However, it was identified as a recommendation/ follow-up action during the OU IV Five-Year Review in 2003. Since that time, the characterization of the soil was completed and a report summarizing the results and an evaluation of remediation options was submitted to the regulators for review in March 2004. The report is titled, *Remedial Investigation and Soil Remediation Evaluation and Cost Estimate for the Central Steam Facility Storm Water Outfall*, dated February 2004.

OU IV Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?

- The standards or TBCs identified in the OU IV ROD have not changed, nor do they call into question the protectiveness of the remedy. The radiological soil cleanup levels and the MCLs for drinking water have remained the same since 1999. Attachment 7 provides the cleanup levels for the OU IV primary contaminants of concern.
- The remedial action objectives have been met and have not changed.
- The groundwater within OU IV is not contaminated with VOCs above MCLs, therefore, the subsurface vapor to indoor air pathway is incomplete, and no further evaluation is needed.

OU IV Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No additional information calls into the question the protectiveness of the remedy at OU IV.

7.5 Operable Unit V

OU V Question A: Is the remedy functioning as intended by the decision documents?

OU V Remedial Action Performance

- Based on information presented in the closeout report for the sludge drying beds, sand filter beds and berms, firing range berms, and sewer line cleanups (BNL 2004d), and on regulatory interviews, the remedies were implemented in accordance with the OU V STP ROD. Based on confirmatory sampling, all areas met the prescribed cleanup levels for Cs-137 and mercury, thereby minimizing the potential for migration of these contaminants from the surface soil to groundwater.
- Removal of elevated levels of Cs-137 and mercury minimizes the potential for uptake of these contaminants in the soil by ecological receptors. Backfilling with clean material further reduces the potential for exposure.
- Groundwater contaminated with low levels of VOCs and tritium continues to be monitored on a routine basis. The extent of the VOC plume is well defined and is updated annually. All tritium concentrations remain less than the 20,000 pCi/L drinking water standard.

- Excavation of the sediment in the portion of the Peconic River on BNL property was completed in accordance with the requirements of the Action Memorandum *Peconic River Removal Action for Sediment on BNL Property* (BNL 2004e), as well as the OU V Peconic River ROD. Based on confirmatory sampling discussed in the *Completion Report for Peconic River Remediation On BNL Property* (Envirocon 2004), the cleanup goal for mercury has been met. This remedy is considered the final remedy in the OU V Peconic River ROD.
- Excavation of the sediment in the portion of the Peconic River off of BNL property was completed in accordance with the requirements of the OU V Peconic River ROD. Based on confirmatory sampling, the cleanup goal for mercury has been met. The *Draft Closeout Report for Peconic River Remediation Phases 1 and 2* (BNL 2005c) was issued to the regulators.
- Average silver, copper, PCB, and Cs-137 concentrations in sediment on and off of BNL property were reduced to background concentrations as a result of the cleanup.
- Ecological risks are expected to be reduced to background. Monitoring of the ecological receptors will be performed in accordance with the OU V Peconic River ROD and further detailed in the *Operable Unit I Soils and Operable Unit V Long-Term Monitoring and Maintenance Plan* (BNL, 2006).

OU V System Operations/O&M

- As required by the OU V Peconic River ROD, a long-term monitoring program will be implemented to ensure protection of human health and the environment. As noted above, a long-term monitoring and maintenance plan was prepared that included methyl mercury water column sampling, sediment sampling, and fish sampling on and off of BNL property.
- Pilot studies performed for the Peconic River restoration have demonstrated that wetland restoration techniques have been effective. However, additional monitoring of the progress of the vegetation regrowth in the Peconic River is required.

OU V Costs of System Operations/O&M (Not applicable for this project.)

OU V Implementation of Institutional Controls and Other Measures

- The OU V groundwater land use and institutional controls continue to be maintained and effective in protecting human health and the environment. These controls include:
    - The New York State general advisory on the consumption of freshwater fish caught from New York freshwaters applies to the Peconic River. The advisory is to eat no more than one meal (1/2 pound) of fish per week.
    - The DOE does not envision any sale or transfer of property in the Peconic River area. If it were to occur, the sale or transfer would meet the requirements of Section 120 (h) of CERCLA to ensure that future users are not exposed to unacceptable levels of contamination.
    - Excavation activities in designated residual contaminated soil areas are prohibited.
    - Groundwater monitoring to track contaminant plumes as well as reporting in the Annual Groundwater Status Report.
    - Five-year reviews will be performed, as required by CERCLA, until cleanup goals are met, to determine the effectiveness of the groundwater monitoring program and

sediment remediation.
    - Controls have been placed on the installation of new supply wells and recharge basins on BNL property.
    - NYSDEC regulations regulate all work within 100 feet of wetlands with confirmed protected species habitats. Any work activities within 100 feet of a wetland requires DOE and NYSDEC notification and approval.
    - BNL limits activities within 850 feet of wetlands with confirmed protected species habitats.
    - Installation of new drinking water wells and other pumping wells where public water service exists is prohibited (Suffolk County Sanitary Code Article 4).

As a result of inspections performed at the STP and the Peconic River, no activities were observed at OU V that violated these institutional controls.

OU V Monitoring Activities

- Confirmatory monitoring data was collected following the completion of the soil excavation at the STP sludge drying beds and sand filter beds/berms. These data confirmed that the cleanup levels were met, and permitted the excavation to be backfilled. In addition, ORISE performed independent sampling of the excavated areas to confirm the cleanup for DOE. This is documented in the *Final Completion Report for the STP* (BNL 2004d).
- Confirmatory monitoring data was collected following the completion of the Peconic River sediment excavation on and off of BNL property. These data confirmed that the cleanup levels were met. The *Completion Report for the Peconic River Remediation on BNL Property* (Envirocon, 2004) documents that the mercury cleanup levels were met. The confirmatory data for the sediment off of BNL property is documented in a closeout report that was submitted to the regulators.
- As noted above, monitoring of surface water, sediment, fish, and vegetation regrowth will be performed. In addition to periodic reporting of the analytical results, the data will be evaluated during subsequent five-year reviews, and an assessment will be made on the effectiveness of the remedy in meeting the cleanup and restoration objectives. The need for potential additional remedial actions will also be evaluated.
- The groundwater monitoring over the past five years shows no indication of VOC or tritium concentrations increasing in magnitude.
- Groundwater monitoring will continue and the data is reported in the Annual Groundwater Status Report.

OU V Opportunities for Optimization

At this time, there are no opportunities for optimization of the monitoring activities at the STP, the Peconic River, or the groundwater.

OU V Early Indicators of Potential Issues

- The regrowth of invasive species (e.g., *phragmites*), is a significant concern for the long-term success of the Peconic River revegetation. Monitoring, followed by appropriate controls for the invasive species *phragmites*, is needed on a timely basis.
- As required by the NYSDEC Equivalency Permit, the stone and fabric from the haul access roads need to be removed. However, once they are removed and the path is revegetated,

access to the river for future sediment and water sampling may become difficult. Access options need be evaluated.

- Although there is currently no drinking water standard for the compound perchlorate, NYSDOH has established an Action Level in drinking water supply wells of 18 µg/L. Several monitoring wells at the STP have detected perchlorate, but at concentrations below the action level. The impacts from the future establishment of a lower drinking water standard will be evaluated at that time. Perchlorate is not a contaminant of concern in the ROD, and does not affect the remedy for OU V. Additional information on perchlorate is available at http://www.epa.gov/fedfac/pdf/perchlorate_guidance.pdf and http://www.epa.gov/fedfac/documents/perchlorate_qa.htm.

OU V Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid?

OU V Changes in Standards and TBCs

- The standards or TBCs identified in the OU V ROD have not changed nor do they call into question the protectiveness of the remedy. The mercury sediment cleanup level and the MCLs for drinking water have remained the same since 1999. Attachment 7 provides the cleanup levels for the OU V primary contaminants of concern.

OU V Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics, and Risk Assessment Methods

- There have been no changes in the physical conditions within OU V or in the use of the STP, the Peconic River, or the groundwater that would reduce the protectiveness of the remedies or render the initial risk analysis invalid. The exposure assumptions used in the original risk assessment are consistent with current land use.
- DOE continues to offer free annual water testing to the one homeowner known to be using a private well for drinking water purposes in the OU V public water hookup area. The last time the homeowner accepted the annual test was in February 2002. These results were below the State Department of Health drinking water standards, except for iron. Iron is not normally considered harmful to health, but can cause off-taste, odor or staining problems. At the time, the County recommended connection to a public water supply wherever possible.
- No new contaminants or sources of contamination have been identified within OU V, and no unanticipated toxic byproducts have been detected.
- A preliminary initial screening of the OU V groundwater VOC plume was performed to evaluate the potential for soil vapor intrusion. The plume is deeper and has a clean layer of groundwater above. Therefore the contaminants are not present in the uppermost portion of the groundwater (i.e., water table) to present a soil gas concern.

OU V Expected Progress in Meeting RAOs

- Excavation of the radiological and metal contaminated sediments at the STP and in the Peconic River on and off of BNL property met the appropriate cleanup levels and remedial action objectives in the OU V STP and OU V Peconic River RODs. A monitoring program is being implemented to demonstrate the effectiveness of the Peconic River cleanup to

mitigate potential ecological effects.
- Groundwater monitoring results continue to indicate that MCLs will be met within 30 years.

OU V Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No newly identified ecological risks have been found within OU V or impacts from natural disasters. No additional information has come to light that calls into question the protectiveness of the OU V remedies.

7.6 Operable Unit VI

OU VI Question A: Is the remedy functioning as intended by the decision documents?

OU VI Remedial Action Performance

- The OU VI EDB groundwater plume has been defined and continues to be monitored via a network of monitoring wells on and off of BNL property. The plume map is updated on at least an annual basis.
- The EDB groundwater treatment system was installed in accordance with the OU VI ROD, and began operating in August 2004. Although EDB has yet to be detected in the extraction wells, the hydraulic capture performance of the system is being met as described in the Startup Report. The recent detection of EDB at levels just above detection limits in a plume core well located immediately north of the extraction wells indicates that the leading edge of the plume is just now arriving at this location. The system is currently on schedule to meet the cleanup goals of reaching MCLs within 30 years.
- DOE continues to offer free annual water testing to the three remaining known homeowners still using private wells for drinking water purposes in the OU VI public water hookup area. A fourth homeowner connected-up to public water in the fall of 2005. The one homeowner that recently hooked-up previously accepted the annual testing offer in 2003, 2004, and 2005. The other three homeowners had their wells last sampled in 2002 or 2003. The results for all samples were below the State Department of Health drinking water standards.

OU VI System Operations/O&M

- The system O&M manual identifies required preventative maintenance tasks. There do not appear to be any issues that would impact continued operations or the effectiveness of the remedy. The BNL Preventive Maintenance Program helps to eliminate unnecessary system shutdowns due to routine wear and tear on equipment.
- An evaluation of the operation of the treatment system is performed monthly during preparation of the discharge monitoring reports, during preparation of the quarterly operation reports, and annually in the *BNL Groundwater Status Report*. These evaluations include review of the extraction well and system influent data, treatment system midpoint data, and the effluent data. From March 28 through May 24, 2005, VOC analyses were inadvertently not performed. The matter was corrected, and on May 25, 2005 all parameters were being analyzed.

OU VI Costs of System Operations/O&M

- The system is still in the first year of O&M. The largest overall cost drivers for the system are annual property access payments and electricity.
- Since the OU VI ROD was signed in 2001, two access agreements were negotiated with private property owners to allow for treatment system operations on their property. In consideration for the agreements, payments of $85K per year will be made to the property owners as long as the treatment system is on their property. These costs are in addition to the payments required for the OU III systems discussed above.

OU VI Implementation of Institutional Controls and Other Measures

- The OU VI groundwater land uses and institutional controls continue to be maintained and effective in protecting human health and the environment. These controls include:
    - Groundwater quality is monitored in the vicinity of the EDB treatment system to evaluate its performance and to detect any change in conditions that might result in the system not meeting its stated objective or threatening a water supply source. The details of this monitoring are prescribed in the *BNL Environmental Monitoring Plan* (BNL 2003c*).*
    - Groundwater monitoring to track the contaminant plume as well as reporting in the Annual Groundwater Status Report.
    - Monitoring by SCDHS of Suffolk County Water Authority well field at Country Club Drive in Manorville.
    - Five-year reviews will be performed, as required by CERCLA, until cleanup goals are met.
    - Public water service is in place in the OU VI plume area south of BNL.
    - Installation of new drinking water wells and other pumping wells where public water service exists is prohibited (Suffolk County Sanitary Code Article 4).
    - BNL maintains an internal Water and Sanitary Planning Committee to coordinate operational activities on the BNL site that may impact the flow of contaminated groundwater. The Committee also tracks and evaluates changes in groundwater management activities off of the BNL site (i.e., SCWA and drainage changes planned in the vicinity of BNL) to determine if they will affect BNL groundwater remedies.
    - Property access agreements are in place for the OU VI treatment system off of BNL property. Deed restriction transfer with property ownership change will be completed in mid 2005.
    - The deeds for certain private properties beyond the BNL boundary are being updated to reflect the operation of the OU VI remediation system.
    - The EDB treatment system off of the BNL site is fenced, has locked gates, a locked building, and video surveillance provides direct feed back to BNL police. No violations have been identified.

  Based on inspections, no activities were observed at OU VI that would have violated these institutional controls.

OU VI Monitoring Activities

- The monitoring data obtained from the EDB treatment system, as well as the data from the plume monitoring wells, provide the basis to evaluate the performance and effectiveness of the remediation system. The data is reported in the Annual Groundwater Status Report.
- Changes to the OU VI plume monitoring network would be recommended in the annual *Groundwater Status Report*. These modifications, such as additional monitoring wells and temporary wells, would increase BNL's confidence in the plume's distribution and remediation progress.

OU VI Opportunities for Optimization

There are no opportunities identified at this time because the system has been operating for less than one year.

OU VI Early Indicators of Potential Issues

There do not appear to be any problems or issues at this time that could place protectiveness of the remedy at risk.

OU VI Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid?

OU VI Changes in Standards and TBCs

- The regulatory standards or TBCs identified in the OU VI ROD have not changed nor do they call into question the protectiveness of the remedy. The EDB standard and the MCLs for drinking water have remained the same since 1999. Attachment 7 provides the cleanup levels for the OU VI primary contaminants of concern.
- Note that the SPDES equivalency discharge permit level for EDB was assigned as 5.0 µg/L by NYSDEC. The drinking water standard for EDB is 0.05 µg/L. BNL is striving to reduce the EDB concentrations in the treated effluent to below the drinking water standard. This is not considered a change in standards or TBCs.

OU VI Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics, and Risk Assessment Methods

- There have been no changes in the physical conditions within OU VI or in the use of the site that would reduce the protectiveness of the remedies or render the initial risk analysis invalid. Also, the exposure assumptions have not changed since the ROD was signed in 2001.
- DOE continues to offer free annual water testing to the three homeowners in the OU VI plume area who are still using their private wells for drinking purposes. A fourth homeowner previously hooked-up to public water in the fall of 2005. The one homeowner that previously hooked-up accepted the water testing offer in 2003, 2004, and 2005. The other three homeowners had their wells last sampled in 2002 or 2003. The results for all samples were below the State Department of Health drinking water standards.

- A preliminary initial screening of the OU VI groundwater VOC plume was performed to evaluate the potential for soil vapor intrusion. The portion of the plume that exceeds the MCL is located off of the BNL property boundary, is deeper, and has a clean layer of groundwater above. Therefore the contaminants are not present in the uppermost portion of the groundwater to present a soil gas concern.

OU VI Expected Progress in Meeting RAOs

- The annual *BNL Groundwater Status Report* evaluates the system's performance based on five major decisions identified from the BNL groundwater DQO process (see *BNL Environmental Monitoring Plan* (BNL 2003c) for the DQO process). As described in the *2004 BNL Groundwater Status Report* (BNL 2005d), EDB concentrations are expected to be lowered to below the 0.05 µg/L MCL by 2030, as required by the OU VI ROD.
- There are no known issues with the property access agreements or institutional controls that could jeopardize the EDB system's future operation.

OU VI Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No newly identified ecological risks have been found within OU VI or impacts from natural disasters. No additional information has come to light that calls into question the protectiveness of the OU VI remedy.

7.7 BGRR

BGRR Question A: Is the remedy functioning as intended by the decision documents?

BGRR Remedial Action Performance

- As described in the completion and closeout reports completed to date, site inspections, and regulatory interviews, the interim cleanup measures were implemented in accordance with the Action Memos and are consistent with the BGRR ROD. This has achieved the remedial action objectives of: protecting human health from the hazards posed by the radiological inventory at the BGRR, using the ALARA principle, and implementing monitoring, maintenance, and institutional controls to manage potential hazards. Specific activities completed include:
    - Removal of Primary Air Cooling Fans - Removed and properly disposed of contaminated equipment in the fan rooms and decontaminated or fixed surface contamination.
    - Removal of the Pile Fan Sump, Pipes, and Contaminated Soil – Removed to reduce the radiological footprint of the BGRR complex.
    - Removal of Above Ground Ducts, Pipes, and Contaminated Soil – Prevented low-level radioisotopes from being released to soil and potential migration into groundwater.
    - Removal of Canal and Water Treatment House, Piping, and Accessible Contaminated Soils – Reduced the amount of contamination in the concrete

structures of the canal and removed contaminated surface soil to reduce the radiological footprint of the BGRR complex.
    - Removal of the Exhaust Cooling Coils and Filters – To prevent the future migration of radiological contamination into surrounding soil and groundwater.
    - Removal of BGD Primary Liner – To prevent the future migration of radiological contamination into surrounding soil and groundwater.
    - Sealing of the BGDs – To prevent the future migration of radiological contamination into surrounding soil and groundwater.
    - Removal of the Canal Structure, and Subsurface Contaminated Soil – To prevent the future migration of radiological contamination into surrounding soil and groundwater.

- The April 2005 completion of the removal of the canal structure and subsurface contaminated soil located outside the footprint of the reactor building was performed in accordance with the Action Memorandum and is consistent with the selected remedy in the BGRR ROD. A completion report was prepared and issued to the regulators in mid 2005.
- A temporary asphalt cap will be installed over the soil areas in mid 2005 to minimize water infiltration prior to the final cap installation.
- The remaining work to be performed including removal of the graphite pile and biological shield, and installation of the final engineered cap for water infiltration management, is to be implemented in accordance with the ROD, work plans, design documents, and BNL work permit.
- The Sr-90 groundwater plume is defined, is located entirely on the BNL property, and continues to be monitored via a comprehensive network of monitoring wells. Plume maps are updated on at least an annual basis. Groundwater is being monitored and remediated under the OU III ROD and ESD.

BGRR System Operations/O&M

- As required by the 2005 BGRR ROD, long-term O&M activities will be conducted to ensure effectiveness of the remedy. The BNL LUCMP contains sitewide control measures and land-use restrictions to prevent exposure to environmental contamination and to protect the integrity of remedies specified within this and other approved RODs. To accomplish this objective, specific measures are being implemented for the BGRR project. They include the following:

    - Routine environmental health and safety monitoring
    - Periodic structural inspections of Building 701
    - Water intrusion monitoring
    - Preventive maintenance of Building 701 and the infiltration management system
    - Groundwater monitoring required as part of the OU III ROD and the ESD.

BGRR Costs of System Operations/O&M

The estimated cost of long-term actions is approximately $275K annually for routine surveillance and groundwater monitoring. Additionally requirements include $10K every 10 years for infiltration barrier upkeep and $700K every 20 years to refurbish the Building 701 exterior facade and roof system. The cost estimate assumes these long-term actions are performed following completion of the remaining ROD remediation activities at the pile and

bioshield. Repointing of the Building 701 brickwork is currently in progress.

BGRR Implementation of Land Use and Institutional Controls and Other Measures

In addition to the administrative controls placed on the future land use at BNL, the following specific institutional controls will be included as part of the remedial design for the BGRR complex and will be included in the BNL Land Use and Institutional Controls Database in 2005:

- Control measures for future excavation of residual subsurface contamination - No digging, drilling, ground-disturbing activities, or groundwater shall be extracted within the area designated in Figure 10-1 of the BGRR ROD unless the activity has undergone a BNL review process, which includes but is not limited to the restrictions in BNL's LUCMP. This figure is included as Figure 7. Any activity that occurs deeper than 15 feet will require EPA concurrence. Upon implementation of the BGRR remedy, a reassessment will be made to determine the area in which the digging, drilling, ground-disturbing and groundwater extraction restrictions will be applied during the post-remedy phase.
- Following any future excavation, modifications to the existing limitations on land use/reuse will be in accordance with NYSDEC regulations.
- Specific land use restrictions are established within the BNL LUCMP limiting future use and development of the BGRR complex to commercial or industrial uses only. Additionally, any future plans for excavation of the inaccessible contaminated soils will include the assessment of risk to human health and the environment based on the actual distribution, depth, and concentrations of the residual radioactive material encountered.
- Annual certification will be provided to NYSDEC verifying that the institutional controls and engineering controls put in place are unchanged from the previous certification, and that nothing has occurred that would impair the ability of the control to protect public health or the environment. The annual certification will be prepared and submitted by a professional engineer or environmental professional accepted by NYSDEC.
- Land use restrictions and reporting requirements will be passed on to any/all future landowners through an environmental easement on the deed to the property. In light of the fact that a deed does not exist for property owned by a federal entity, DOE will be responsible for implementing, enforcing, maintaining, and reporting on these controls. Although DOE may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the DOE or its successor agency shall retain ultimate responsibility for remedy integrity. Upon transfer of the property to a nonfederal entity by the U.S. government, a deed will be established and an environmental easement will be added to the deed at that time.

BGRR Monitoring Activities

- Monitoring environmental health and safety, such as radiological dose monitoring, is a significant component of the remediation completed to date as well as for the remaining work. The ALARA principle is used to control worker exposure throughout all phases of the remediation effort.
- Groundwater monitoring in the vicinity of the BGRR complex will continue throughout the institutional control period. Results of the OU-III BGRR/WCF monitoring program will be

used to help verify the effectiveness of the BGRR remedy.

- Water intrusion monitoring is routinely performed in accordance with a surveillance and maintenance procedure to ensure that water does not infiltrate into contaminated areas of the BGRR complex, which could potentially cause the migration of radiological contamination into surrounding soils and groundwater.

BGRR Opportunities for Optimization

There are no apparent opportunities for optimization at this time.

BGRR Early Indicators of Potential Issues

Of particular concern is ensuring the protectiveness of workers during the remaining pile and bioshield removal. Proper planning, that includes continued focus on health and safety, use of the ALARA principle, daily tailgate meetings, and contingency measures, will help mitigate potential risk.

BGRR Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid?

BGRR Changes in Standards and TBCs

The standards or TBCs, including DOE Orders, identified in the BGRR ROD have not changed nor do they call into question the protectiveness of the remedy. Attachment 7 provides the cleanup levels for the BGRR primary contaminants of concern.

BGRR Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics, and Risk Assessment Methods

- There have been no changes in the physical conditions within the BGRR complex or in the use of the site that would reduce the protectiveness of the remedies or render the initial risk analysis invalid. Also, the exposure assumptions have not changed since the ROD was signed in 2005.
- No new contaminants or sources of contamination have been identified within the BGRR, and no unanticipated toxic byproducts have been detected.

BGRR Expected Progress in Meeting RAOs

- A significant effort has already been completed with the removal and disposal of contaminated components, structures, water, and soil at the BGRR complex. Based on sampling results, continued monitoring and surveillance of the facility, groundwater monitoring downgradient of potential source areas, and visual inspections of remediated areas, those projects completed to date continue to meet the remedial action objectives identified in the ROD.
    - A portion of the radiological inventory at the BGRR has been either removed or stabilized as a result of the interim cleanup actions.
    - The ALARA principle was extensively used to help protect workers while implementing the removal actions.

- The implementation of long-term monitoring, maintenance, and institutional controls has been initiated for the BGRR.

- The remaining remedial activities to be implemented for the pile and bioshield removal, as well as installation of the temporary and final engineered caps, are also expected to meet the overall ROD remedial action objectives.

  - Once completed, the overall remedy will remove over 99 percent of the radioactive material inventory at the BGRR complex.
  - The Building 701 foundation will protect the contaminated soil and components that will remain under the building footprint. It will form a significant barrier to future excavation and direct exposure, and serve as an effective barrier to prevent the migration of the remaining contaminants to groundwater.
  - Water infiltration management and institutional controls will be effective in protecting human health and the environment.

- As noted in Section 7.3 above, BNL will carefully evaluate the performance and efficiency of the Sr-90 ion exchange treatment system implemented/used for remediation of the BGRR/WCF plumes to ensure that they are on track to meet their objectives as stated in the OU III ROD and ESD of meeting MCLs in the aquifer within 70 years. BNL will also remain alert to any new Sr-90 remediation techniques and technologies as well as any operational efficiencies that might accomplish cleanup sooner with less remediation waste.

BGRR Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No newly identified risks have been found within the BGRR complex, nor impacts from natural disasters or land use changes. No additional information has come to light that calls into question the protectiveness of the BGRR remedy.

7.8 Technical Assessment Summary

Currently, seven of eight RODs have been signed at BNL. The ROD for the remaining OU, the g-2 Tritium Plume, BLIP, and USTs (AOCs 16T, 16K and 12), is still pending and is due for submittal to the regulators in the fall of 2006. This additional time allows for the collection of additional groundwater monitoring data for the g-2 tritium plume to support the evaluation of alternatives in the Focused Feasibility Study (FFS). With the exception of remaining soil excavation/waste disposal at the OU I former HWMF Waste Loading Area and the BGRR pile and bioshield removal, all selected remedies for the seven RODs have been implemented. This includes the excavation and off-site disposal of contaminated soil, sediment, tanks, and the installation and operation of all planned groundwater treatment systems. All closeout reports were prepared and submitted to the regulators. As noted earlier, another decision document will be prepared for the HFBR.

Remedies have been implemented in accordance with the RODs and the ESD, according to the data presented in the closeout reports and the annual *BNL Groundwater Status Reports*, site inspections, and regulatory interviews. Soil cleanup levels were met and groundwater pump and treat systems have been functioning as intended by the RODs. The cleanup performed continues to meet the remedial action objectives identified in each ROD.

For soil excavation/disposal remedies, work was performed in accordance with the ROD, applicable design documents, and Remedial Action Work Plans. Soil cleanup levels were met for these areas. The remaining work at the former HWMF Waste Loading Area and BGRR will be implemented in accordance with the ROD.

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedies. Soil and groundwater applicable or relevant and appropriate requirements in the RODs and ESD have either been met or are expected to be met. Although there were minor changes to two drinking water standards, arsenic and MTBE, they are not related to contaminants of concern and do not affect the remedies. There is no other information that calls into question the protectiveness of the remedies.

8.0 Issues

Issues are identified in Section 9, Table 7.

9.0 Recommendations and Follow-up Actions

Table 7: Recommendations and Follow-up Actions

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
Document OU I and OU V monitoring and maintenance requirements in one document	Prepare and submit the OU I Soils and OU V Long-Term Monitoring and Maintenance Plan to the regulators	BNL	DOE, EPA, DEC, SCDHS	July 2005 (actual of 8/12/05)	N	N
Some USTs in AOC 12 are not documented as final remedies in a ROD	Document the final remedy for remaining AOC 12 USTs in the g-2/BLIP ROD	BNL	DOE, EPA, DEC, SCDHS	October 2006	N	N
OU I - Animal burrows in Current Landfill cap, and gates broken	Repair current burrows and fix gates	BNL	DOE, EPA, DEC, SCDHS	July 2005 (gates fixed 12/16/05, burrows repaired 2/27/06)	N	N
OU I - Consistent long-term results from Wooded Wetland Monitoring	Evaluate the need to continue the annual sampling or reduce the frequency	BNL	DOE, EPA, DEC, SCDHS	September 2005 (actual of 8/12/05)	N	N
Institutional controls documentation needs updating	Update Land Use Controls Management Plan and web-based database	BNL	DOE, EPA, DEC, SCDHS	September 2005 (Plan updated 6/17/05)	N	Y
OU I - Consistent low VOCs in OU I extraction wells	Implement pulse pumping of treatment system to optimize performance	BNL	DOE, EPA, DEC, SCDHS	October 2005 (actual of 9/6/05)	N	N
OUs III, VI - Deeds not reflecting operating treatment systems	Complete survey/mapping of treatment systems off of BNL property and record updated deeds with County	BNL	DOE, EPA, DEC, SCDHS	June 2005 (Survey/mapping completed 6/30/05)	N	Y
OU III - Consistent low VOCs in WSB extraction wells	Implement pulse pumping of treatment system to optimize performance	BNL	DOE, EPA, DEC, SCDHS	October 2005 (actual of 9/6/05)	N	N
OU III - Consistent low VOCs in IP recirculation well	Implement pulse pumping of UVB-1 to optimize performance	BNL	DOE, EPA, DEC, SCDHS	October 2005 (actual of 10/05)	N	N
OU III - Consistent low VOCs in Airport recirculation wells	Implement pulse pumping of treatment system to optimize performance	BNL	DOE, EPA, DEC, SCDHS	October 2005 (actual of 10/3/05)	N	N
Enhance monitoring well network	Implement changes to various well networks based on 2004 Groundwater Status Report	BNL	DOE, EPA, DEC, SCDHS	October 2005 (actual of 10/05)	N	N
OU V – Restore haul roads	Per the DEC equivalency permit, remove stone/fabric	BNL	DOE, EPA, DEC, SCDHS	September 2005 (actual of 9/30/05)	N	N
Housekeeping	Dispose of miscellaneous monitoring well materials at Meadow Marsh & 650 Outfall, remove Spray Aeration piping and RA V tanks	BNL	DOE, EPA, DEC, SCDHS	August 2005 (Spray Aeration piping removed 1/11/06)	N	N

10.0 Protectiveness Statements

Individual Protectiveness Statements
Protectiveness statement for the individual OUs and the BGRR are presented below:

Operable Unit I: The remedy is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

- The remedy is expected to be protective upon attainment of soil cleanup goals once excavation at the former HWMF Waste Loading Area is complete, and once groundwater cleanup goals are met, which is expected to require 30 years or less to achieve. The decontamination of the Merrimack hole at the former HWMF will be complete in July 2006. In the interim, exposure pathways that could result in unacceptable risks are being controlled. Institutional controls are preventing exposure to, or the ingestion of, contaminated groundwater and soil. Contamination within OU I has been addressed through excavation of contaminated soil including disposal pits, capping of landfills, the installation of fencing and signs, and the implementation of specific institutional controls for soil and groundwater.
- Long-term protectiveness of the remedy will be verified by monitoring the movement and remediation of the plume. Current monitoring data indicate that the remedies are effective and they are functioning as required to achieve the groundwater cleanup goals.

Operable Unit II: Remedial actions for the AOCs in this OU are documented in the OU I and OU III RODs, except for BLIP and the g-2 tritium plume, which will be documented in a subsequent ROD. Since there is no ROD or remedial action for this OU, a protectiveness statement cannot be prepared. A protectiveness statement for the g-2, BLIP, UST AOCs will be prepared during the second Five-Year Review, following the issuance of a ROD.

Operable Unit III: The remedy is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals. In the interim, exposure pathways that could result in unacceptable risks are being controlled.

- All soil cleanup actions are complete and all groundwater treatment systems are operational or in standby mode. The attainment of groundwater cleanup goals is expected to require:
  - 30 years or less to achieve MCLs for VOCs and tritium in the Upper Glacial aquifer,
  - 40 years and 70 years or less to achieve MCLs for Sr-90 at the former Chemical Holes plume and the BGRR/WCF plumes, respectively, and
  - 65 years or less to achieve MCLs for VOCs in the Magothy aquifer.
- Exposure pathways that could result in unacceptable risks are being controlled. Site-specific institutional controls are preventing exposure to contaminated groundwater and soil.

Long-term protectiveness of the remedies will be verified by continuing to monitor the movement and remediation of the plumes. Current monitoring data indicate that the remedies are functioning as required to achieve the groundwater cleanup goals.

Operable Unit IV: The remedy is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals. In the interim, exposure pathways that could result in unacceptable risks are being controlled.

- The groundwater cleanup goals have been met for the VOCs/SVOCs present at the 1977 spill site, and the treatment system has been dismantled. Institutional controls are preventing exposure to contaminated soil and groundwater. All threats at the site have been addressed through the installation of fencing and warning signs, and the implementation of institutional controls.
- Long-term protectiveness of the remedial action will be verified by obtaining additional groundwater samples to fully evaluate potential migration of the Sr-90 plume downgradient of the source area. Current data indicate that the Sr-90 plume remains in the OU IV area and that the remedy is functioning as required to achieve groundwater cleanup goals.

Operable Unit V: The remedy currently protects human health and the environment because the contaminated soil at the STP filter beds and contaminated sediment in the Peconic River have been excavated to meet the appropriate cleanup levels. Revegetation of remediated areas has been completed. However, for the remedy to be protective in the long-term, the monitoring program must demonstrate the effectiveness of the Peconic River cleanup to mitigate potential ecological effects.

- The soil cleanup goals for the STP filter beds/berms have been met.
- All potential threats have been addressed through excavation of contaminated sediment, and the implementation of specific institutional controls for fish, soil/sediment, and groundwater.
- Long-term protectiveness of the remedy will be verified by continuing to monitor the sediment, surface water, fish, and revegetation. A long-term monitoring plan has been prepared. Similar to the other OUs, in addition to periodic reporting of the analytical results, the monitoring data will be evaluated during subsequent five-year reviews to evaluate the effectiveness of the remedy in meeting the cleanup and restoration objectives. The potential need for additional actions will also be evaluated.

Operable Unit VI: The remedy is expected to be protective of human health and the environment upon attainment of the groundwater cleanup goals. In the interim, exposure pathways that could result in unacceptable risks are being controlled.

- The EDB groundwater treatment system is operational. The attainment of groundwater cleanup goals is expected to require 30 years or less to achieve MCLs for EDB in the Upper Glacial aquifer.
- Exposure pathways that could result in unacceptable risks (e.g., off-site potable water supply) are being controlled and site-specific institutional controls are preventing exposure to, or the ingestion of, contaminated groundwater.

BGRR: The completed remedy is expected to be protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

- The remedy is expected to be protective upon completion of the pile and bioshield removal and installation of the final engineered cap. In the interim, exposure pathways that could result in unacceptable risks are being controlled. Institutional controls are preventing exposure to contaminated structures, soil, and groundwater.
- All threats at the site are being addressed through removal or stabilization of the radiological inventory, excavation of contaminated soil, infiltration management, the installation of signs, and the implementation of specific institutional controls for the structure, soil and groundwater.
- Long-term protectiveness of the remedy will be verified by continuing to perform health and safety monitoring, periodic structural inspections of Building 701, water intrusion monitoring, preventive maintenance and the infiltration management system, and groundwater monitoring required as part of the OU III ROD and the ESD.

Comprehensive Protectiveness Statement
A comprehensive sitewide protectiveness determination covering all the OUs and BGRR must be reserved at this time because:

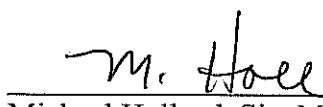
- Construction is not complete for OU I former HWMF Waste Loading Area soils, and the BGRR pile, bioshield, and final engineered cap.
- The final remedy for the g-2 Tritium Plume, BLIP, and USTs (AOCs 16T, 16K, and 12) has not yet been selected. The ROD is due for submittal to the regulators in the fall of 2006.

11.0 Next Review

The second sitewide Five-Year Review for BNL will be submitted within five years of issuance of this final Report. This will include all OUs, including the g-2 Tritium Plume, the BLIP, and USTs ROD (AOCs 16T, 16K, and 12). A comprehensive sitewide protectiveness determination will be included at that time.

Rodrigo V. Rimando, Brookhaven Project Director
Office of Environmental Management
U.S. Department of Energy

July 13, 2006
Date



Michael Holland, Site Manager
Brookhaven Site Office
U.S. Department of Energy

7/13/06
Date

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Figures

(Figures 1 through 7)

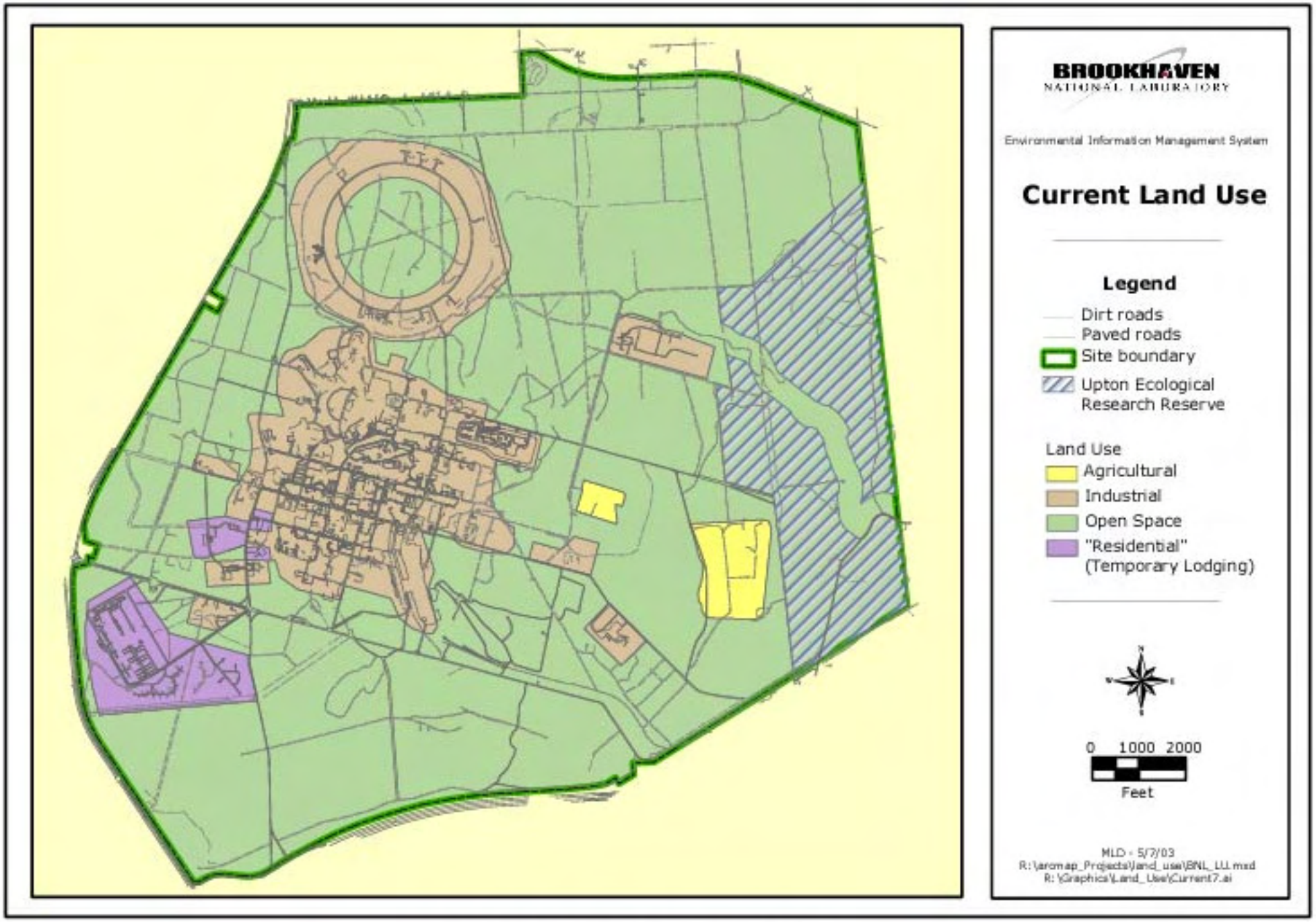
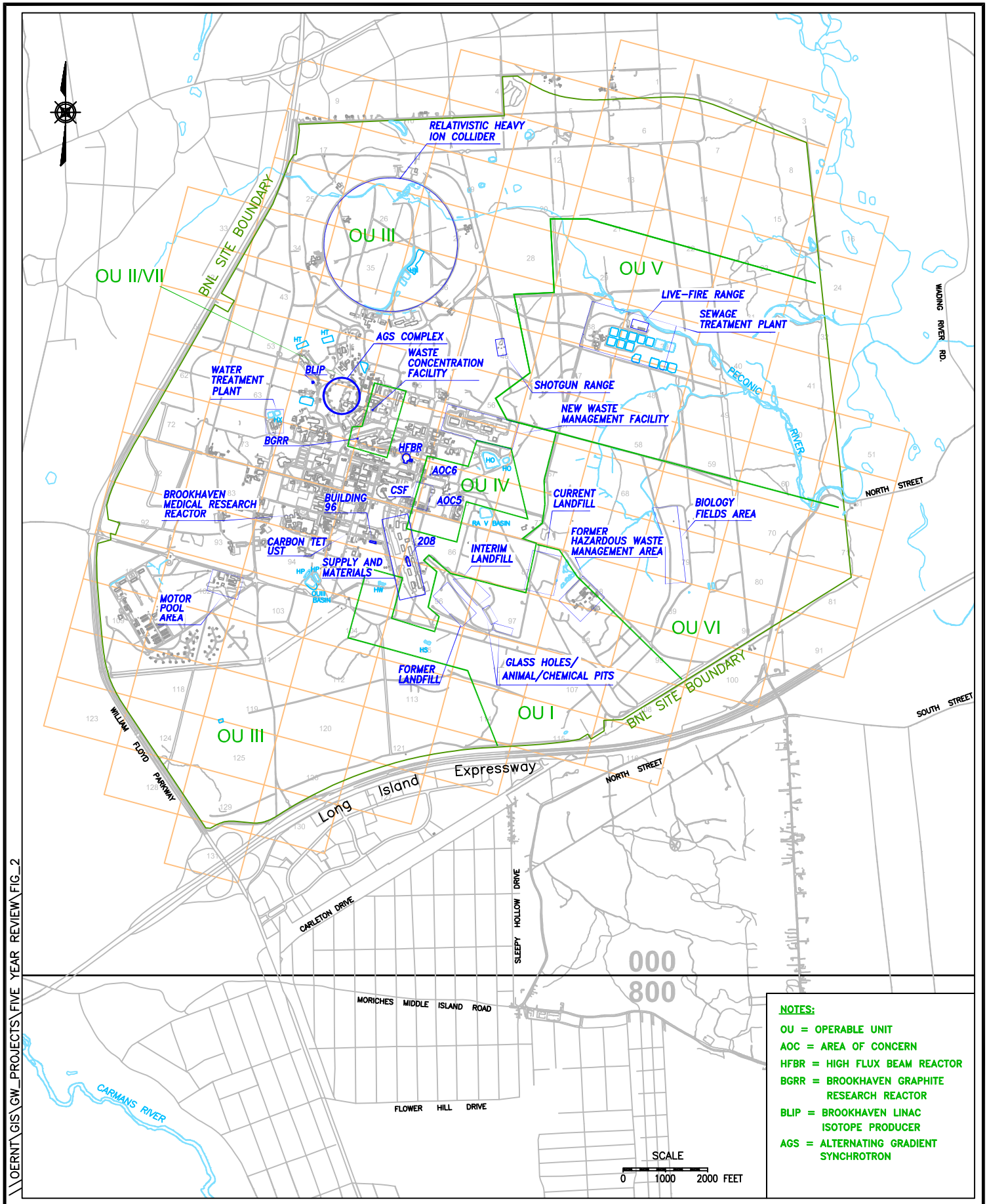


FIGURE 1 - BNL Current Land Use



\\OERNT\GIS\GW_PROJECTS\FIVE YEAR REVIEW\FIG_2

NOTES:

OU = OPERABLE UNIT
AOC = AREA OF CONCERN
HFBR = HIGH FLUX BEAM REACTOR
BGRR = BROOKHAVEN GRAPHITE RESEARCH REACTOR
BLIP = BROOKHAVEN LINAC ISOTOPE PRODUCER
AGS = ALTERNATING GRADIENT SYNCHROTRON

BROOKHAVEN NATIONAL LABORATORY
EWMS DIVISION

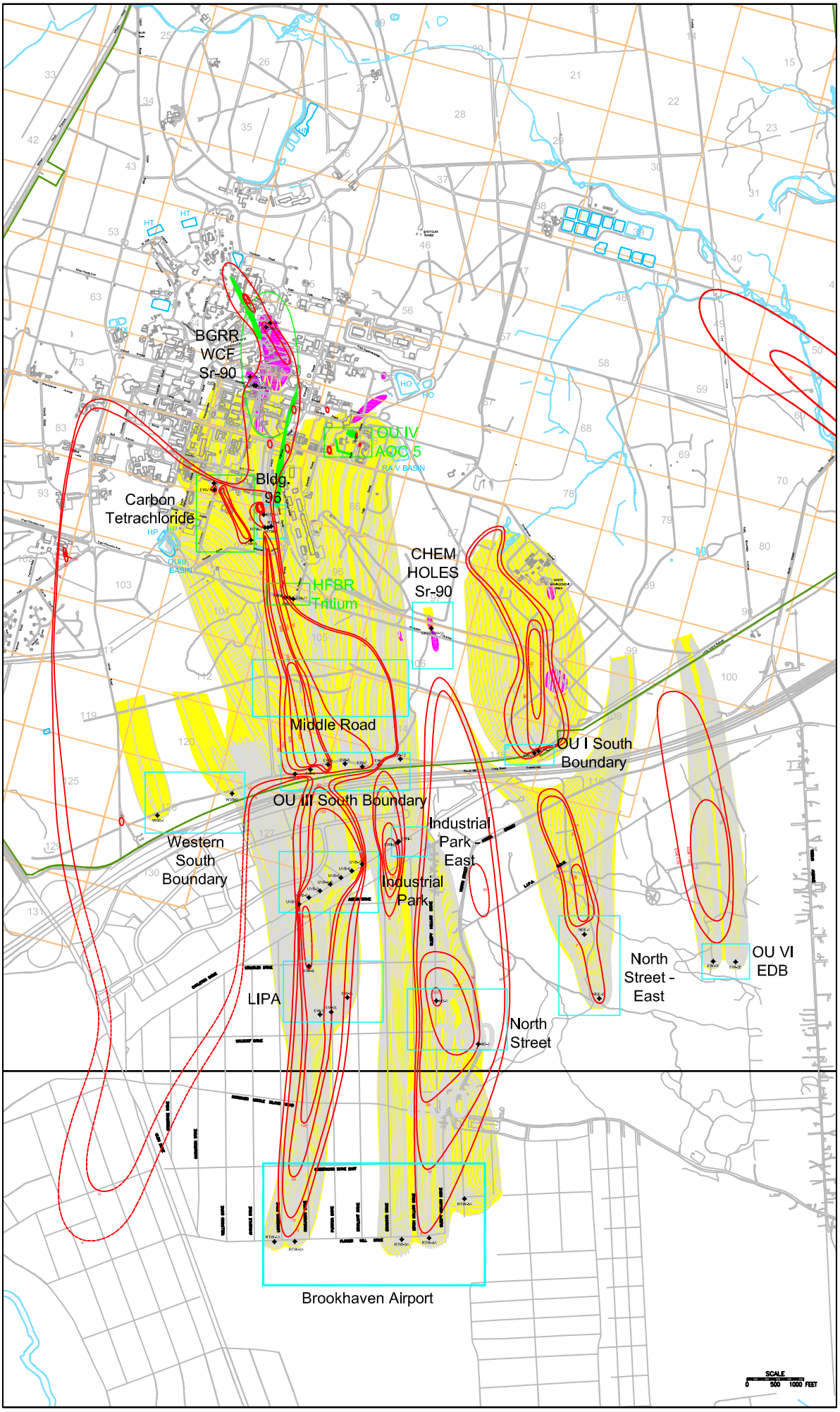
TITLE:

OPERABLE UNIT LOCATIONS

BNL FIVE-YEAR REVIEW

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
YS	–	06/7/05	07926
CHKD:	APPD:	REV.:	NOTES:
JEB	–	–	–

FIGURE NO.: 2



BROOKHAVEN NATIONAL LABORATORY

EWMS DIVISION

2004 BNL GROUNDWATER STATUS REPORT

07/13/05

FIGURE: 3

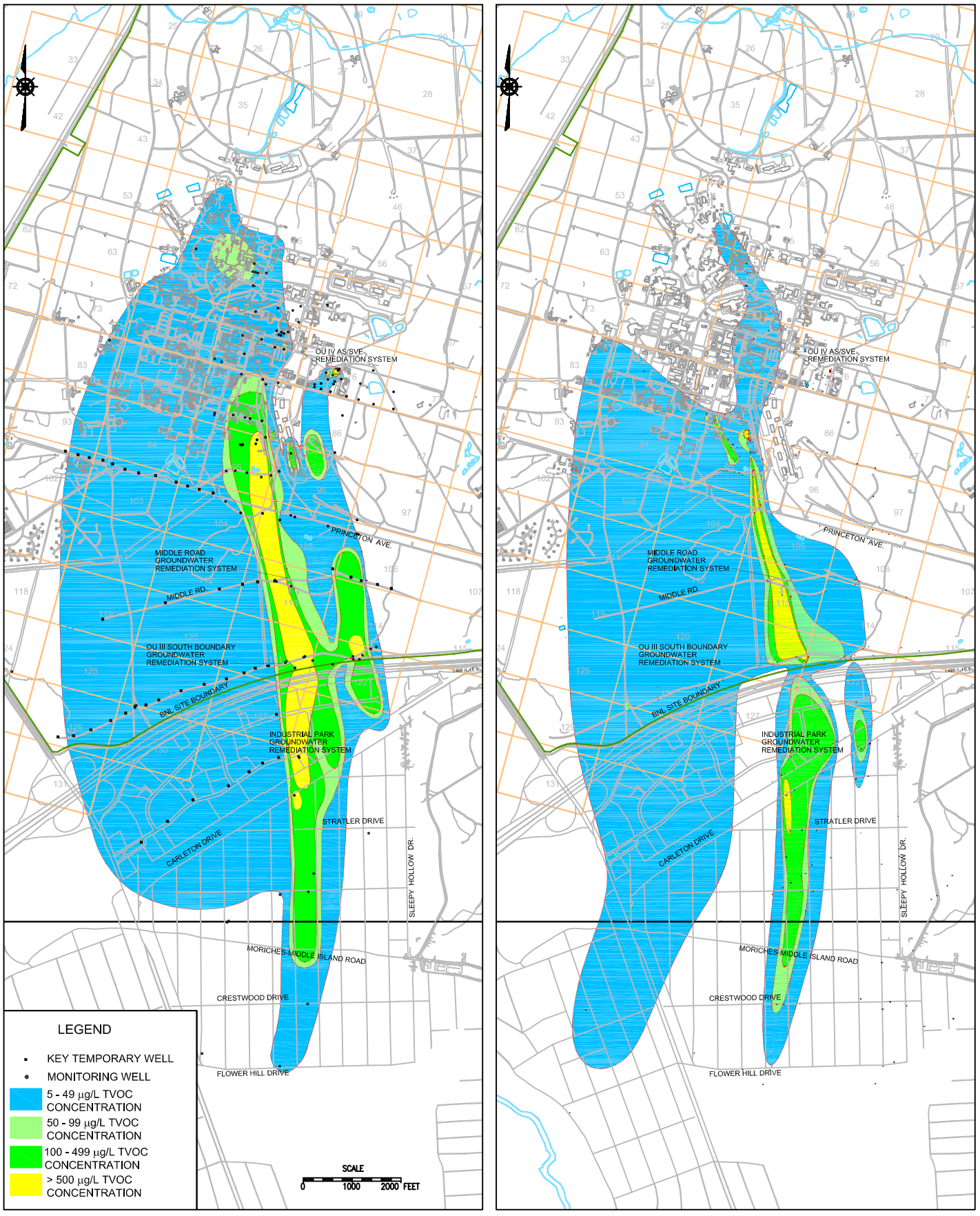
OPERATING AND PLANNED GROUNDWATER REMEDIATION SYSTEMS

LEGEND

- 32 — BNL GRID NUMBER
- EW-12 — BNL REMEDIATION WELL
- PROPOSED BNL REMEDIATION WELL
- BNL-12 — BNL SUPPLY / PROCESS WELL
- OPERATING REMEDIATION SYSTEMS
- REMEDIATION SYSTEM PLACED IN STANDBY MODE
- PLANNED REMEDIATION SYSTEMS
- GROUNDWATER REMEDIATION SYSTEM CAPTURE ZONES
- 2004 TVOC PLUME UNLESS SPECIFIED. CONCENTRATION AS INDICATED. (DASHED WHERE INFERRED)
- 2004 TRITIUM PLUME. OUTLINE IS 20,000 PCI/L.
- 2004 STRONTIUM 90 PLUME. OUTLINE IS 8 PCI/L.

1997 TVOC PLUME DISTRIBUTION

2004 TVOC PLUME DISTRIBUTION



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BROOKHAVEN NATIONAL LABORATORY

EWMS DIVISION

TITLE:

OU III/ OU IV/NORTH STREET TVOC PLUME COMPARISON 1997 – 2004

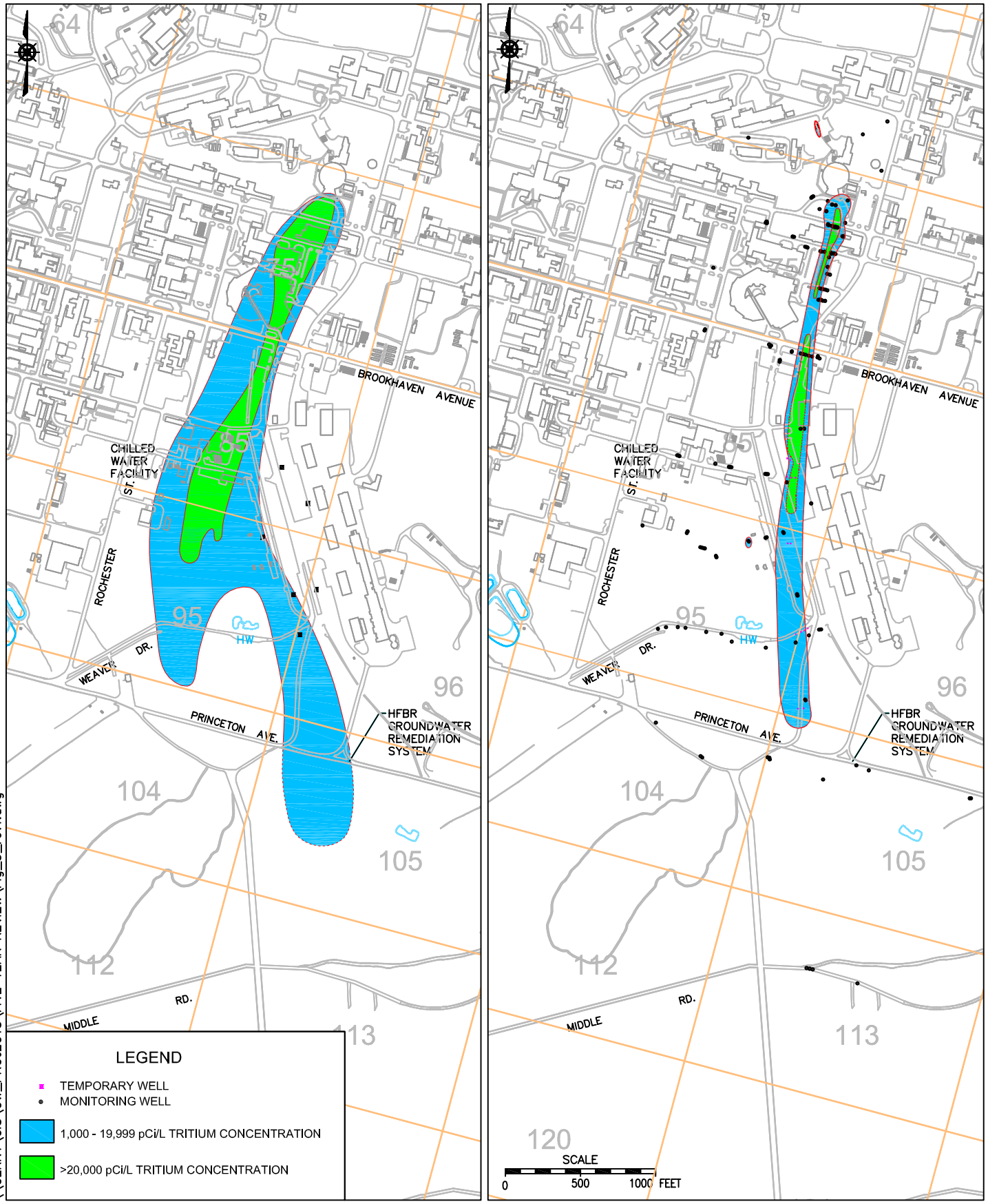
BNL FIVE-YEAR REVIEW

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
SRW	–	06/14/05	07926
CHKD:	APPD:	REV.:	NOTES:
JEB	WRD	–	–

FIGURE NO.: 4

1997 TRITIUM PLUME DISTRIBUTION

2004 TRITIUM PLUME DISTRIBUTION



\\OERNT\GIS\GW_PROJECTS\FIVE YEAR REVIEW\Fig_5_rev1.dwg

BROOKHAVEN NATIONAL LABORATORY

EWMS DIVISION

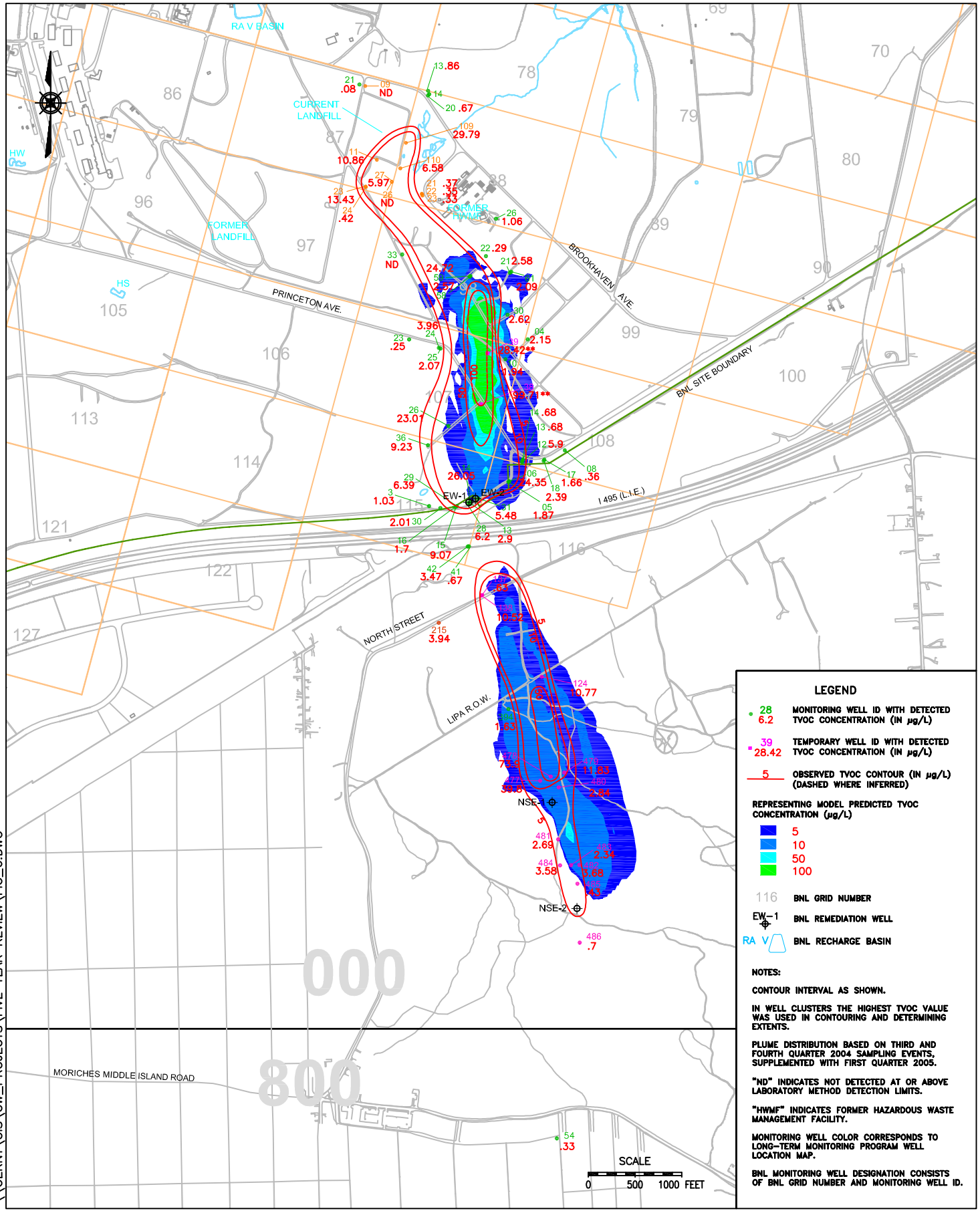
TITLE:

OU III HFBR AOC29
TRITIUM PLUME COMPARISON
1997 – 2004

BNL FIVE-YEAR REVIEW

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
SRW	–	06/14/05	07926
CHKD:	APPD:	REV.:	NOTES:
JEB	WRD	–	–

FIGURE NO.: 5



\\OERNT\GIS\GW_PROJECTS\FIVE YEAR REVIEW\FIG_6.DWG

BROOKHAVEN NATIONAL LABORATORY
EWMS DIVISION

TITLE:
OU I SOUTH BOUNDARY MODEL VS. OBSERVED (12/04) TVOC PLUME DISTRIBUTION
BNL FIVE-YEAR REVIEW

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
DBB	–	06/7/05	07926
CHKD:	APPD:	REV.:	NOTES:
JEB	–	–	–

FIGURE NO.: 6

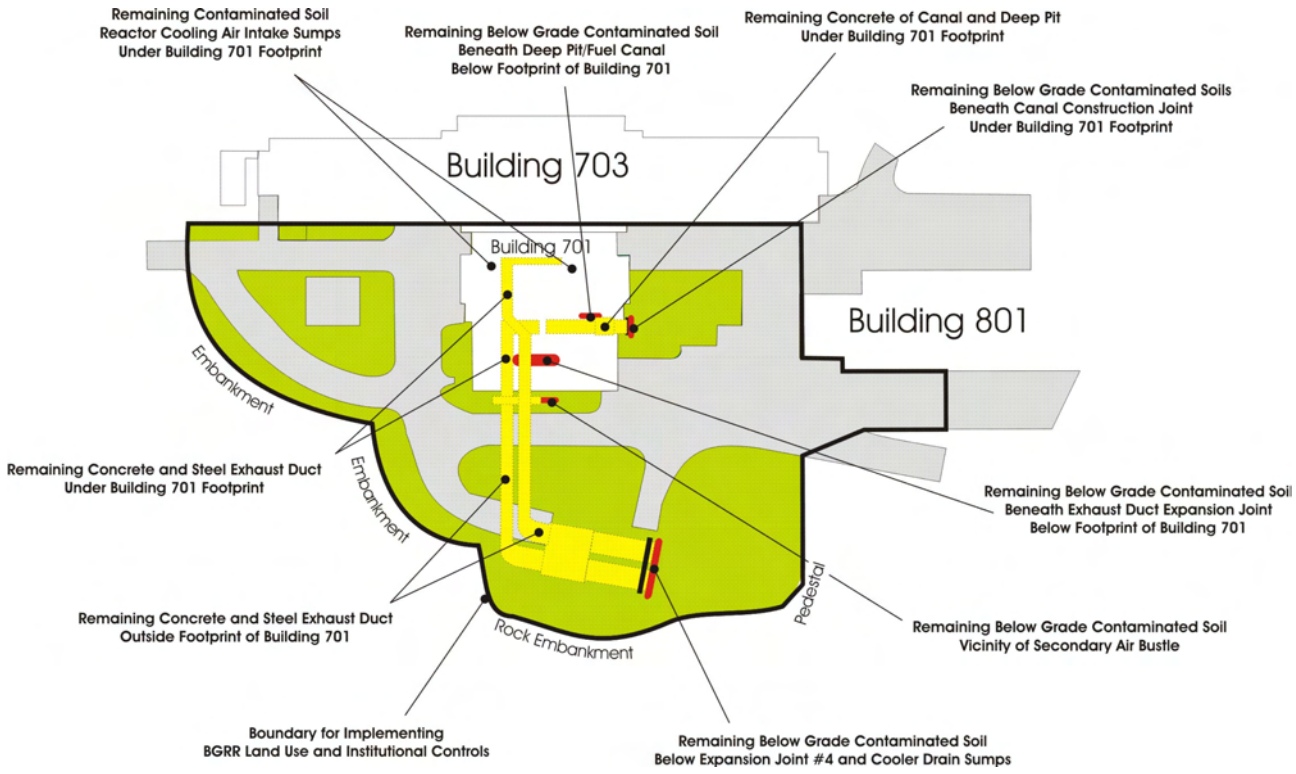
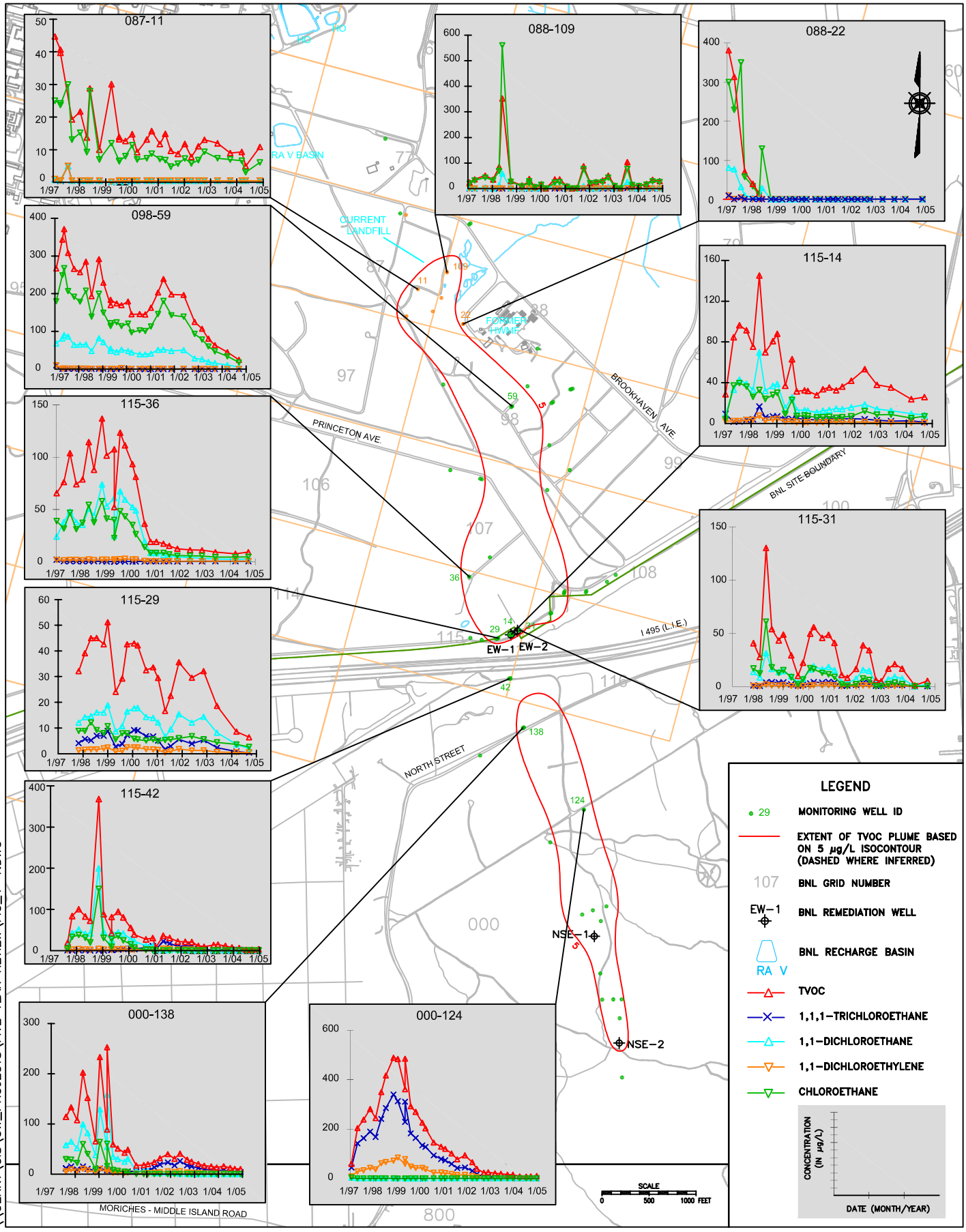


Figure 7. BGRR Complex - Land Use and Institutional Controls Area.

Attachment 1

Trend Figures for Key Groundwater Monitoring Wells

(Figures 1-1 through 1-14)



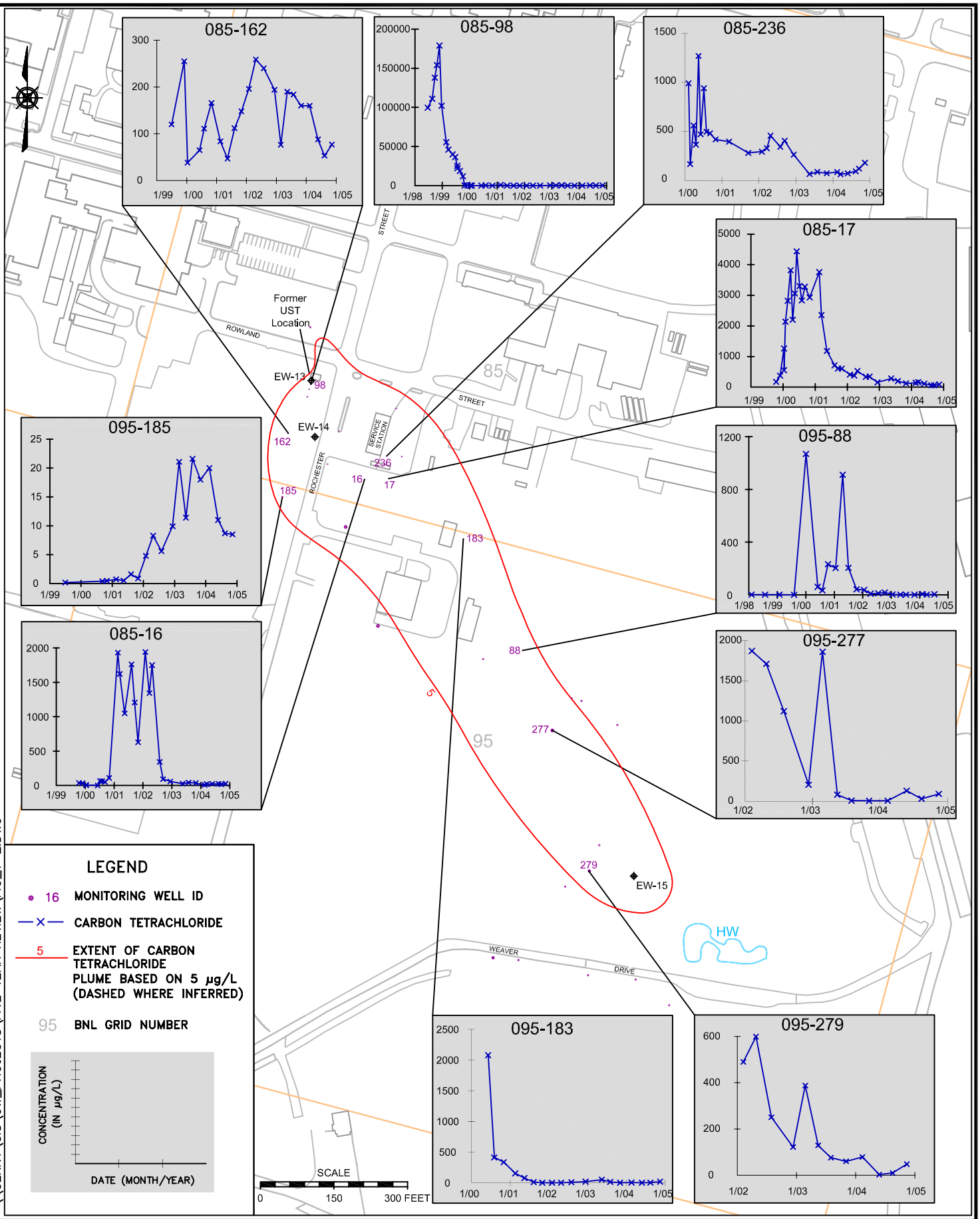
\\OERNT\GIS\GW_PROJECTS\FIVE YEAR REVIEW\FIG_1-1.DWG

BROOKHAVEN NATIONAL LABORATORY
EWMS DIVISION

TITLE:
OU I CURRENT LANDFILL/ SOUTH BOUNDARY/ NORTH STREET EAST HISTORICAL VOC TRENDS
BNL FIVE-YEAR REVIEW

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
YS	–	06/14/05	07926
CHKD:	APPD:	REV.:	NOTES:
JEB	–	–	–

FIGURE NO.: 1-1



BROOKHAVEN NATIONAL LABORATORY

EWMS DIVISION

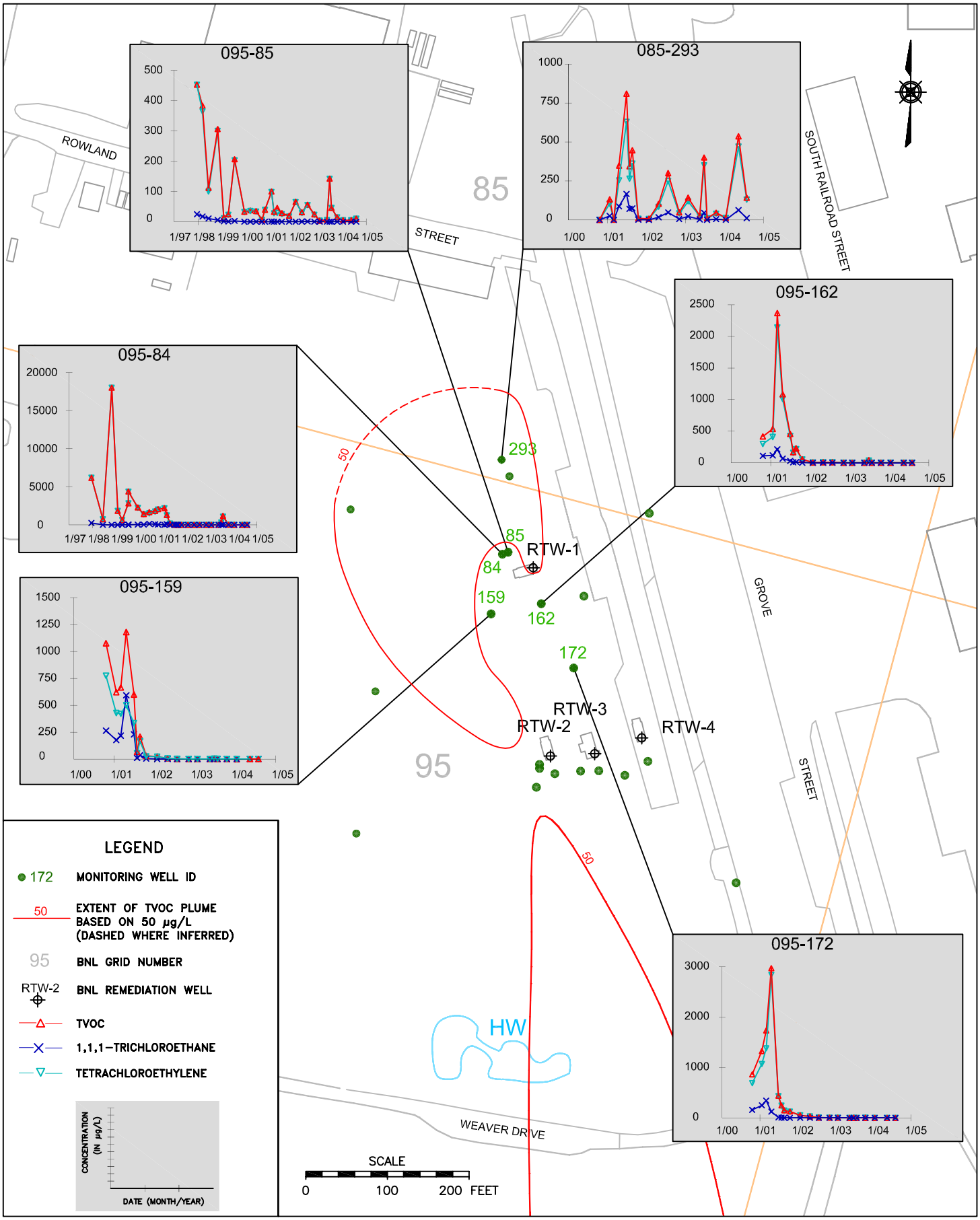
TITLE:

OU III CARBON TETRACHLORIDE HISTORICAL TRENDS

BNL FIVE-YEAR REVIEW

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
YS	–	06/7/05	07926
CHKD:	APPD:	REV.:	NOTES:
JEB	–	–	

FIGURE NO.: 1-2



\\OERNT\GIS\GW_PROJECTS\FIVE YEAR REVIEW\FIG_1-3

BROOKHAVEN NATIONAL LABORATORY

EWMS DIVISION

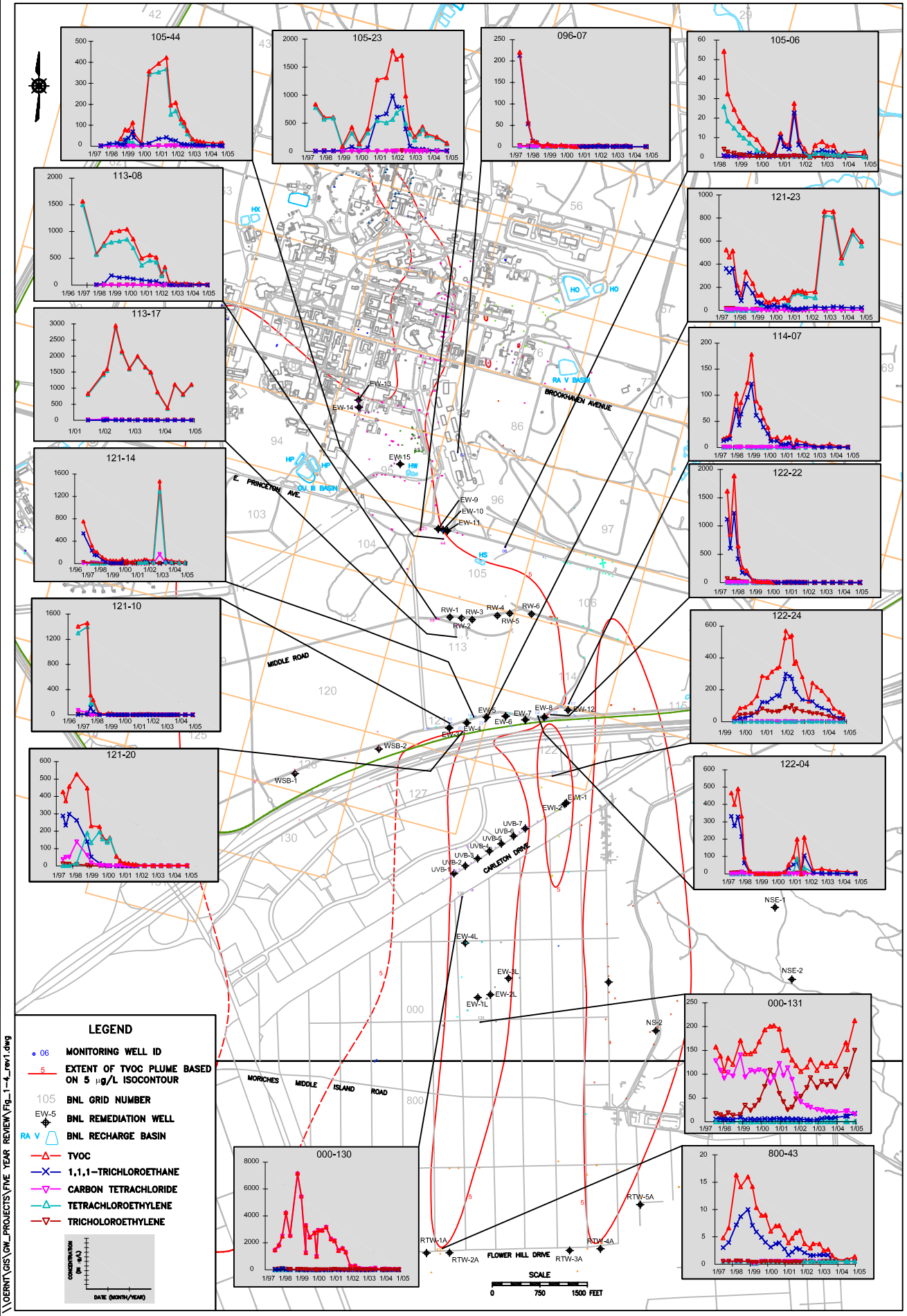
TITLE:

OU III BUILDING 96 AREA HISTORICAL VOC TRENDS

BNL FIVE-YEAR REVIEW

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
YS	–	06/7/05	07926
CHKD:	APPD:	REV.:	NOTES:
JEB	–	–	–

FIGURE NO.: 1-3



BROOKHAVEN NATIONAL LABORATORY

EWMS DIVISION

TITLE:

OU III AND OU IV PLUME(S) HISTORICAL VOC TRENDS

BNL FIVE-YEAR REVIEW

DWN:	VT:HZ.:	DATE:	PROJECT NO.:
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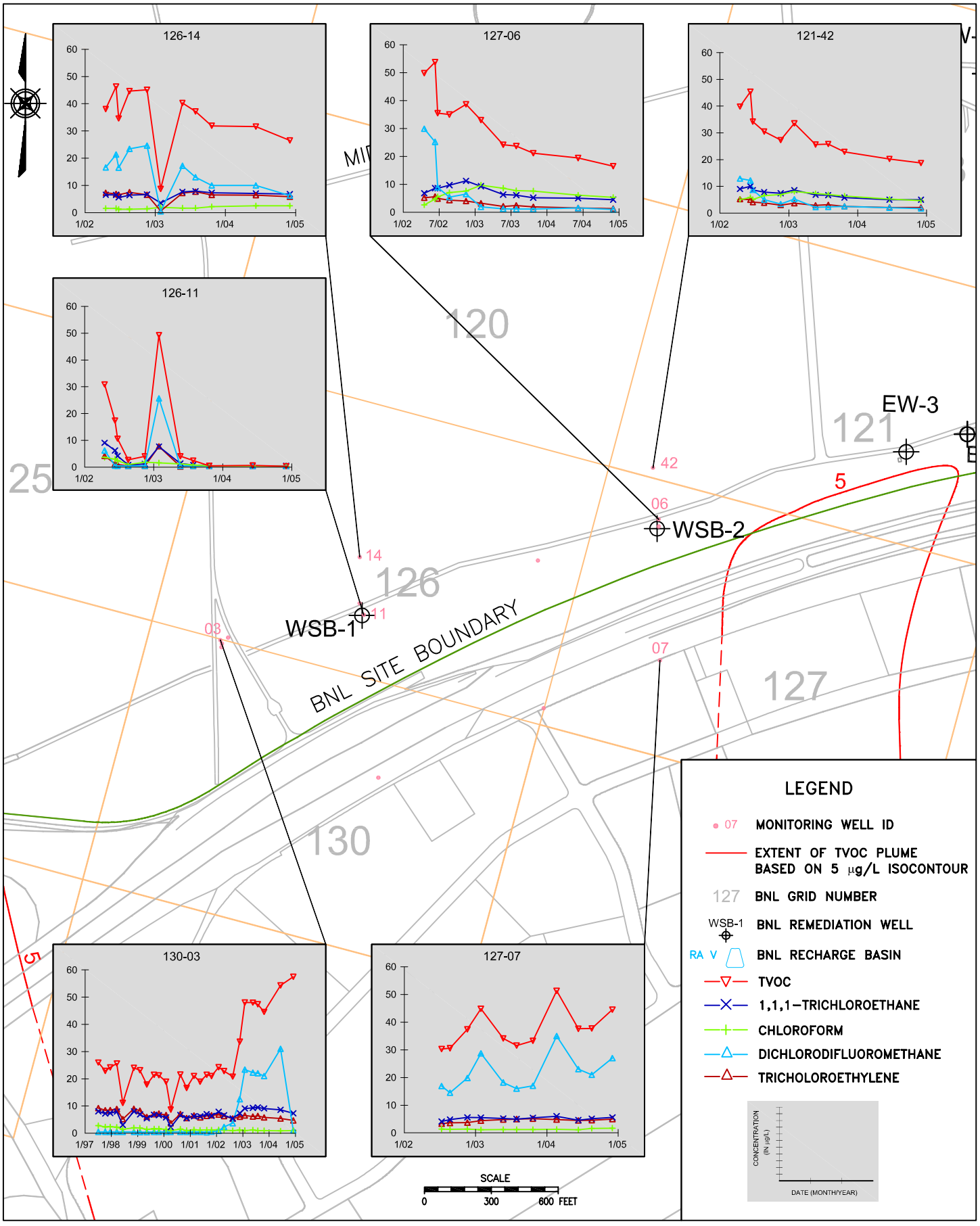
CHKD:	APPD:	REV.:	NOTES:
JEB	WRD	–	–
FIGURE NO.:			
1–4			



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BROOKHAVEN NATIONAL LABORATORY

EWMS DIVISION

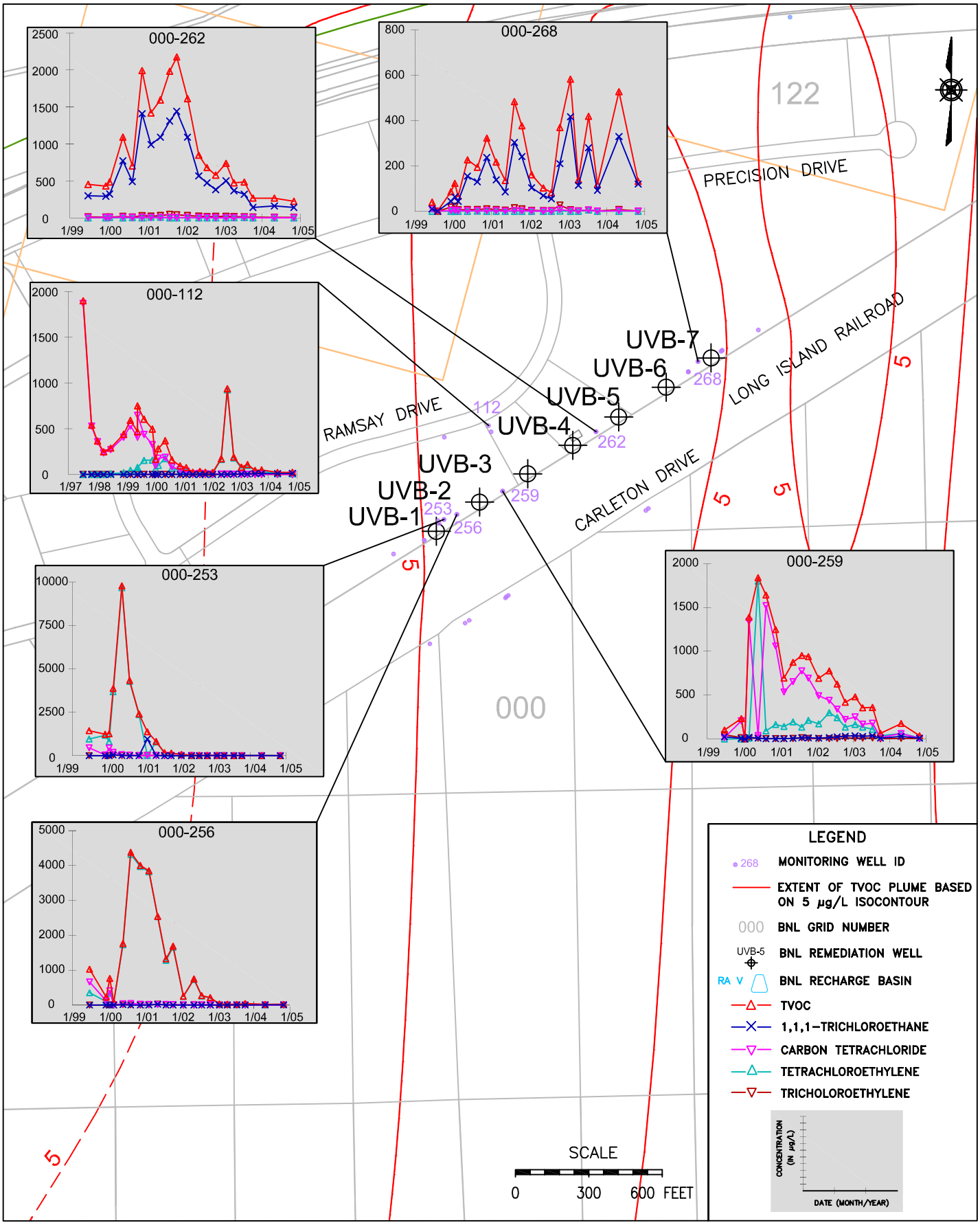
TITLE:

OU III WESTERN SOUTH BOUNDARY HISTORIC VOC TRENDS

BNL FIVE-YEAR REVIEW

DWN:	VT:HZ.:	DATE:	PROJECT NO.:
YS	–	06/14/05	07926
CHKD:	APPD:	REV.:	NOTES:
JEB	WRD	–	–

FIGURE NO.: 1-5



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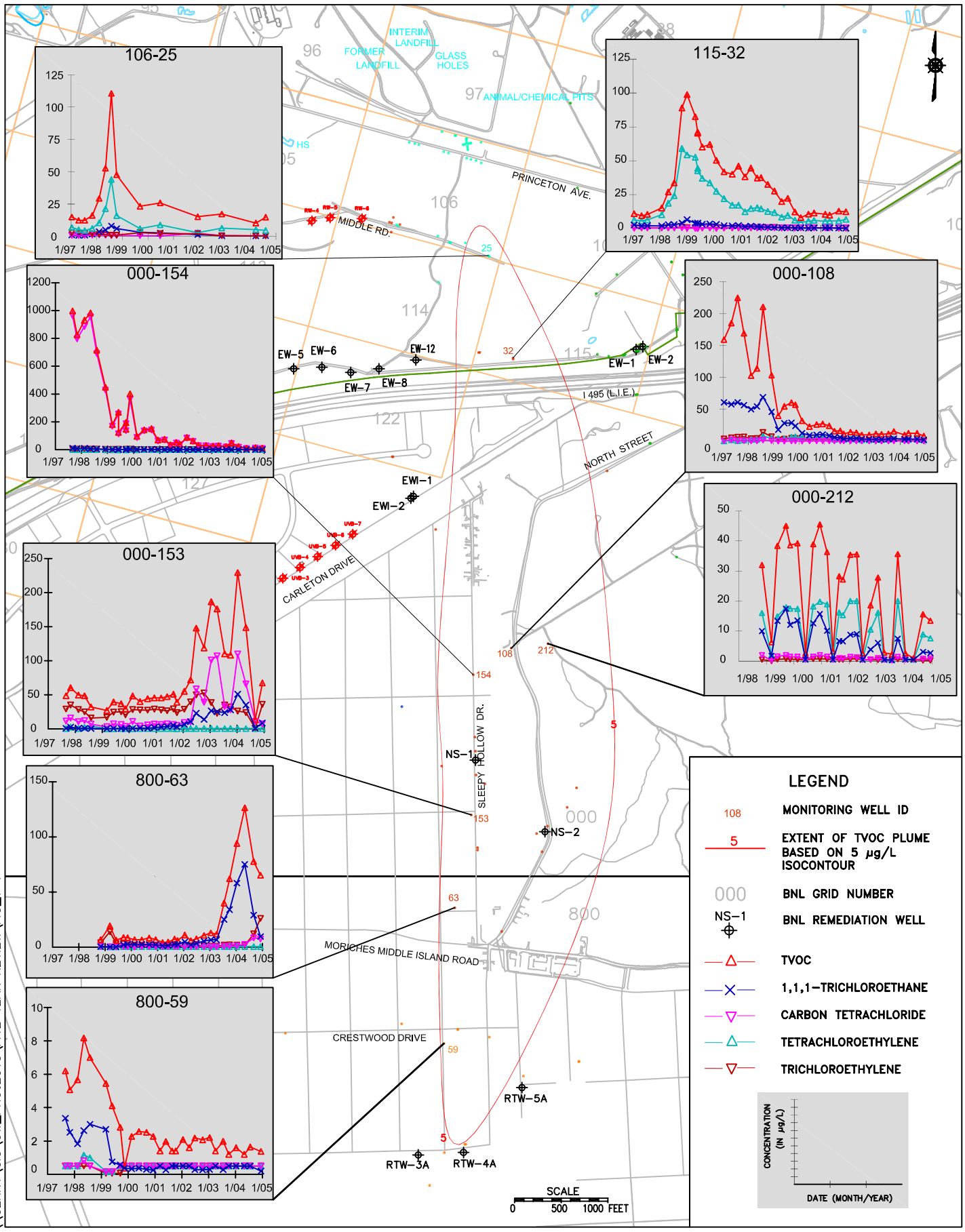
BROOKHAVEN NATIONAL LABORATORY
EWMS DIVISION

TITLE:
OU III INDUSTRIAL PARK HISTORICAL VOC TRENDS
BNL FIVE-YEAR REVIEW

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
YS	–	06/14/05	07926
CHKD:	APPD:	REV.:	NOTES:
JEB	WRD	–	–

FIGURE NO.: 1-6



\\OERNT\GIS\GW_PROJECTS\FIVE YEAR REVIEW\FIG_1-7

BROOKHAVEN NATIONAL LABORATORY

EWMS DIVISION

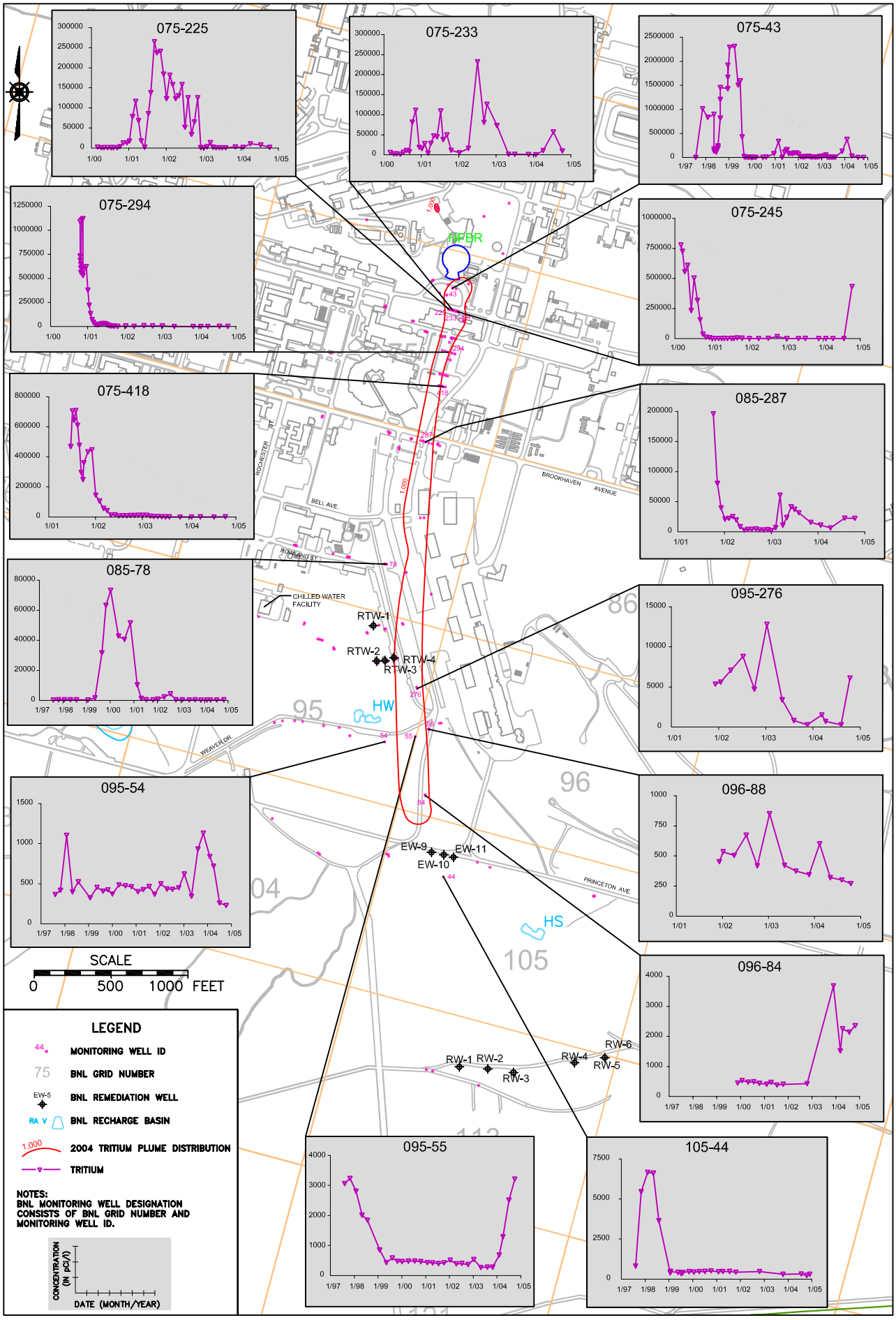
TITLE:

NORTH STREET (OU I/IV FORMER LANDFILL, ANIMAL/CHEMICAL PITS AND GLASS HOLES) HISTORICAL VOC TRENDS

BNL FIVE-YEAR REVIEW

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
YS	–	06/7/05	07926
CHKD:	APPD:	REV.:	NOTES:
JEB	–	–	–

FIGURE NO.: 1-7



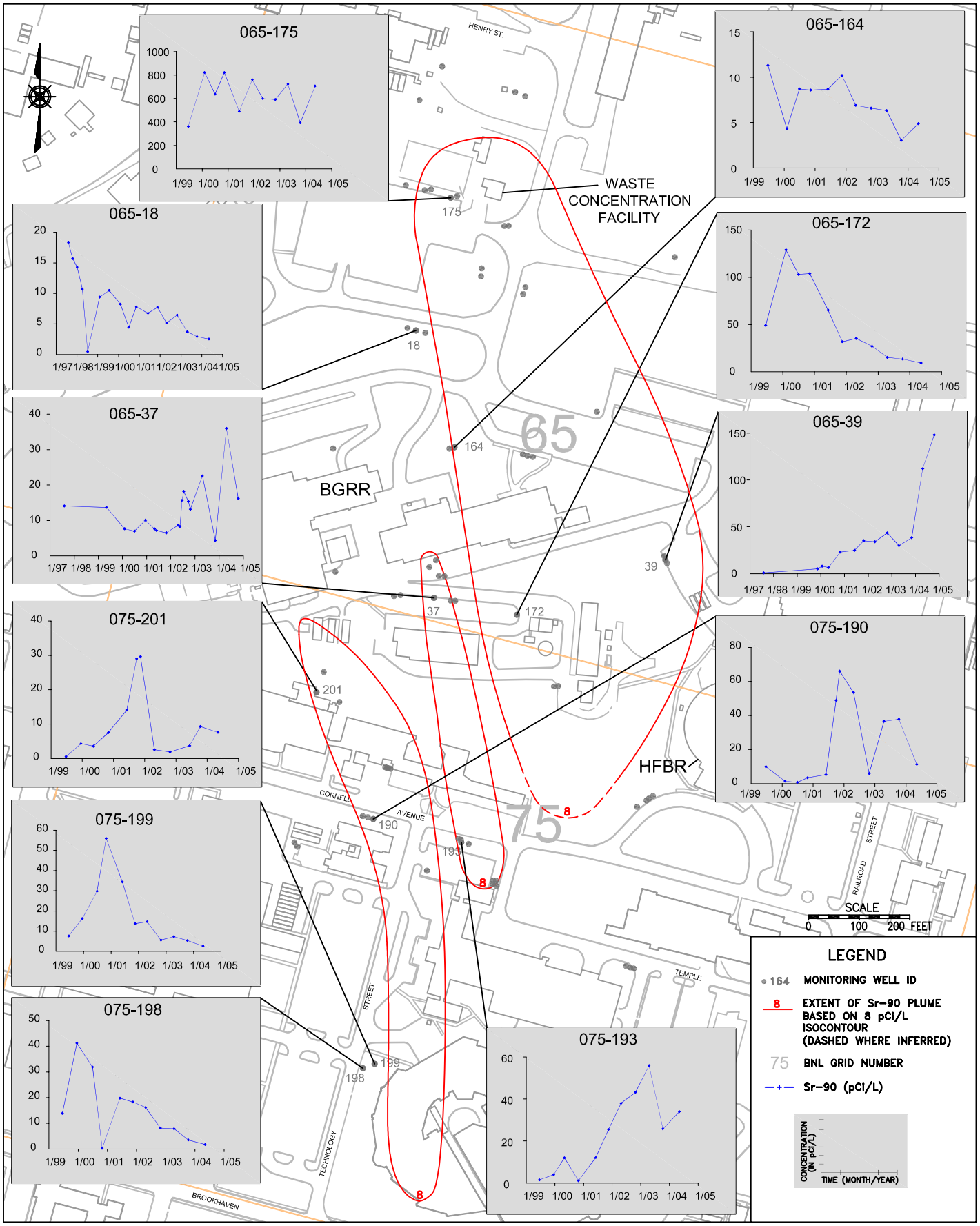
\\CERNT\GIS\GW_PROJECTS\FIVE YEAR REVIEW\FIG_1-8.DWG

BROOKHAVEN NATIONAL LABORATORY
EWMS DIVISION

TITLE:

OU III HFBR AOC 29
HISTORICAL TRITIUM TRENDS
BNL FIVE-YEAR REVIEW

DWN:	VS:HS.:	DATE:	PROJECT NO.:
SRW	–	06/7/05	07926
CHKD:	APPD:	REV.:	NOTES:
–	–	–	–
FIGURE NO.:			
1–8			



\\OERNT\GIS\GW_PROJECTS\FIVE YEAR REVIEW\FIG_1-9.DWG

BROOKHAVEN NATIONAL LABORATORY

EWMS DIVISION

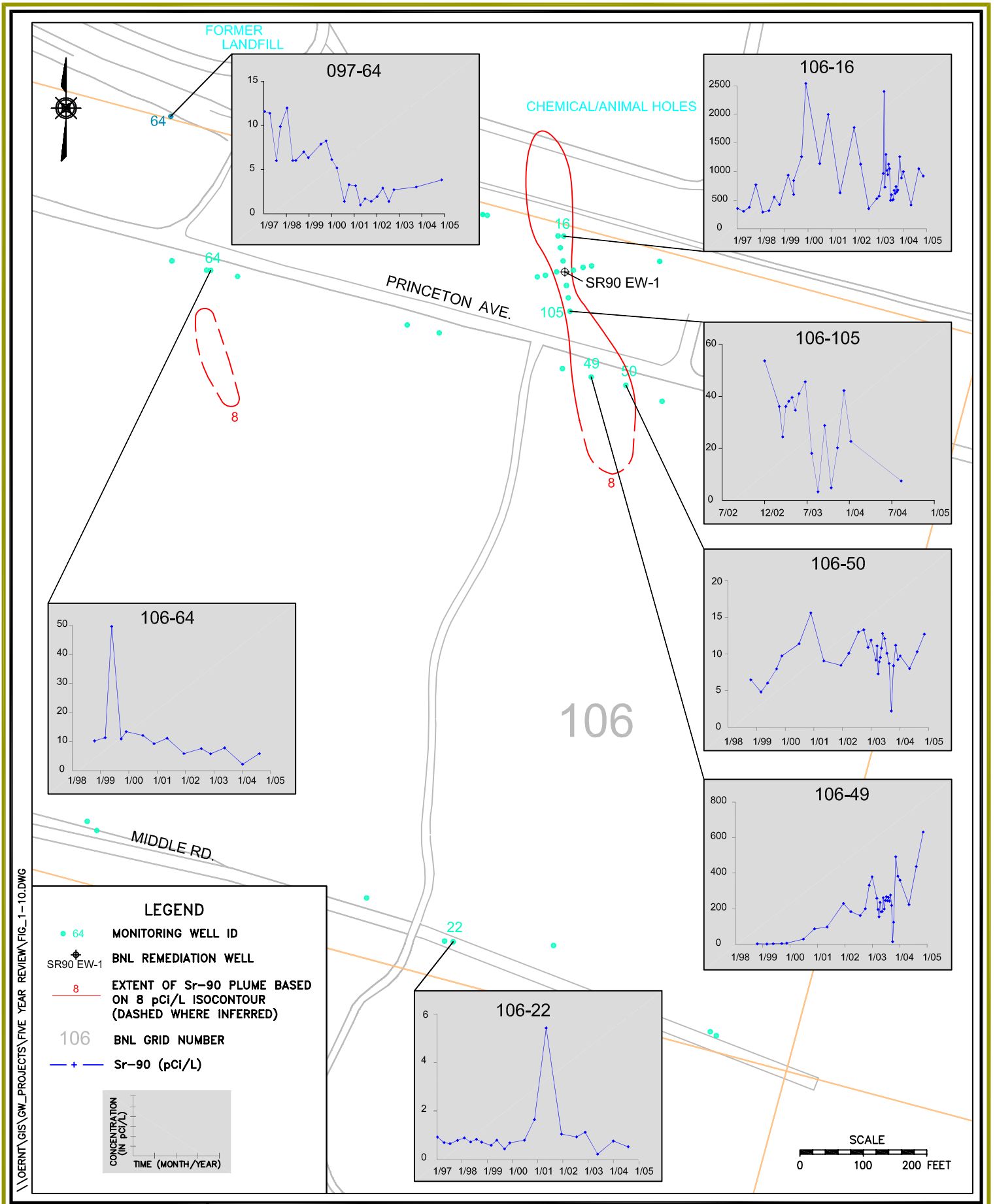
TITLE:

OU III BGRR/WCF HISTORICAL Sr-90 TRENDS

BNL FIVE-YEAR REVIEW

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
YS	–	06/8/05	07926
CHKD:	APPD:	REV.:	NOTES:
JEB	–	–	–

FIGURE NO.: 1-9



BROOKHAVEN NATIONAL LABORATORY

EWMS DIVISION

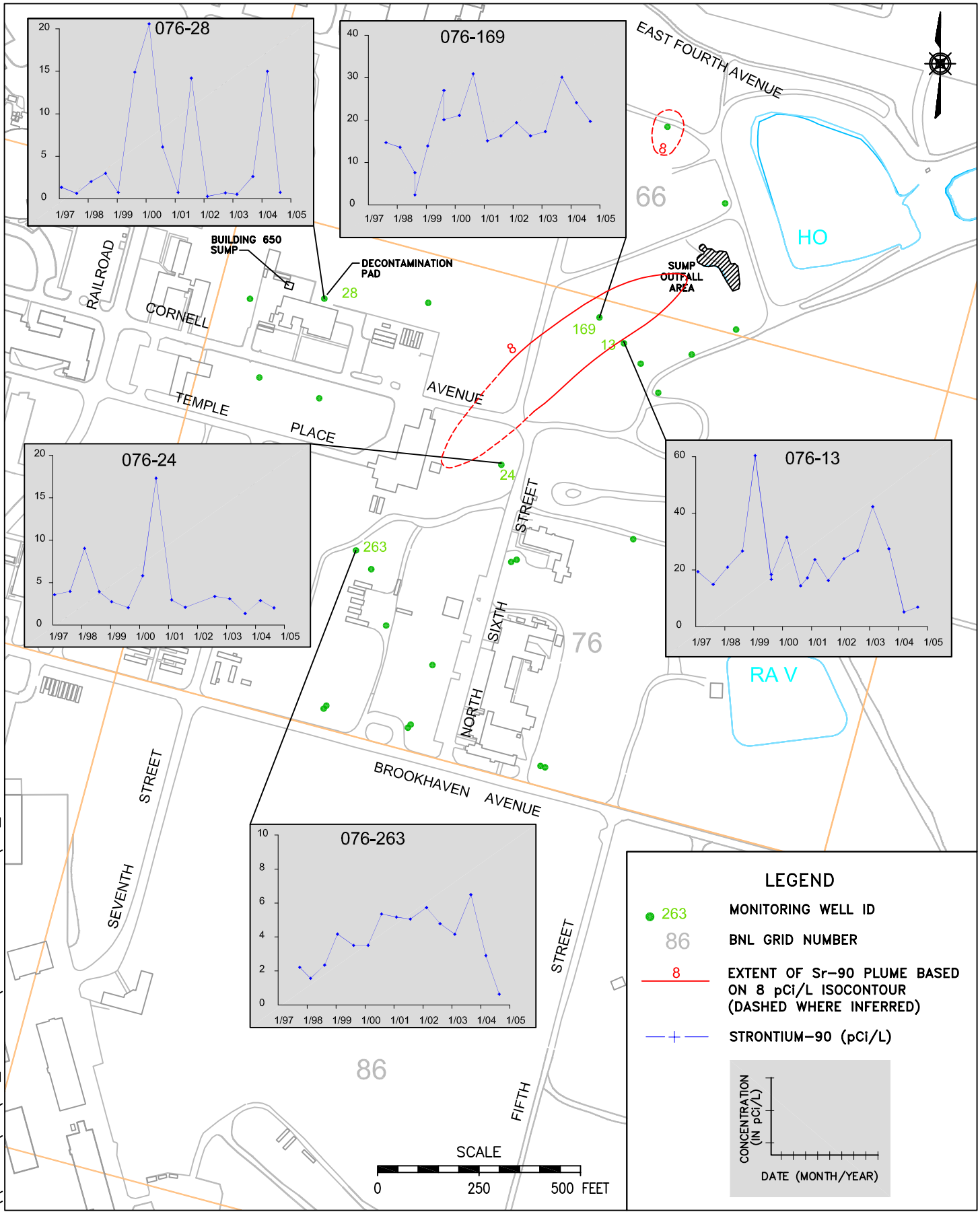
TITLE:

OU III CHEMICAL/ANIMAL HOLES HISTORICAL Sr-90 TRENDS

BNL FIVE-YEAR REVIEW

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
YS	–	06/8/05	07926
CHKD:	APPD:	REV.:	NOTES:
JEB	–	–	–

FIGURE NO.: 1-10



\\OERNT\GIS\GW_PROJECTS\FIVE YEAR REVIEW\FIG_1-11.DWG

BROOKHAVEN NATIONAL LABORATORY

EWMS DIVISION

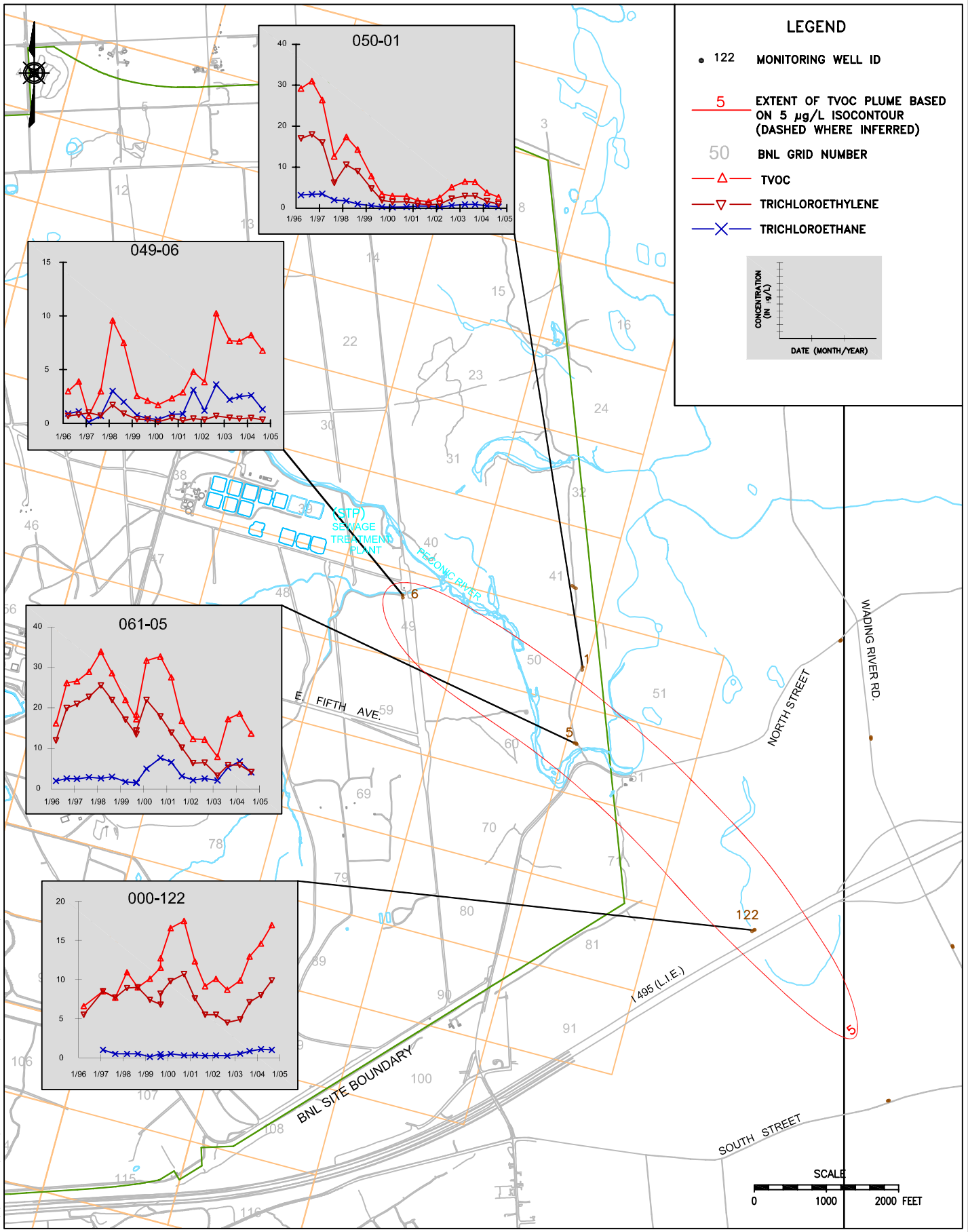
TITLE:

OU IV AOC 6
HISTORICAL Sr-90 TRENDS

BNL FIVE-YEAR REVIEW

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
SRW	–	06/7/05	07926
CHKD:	APPD:	REV.:	NOTES:
JEB	–	–	–

FIGURE NO.: 1-11



\\OERNT\GIS\GW_PROJECTS\FIVE YEAR REVIEW\FIG_1-12.DWG

BROOKHAVEN NATIONAL LABORATORY

EWMS DIVISION

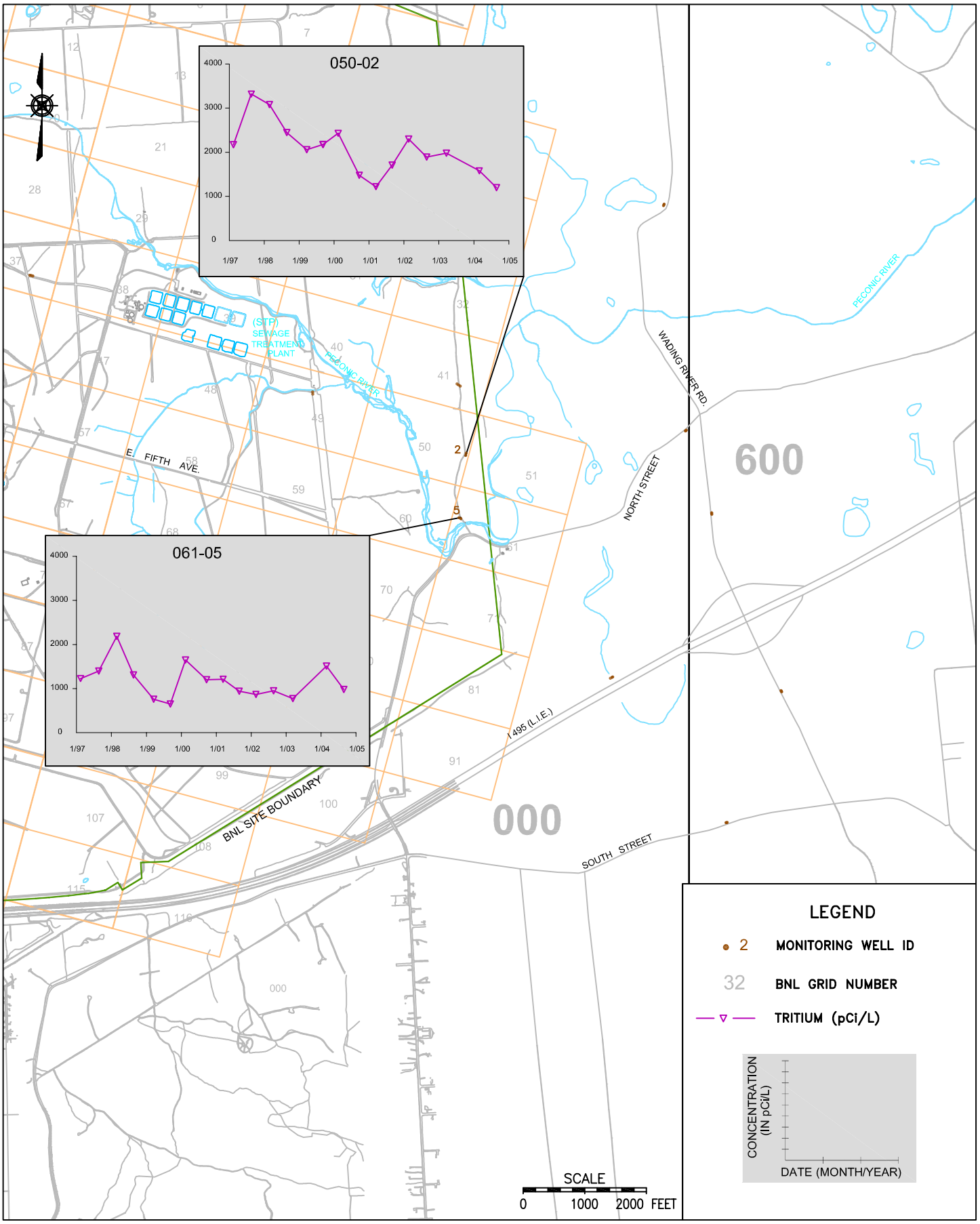
TITLE:

OU V SEWAGE TREATMENT PLANT HISTORICAL VOC TRENDS

BNL FIVE-YEAR REVIEW

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
YS	–	06/7/05	07926
CHKD:	APPD:	REV.:	NOTES:
JEB	–	–	–

FIGURE NO.: 1-12



\\OERNT\GIS\GW_PROJECTS\FIVE YEAR REVIEW\FIG_1-13.DWG

BROOKHAVEN NATIONAL LABORATORY

EWMS DIVISION

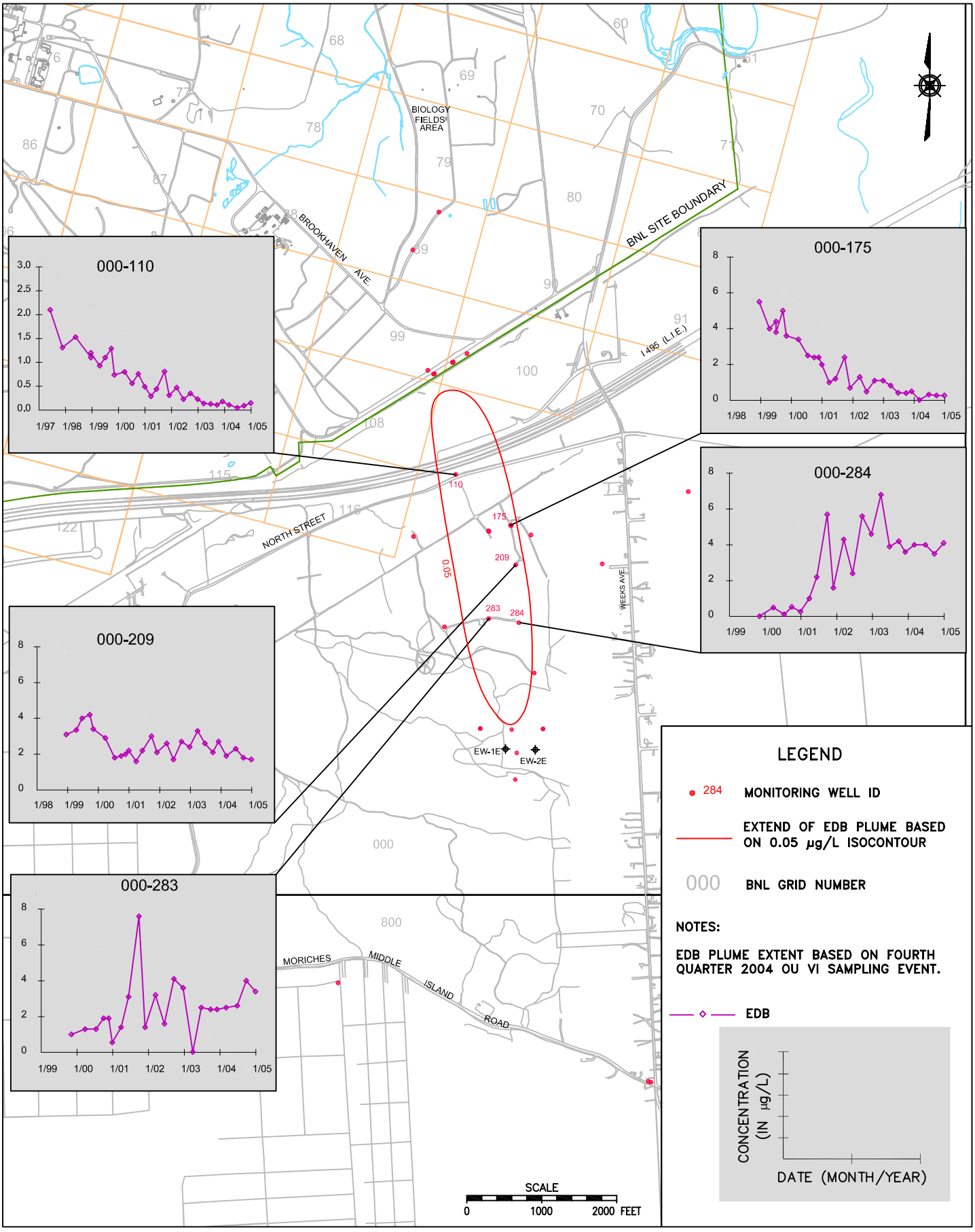
TITLE:

OU V SEWAGE TREATMENT PLANT HISTORICAL TRITIUM TRENDS

BNL FIVE-YEAR REVIEW

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
SRW	–	06/8/05	07926
CHKD:	APPD:	REV.:	NOTES:
JEB	–	–	–

FIGURE NO.: 1-13



\\OERNT\GIS\GW_PROJECTS\FIVE YEAR REVIEW\FIG_1-14.DWG

BROOKHAVEN NATIONAL LABORATORY

EWMS DIVISION

TITLE:

OU VI
HISTORICAL EDB TRENDS

BNL FIVE-YEAR REVIEW

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
SRW	–	06/8/05	07926
CHKD:	APPD:	REV.:	NOTES:
JEB	–	–	–

FIGURE NO.: 1-14

Attachment 2

2004 BNL Groundwater Status Report, BNL 2005 (CD Version)

(to be included in public availability version)

http://webeims.b459.bnl.gov/gw_home/gw_home.asp

Attachment 3

Inspection Checklists

BROOKHAVEN NATIONAL LABORATORY
CURRENT LANDFILL AREA
SITE INSPECTION FORM

Name of Inspector(s): E. Kramer, W. Dorsch V. Racaniello, T. Kneitel, R. Howe

Date of Inspection: April 4, 2005

Purpose of Inspection: X Routine ____Heavy Rainfall ____Reported Incident

Time on Site: 1310 hours

Time off Site: 1350 hours

Weather Conditions: Cool, sunny

A. Inspection Checklist

Component	Observed Condition			Further Action Required	
	Excellent	**Fair**	**Poor**	**Yes**	**No**
1.0 Landfill Cap					
Vegetation	X				X
Cap		X		X	
Gas Vents	X				X
2.0 Drainage Structures:					
Toe Drain		X		X	
Drainage Channels		X		X	
French Drains/Outfalls	X				X
Subsurface Drainage Pipes/Outfalls	X				X
Manholes	X				X
Recharge Areas	X				X
3.0 Monitoring System:					
Soil Gas Wells	X				X
Groundwater Wells	X				X
4.0 Site Access					
Asphalt Access Road	X				X
Crushed-Concrete Access Road	X				X

B. Description of Further Action Requirements:

1. Location:

Observed Conditions: 1) Weeds in drainage channels, 2) animal burrowing holes along south and east slopes, 3) netting on north and east slopes showing through in some areas, 4) BNL contacts on green emergency placard out of date, 5) lock missing from Brookhaven Ave gate, and south gate is broken (can't latch).

Recommendations: 1 and 2) Have PE Grounds perform weed trimming and fill in holes, 3) evaluate need to seed or fill in areas with netting visible, 4) Modify green placard to reflect LTRA ownership, 5) Get lock and have PE grounds fix south gate.

BROOKHAVEN NATIONAL LABORATORY
FORMER LANDFILL AREA
SITE INSPECTION FORM

Name of Inspector(s): E. Kramer, W. Dorsch V. Racaniello, R. Howe

Date of Inspection: April 4, 2005

Purpose of Inspection: X Routine ____Heavy Rainfall ____Reported Incident

Time on Site: 1355 hours

Time off Site: 1420 hours

Weather Conditions: Cool, sunny

A. Inspection Checklist

Component		Observed Condition			Further Action Required	
		Excellent	**Fair**	**Poor**	**Yes**	**No**
1.0	Landfill Cap					
	Vegetation	X				X
	Cap	X				X
	Gas Vents	X				X
2.0	Drainage Structures:					
	Toe Drain	X				X
	Drainage Channels	X				X
	French Drains/Outfalls	X				X
	Subsurface Drainage Pipes/Outfalls	X				X
	Manholes	X				X
	Recharge Areas	X				X
3.0	Monitoring System:					
	Soil Gas Wells	X				X
	Groundwater Wells	X				X
4.0	Site Access					
	Asphalt Access Road	X				X
	Crushed-Concrete Access Road	X				X

B. Description of Further Action Requirements:

2. Location:

Observed Conditions: Conditions normal

Recommendations: None

BNL Five-Year Review Site Inspection Checklist

I. SITE INFORMATION

Site name: Brookhaven National Laboratory	**Date(s) of inspection:** 3/10/05 through 6/9/05
Location and Region: Upton, NY, EPA Region 2	**EPA ID:** NY7890008975
Agency, office, or company leading the five-year review: Brookhaven Science Associates (BSA) for the U.S. Department of Energy (DOE)	**Weather/temperature:** NA

Remedy Includes: (Check all that apply)

- ☒ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other_____
- ☒ Monitored natural attenuation
- ☒ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** _ Bill Dorsch (Name) _ LTRA Manager_ (Title) NA___ (Date)
   Interviewed ☒ at site ☒ at office ☐ by phone Phone no. _344-5186
   Problems, suggestions; ☐ Report attached _Work with on a daily basis and discuss issues weekly. ___

2. **O&M staff** Vinnie Racaniello, Eric Kramer, Chris Ogeka (Names) Project Manager and Field Engineers (Titles) NA (Date)
   Interviewed ☒ at site ☒ at office ☐ by phone Phone no. 344-5436, 8226, 2363_____
   Problems, suggestions; ☐ Report attached Work with on a daily basis and discuss issues weekly.____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

   Agency ___EPA, DEC, SCDHS, DOE _____
   Contact _____ _____ _____ _____
   Name Title Date Phone no.
   Problems; suggestions; ☒ Report attached See interview records.
   _____

   Agency _____
   Contact _____ _____ _____ _____
   Name Title Date Phone no.
   Problems; suggestions; ☐ Report attached _____
   _____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

☒ O&M manual	☒ Readily available	☒ Up to date	☐ N/A
☒ As-built drawings	☒ Readily available	☒ Up to date	☐ N/A
☐ Maintenance logs	☐ Readily available	☐ Up to date	☐ N/A

Remarks: The OU I/RA V, Industrial Park, and the Sr-90 Chemical Holes O&M Manuals are in the process of being updated. The as-built drawings are available through Plant Engineering's database.

2. **Site-Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A
☒ Contingency plan/emergency response plan ☒ Readily available ☒ Up to date ☐ N/A
Remarks: Each project has a H&S Plan and Work Permit specific to that job. The operating groundwater treatment systems have a contingency/emergency plan in their O&M Manuals.

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date X N/A
Remarks

4. **Permits and Service Agreements**

☒ Air discharge permit	☒ Readily available	☒ Up to date	☐ N/A
☒ Effluent discharge	☒ Readily available	☒ Up to date	☐ N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☐ N/A
☒ Other permits: Peconic, FHWMF	☒ Readily available	☐ Up to date	☐ N/A

Remarks: DEC air and SPDES equivalency permits in place for all treatment systems, as appropriate. Peconic Phase 1 and Off-site equivalency permits in place.

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks

6. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A
Remarks: Groundwater monitoring data is made available via the Quarterly System Operations Reports, as well as the Annual Groundwater Status Report.

7. **Discharge Compliance Records**

☒ Air	☒ Readily available	☒ Up to date	☐ N/A
☒ Water (effluent)	☒ Readily available	☒ Up to date	☐ N/A

Remarks: Discharge Monitoring Reports (DMRs) for the treatment systems with SPDES equivalency permits are issued monthly to the DEC. Air compliance records are documented in the Annual Groundwater Status Reports.

8. **Daily Access/Security Logs** ☒ Readily available ☐ Up to date ☐ N/A
Remarks_Daily operating data sheets for the groundwater systems are available at the treatment building and the Project files.

9. **Comments**

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☒ Contractor for Federal Facility
☐ Other: Responsibility for managing BNL's Long Term Response Actions lies with the Environmental and Waste Management Services Division (EWMSD).

2. **O&M Cost Records**

☒ Readily available ☒ Up to date
☒ Funding mechanism/agreement in place
Original O&M cost estimate_____ G Breakdown attached

Total annual cost by year for review period if available

From	10/00 Date	To	9/01 Date	Avg. Annual of $200K Total cost	☒ Breakdown attached	
From	10/01 Date	To	9/02 Date	Avg. Annual of $210K Total cost	☒ Breakdown attached	
From	10/02 Date	To	9/03 Date	Avg. Annual of $185K Total cost	☒ Breakdown attached	
From	10/03 Date	To	9/04 Date	Avg. Annual of $140K Total cost	☒ Breakdown attached	

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: No unusually high O&M costs identified. FY05 will be the first full year of operation for the five treatment systems beyond the BNL property. The annual costs for these systems will be identified for the second Five-Year Review.

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A

Remarks: See Current Landfill inspection forms for needed repair to gate. _

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks: Identification signs are in place for all of the on-site groundwater treatment systems and landfills, as well as most of the off-site systems (the remaining signs are being made by BNL). DOE notification signs are in place for all treatment facilities located beyond BNL's property boundary. There are BNL security personnel at the site 24 hours per day. For the systems located beyond the BNL boundaries, security cameras are present that communicate with BNL's security personnel.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): Routine inspections of landfills and groundwater treatment systems _____
Frequency: Varies from almost daily for treatment systems to monthly for landfills.
_____
Responsible party/agency: BSA under contract with DOE.
_____

Contact:	William Dorsch	BSA LTRA Manager	3/21/05	(631) 344-5186
	Gail Penny	DOE Project Manager	3/21/05	(631) 344-4363
	Name	Title	Date	Phone no.

Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☒ No ☐ N/A
Other problems or suggestions: G Report attached
Remarks: There are seven access agreements in place among BSA/DOE and various property owners to allow for BNL's remediation of groundwater contamination that has migrated beyond the BNL property. Each agreement has terms and conditions that must be adhered to.
_____
_____

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks: The Land Use Controls Management Plan and institutional controls website and fact sheets are currently being updated to reflect the most recent IC's for each project.
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks_There has been some vandalism in the past at some of the treatment systems located beyond the BNL property. However, additional precautions have been implemented such as security cameras, motion detectors, and fencing to help minimize the potential risk. _____

2. **Land use changes on site** ☒ N/A
Remarks: None_____

3. **Land use changes off site** ☒ N/A
Remarks: None_____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A
Remarks_____

B. Other Site Conditions

Remarks: _____

VII. SOIL CLEANUP REMEDIES ☒ Applicable ☐ N/A

A. Project OU I AOC 2F Ash Pit 3/29/05

1. **Soil Excavation Complete** ☒ Yes ☐ No

   Remarks _____

2. **S&M Documents**

   ☒ S&M Plan ☐ Readily available ☐ Up to date ☐ N/A
   ☒ Completion/Closeout Report ☒ Readily available ☒ Up to date ☐ N/A
   ☐ Maintenance logs ☐ Readily available ☐ Up to date ☒ N/A

   Remarks: Final Closeout Report for the Ash Pit OU I AOC 2F, dated 2/5/04. Section 4.0 of the Closeout Report identifies LTRA requirements (i.e., annual inspection) and references WP 179 for details. _

3. **Settlement** (Low spots) ☒ Location shown on site map ☐ Settlement not evident

   Areal extent _____ Depth_____

   Remarks: Some minor settlement of 10'x20' area in center of pit. See attached photo.

   _____

4. **Erosion** ☒ Location shown on site map ☐ Erosion not evident

   Areal extent_____ Depth_____

   Remarks: Some erosion identified on a small area on the slope of the soil cover (near south side of road). See attached photo.

   _____

5. **Vegetative Cover** ☒ Grass ☒ Cover properly established ☐ No signs of stress

   ☒ Trees/Shrubs (indicate size and locations on a diagram)

   Remarks: Trees surround the pit area. Native grasses dormant at this time

   _____

6. **Wet Areas/Water Damage** G Wet areas/water damage not evident

   ☒ Wet areas ☐ Location shown on site map Areal extent_____
   ☐ Ponding ☐ Location shown on site map Areal extent_____
   ☐ Seeps ☐ Location shown on site map Areal extent_____
   ☐ Soft subgrade ☐ Location shown on site map Areal extent_____

   Remarks: Minor settlement (see above) area in middle of pit. Moist area probably due to heavy rains day before. Should dry up.

   _____

7. **Monitoring Wells** (within the excavated area)

   ☒ Properly secured/locked ☒ Functioning ☐ Routinely sampled ☒ Good condition
   ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A

   Remarks_____

   _____

8. **Other Site Conditions**

   Remarks: Inspection attendees include W. Dorsch, V. Racaniello, T. Doyle, R. Howe. Heavy rains day before inspection. Recommendations: Provide cover for eroded area.

   _____

VII. SOIL CLEANUP REMEDIES ☒ Applicable ☐ N/A

A. Project OU I AOC 8 Meadow Marsh 3/29/05

1. **Soil Excavation Complete** ☒ Yes ☐ No
   Remarks _____

2. **S&M Documents**
   ☒ S&M Plan ☐ Readily available ☐ Up to date ☐ N/A
   ☒ Completion/Closeout Report ☒ Readily available ☒ Up to date ☐ N/A
   ☐ Maintenance logs ☐ Readily available ☐ Up to date ☒ N/A
   Remarks: Final Closeout Report for the Meadow Marsh OU I AOC 8, dated 2/6/04. Section 4.0 of the Closeout Report identifies LTRA requirements (i.e., ecological monitoring and inspection for Tiger Salamanders. Institutional controls are also identified in the Report.

3. **Settlement** (Low spots) ☐ Location shown on site map ☒ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☒ No signs of stress
   G Trees/Shrubs (indicate size and locations on a diagram)
   Remarks: Native grasses planted adjacent to the pond.

6. **Wet Areas/Water Damage** G Wet areas/water damage not evident
   ☐ Wet areas ☐ Location shown on site map Areal extent_____
   ☒ Ponding ☐ Location shown on site map Areal extent_____
   ☐ Seeps ☐ Location shown on site map Areal extent_____
   ☐ Soft subgrade ☐ Location shown on site map Areal extent_____
   Remarks: The remediated area is a pond for the Tiger Salamanders. See attached photo.

7. **Monitoring Wells** (within the excavated area)
   ☒ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
   Remarks_____

8. **Other Site Conditions**
   Remarks: Inspection attendees include W. Dorsch, V. Racaniello, T. Doyle, R. Howe. Heavy rains day before inspection. Recommendations: Properly dispose of drill auger lying near road.

VII. SOIL CLEANUP REMEDIES ☒ Applicable ☐ N/A

A. Project OU I AOC 6 Bldg. 650 Sump Outfall 3/29/05

1. **Soil Excavation Complete** ☒ Yes ☐ No

   Remarks _____

2. **S&M Documents**

   ☐ S&M Plan ☐ Readily available ☐ Up to date ☐ N/A
   ☒ Completion/Closeout Report ☒ Readily available ☐ Up to date ☐ N/A
   ☐ Maintenance logs ☐ Readily available ☐ Up to date ☒ N/A

   Remarks: Draft Final Closeout Report for AOC 6 Bldg. 650 Sump and Sump Outfall, dated 1/02. No specific LTRA monitoring was identified, however, there are some lessons learned presented.

3. **Settlement** (Low spots) ☒ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____

   Remarks: The entire area is graded and a drainage swale exists that routes surface runoff to the ponded sump. The pond has been staying wet year round.

4. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____

   Remarks: See above.

5. **Vegetative Cover** ☒ Grass ☐ Cover properly established ☐ No signs of stress
   ☒ Trees/Shrubs (indicate size and locations on a diagram)

   Remarks: Some trees surround the sump. Native grass cover dormant at this time.

6. **Wet Areas/Water Damage** G Wet areas/water damage not evident

   ☐ Wet areas ☐ Location shown on site map Areal extent_____
   ☒ Ponding ☐ Location shown on site map Areal extent_____
   ☒ Seeps ☐ Location shown on site map Areal extent_____
   ☐ Soft subgrade ☐ Location shown on site map Areal extent_____

   Remarks: See above

7. **Monitoring Wells** (within the excavated area)

   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ Evidence of leakage at penetration ☒ Needs Maintenance ☐ N/A

   Remarks: Three monitoring wells were abandoned within the ponded areas during the excavation work. Stick-up casings and concrete lying along fence need to be properly disposed of. (Former wells 066-6, 066-10, and 066-18).

8. **Other Site Conditions**

   Remarks: Inspection attendees include W. Dorsch, V. Racaniello, T. Doyle, T. Kneitel, R. Howe. Heavy rains day before inspection. Recommendations: Properly dispose of well covers/concrete and pallets lying near road. A few signs are posted identifying subsurface radiological contaminated soils. Fence partially surrounds the former sump outfall (no restrictions for entering area).

VII. SOIL CLEANUP REMEDIES ☒ Applicable ☐ N/A

A. Project OU I AOC 16S Landscape Soil Area (at Brookhaven Center front lawn) 3/29/05

1. **Soil Excavation Complete** ☒ Yes ☐ No

   Remarks _____

2. **S&M Documents**

   ☐ S&M Plan ☐ Readily available ☐ Up to date ☐ N/A
   ☒ Completion/Closeout Report ☒ Readily available ☐ Up to date ☐ N/A
   ☐ Maintenance logs ☐ Readily available ☐ Up to date ☒ N/A

   Remarks: Final Closeout Report for AOC 16 Landscape Soils, dated 4/10/01. No specific LTRA monitoring was identified, however, there are some lessons learned present

   _____

3. **Settlement** (Low spots) ☐ Location shown on site map ☒ Settlement not evident

   Areal extent_____ Depth_____

   Remarks_____

   _____

4. **Erosion** ☐ Location shown on site map ☒ Erosion not evident

   Areal extent_____ Depth_____

   Remarks_____

   _____

5. **Vegetative Cover** ☒ Grass ☒ Cover properly established ☒ No signs of stress

   G Trees/Shrubs (indicate size and locations on a diagram)

   Remarks_____

   _____

6. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident

   ☐ Wet areas ☐ Location shown on site map Areal extent_____
   ☐ Ponding ☐ Location shown on site map Areal extent_____
   ☐ Seeps ☐ Location shown on site map Areal extent_____
   ☐ Soft subgrade ☐ Location shown on site map Areal extent_____

   Remarks_____

   _____

7. **Monitoring Wells** (within the excavated area)

   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A

   Remarks_____

   _____

8. **Other Site Conditions**

   Remarks: Inspection attendees include W. Dorsch, V. Racaniello, T. Doyle, T. Kneitel, R. Howe. No recommendations.

   _____

VII. SOIL CLEANUP REMEDIES ☒ Applicable ☐ N/A

A. Project AOC 9 BGRR Soil and Canal Excavation 4/18/05

1. **Soil Excavation Complete** ☐ Yes ☒ No

   Remarks: The duct service building will come down following removal of the pile.

2. **S&M Documents**

   ☐ S&M Plan ☐ Readily available ☐ Up to date ☐ N/A
   ☐ Completion/Closeout Report ☐ Readily available ☐ Up to date ☐ N/A
   ☐ Maintenance logs ☐ Readily available ☐ Up to date ☐ N/A

   Remarks: S&M Plan will need to be developed._____

3. **Settlement** (Low spots) ☐ Location shown on site map ☒ Settlement not evident

   Areal extent_____ Depth_____

   Remarks: In May 2005, a temporary asphalt cap will be installed at former hot spot soil excavation areas. A final engineered cap will be installed following completion of the pile removal.

4. **Erosion** ☐ Location shown on site map ☒ Erosion not evident

   Areal extent_____ Depth_____

   Remarks_____

   _____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☒ No signs of stress

   G Trees/Shrubs (indicate size and locations on a diagram)

   Remarks_____

   _____

6. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident

   ☐ Wet areas ☐ Location shown on site map Areal extent_____
   ☐ Ponding ☐ Location shown on site map Areal extent_____
   ☐ Seeps ☐ Location shown on site map Areal extent_____
   ☐ Soft subgrade ☐ Location shown on site map Areal extent_____

   Remarks_____

   _____

7. **Monitoring Wells** (within the excavated area)

   ☐ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☐ Good condition
   ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A

   Remarks_____

   _____

8. **Other Site Conditions**

   Remarks: Inspection attendees include W. Dorsch, V. Racaniello, E. Kramer, M. Parsons, F. Petschauer, V. Peterson (DOE), R. Howe. Toured outside soil excavation areas (including canal), canal inside building, reactor area. Once S&M is transferred to LTRA in a few years, inspections will include areas of potential water intrusion. We should tour the below ground ducts next week. No recommendations.

VII. SOIL CLEANUP REMEDIES ☒ Applicable ☐ N/A

A. Project OU I AOC 1 Hazardous Waste Management Facility (HWMF) 5/23/05_____

1. **Soil Excavation Complete** ☐ Yes ☒ No

Remarks: About 75% complete with excavation, expected to be done by mid June 2005. Following ORISE confirmatory sampling, then backfill, grade, and seed.

2. **S&M Documents**

☒ S&M Plan ☐ Readily available ☐ Up to date ☐ N/A
☒ Completion/Closeout Report ☐ Readily available ☐ Up to date ☐ N/A
☐ Maintenance logs ☐ Readily available ☐ Up to date ☐ N/A

Remarks: The Draft OU I Soils and OU V Long-Term Monitoring and Maintenance Plan, dated 5/13/05, is undergoing internal review. The Closeout Report has not yet been prepared.

3. **Settlement** (Low spots) ☒ Location shown on site map ☐ Settlement not evident
Areal extent_____ Depth_____

Remarks: There are many low spots in the area since the excavation is in progress. It will be mitigated once backfilling is complete.

4. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
Areal extent_____ Depth_____

Remarks: There is evidence of erosion throughout the area from the excavation. It will be mitigated once backfilling is complete.__

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
☒ Trees/Shrubs (indicate size and locations on a diagram)

Remarks: Trees still present in the middle of the yard. Some may still be removed during the remaining excavation. Rest of the area is bare due to excavation not yet complete. Will be seeded once complete.

6. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks: During the winter/early spring wet ponded areas existed in several locations. Additional mitigative measures were taken. Wet areas were not evident at time of inspection due to dry weather for last two weeks. The wetland area immediately to the northwest of the FHWMF was mostly dry. _____

7. **Monitoring Wells** (within the excavated area)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☒ Needs Maintenance ☐ N/A

Remarks: Could not see the monitoring wells within the fenced area sine the tour was on the perimeter. There is a good chance that some of the wells may need to be abandoned or removed if they are within the planned excavation area. Wells just outside the excavation area are secure and locked.

8. **Other Site Conditions**

Remarks: Inspection attendees include W. Dorsch, V. Racaniello, J. Burke, M. Pizzulli (PW Grosser), T. Kneitel, J. Coaxum (DOE FR), R. Howe. The soil cleanup goal is 67 pCi/g for Cs-137 (industrial land use). Additional work remains in the main excavation area, as well as restoration of the wetlands, and completion of the leaching field excavation to the west of the FHWMF. There is a buried 5,000 gal. UST to the west of the FHWMF. It is a previously used water tank for fire protection per M. Clancy. J. Remien wants someone to pull it since it's not used anymore (it's a SCDHS registered tank). Four, fifty-five gallon drums need to be labeled near the main gate (3 empty, and 1 contains sand for excavator). The drums were subsequently labeled accordingly.

VII. SOIL CLEANUP REMEDIES ☒ Applicable ☐ N/A

A. Project OU V AOC 30 Peconic River 5/24/05

1. **Soil Excavation Complete** ☒ Yes ☐ No

Remarks: All excavation and revegetation is complete. However, ~ 1km of haul roads still need to be dug up (fabric and stone mix).

_____

2. **S&M Documents**

☒ S&M Plan ☐ Readily available ☐ Up to date ☐ N/A
☒ Completion/Closeout Report ☐ Readily available ☐ Up to date ☐ N/A
☐ Maintenance logs ☐ Readily available ☐ Up to date ☐ N/A

Remarks: The OU I and V Long Term Monitoring and Maintenance Plan dated 5/13/05, is undergoing internal review. Sediment and surface water sampling locations must be identified on a map and coordinates provided . EM procurement is in progress for the vegetation monitoring contract (bids due 5/27/05). The contract requires annual sampling in Aug/Sept 05 and 06 (see permit), and replanting if necessary. Skip will provide us with a separate contractor experienced with control of invasive species via wand application (phragmaties?). A Completion Report (for Phase I) was submitted to the regulators in Sept 2004. A Closeout Report (documenting Phase I and II) was submitted to DOE for review week of 5/16/05. The format of this report also serves as the basis for deletion of the AOC or OU.

3. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
Areal extent_____ Depth_____
Remarks: Low spots are natural for the River/wetland areas._____

4. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
Areal extent_____ Depth_____
Remarks_____
_____

5. **Vegetative Cover** ☒ Grass ☒ Cover properly established ☐ No signs of stress
☒ Trees/Shrubs (indicate size and locations on a diagram)
Remarks: This is the first growing season for the revegetated plants. The regrowth areas look good and the plants appear to be taking root well (see pictures). The vegetation monitoring contract will determine the success rate over the next couple of years. The goal is 85% success.

6. **Wet Areas/Water Damage** G Wet areas/water damage not evident
☒ Wet areas ☐ Location shown on site map Areal extent_____
☒ Ponding ☐ Location shown on site map Areal extent_____
☒ Seeps ☐ Location shown on site map Areal extent_____
☒ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks: This is all indicitative of the River and wetland environment.

7. **Monitoring Wells** (within the excavated area)
☒ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☒ Good condition
☐ Evidence of leakage at penetration ☒ Needs Maintenance ☐ N/A
Remarks: Most wells are in good condition. One piezometer in the on-site portion of the River (closer to the STP outfall) is bent and needs to be evaluated for possible repair.

8. **Other Site Conditions**

Remarks: Inspection attendees include T. Green, J. Burke, V. Racaniello, W. Medeiros, G. Goode, R. Lagattolla, R. Howe, G. Penny, L. Nelson. Three State equivalency permits need to be closed out with the State (probably when we delete the OU or AOC). Access to River is via Z-Path to either BNL or County property. One private landowner off River Road also allows us access to the River through his driveway. Local DEC contact is Rob Marsh, and F&W is Charles Guthrie.

VII. SOIL CLEANUP REMEDIES ☒ Applicable ☐ N/A

A. Project OU I AOC 10 Building 811 UST and Soils 6/9/05_____

1. **Soil Excavation Complete** ☒ Yes ☐ No

Remarks: Excavation complete, confirmatory data received. Remaining activities includes backfilling, final grading, seeding, and repair of fence.

_____

2. **S&M Documents**

☒ S&M Plan ☐ Readily available ☐ Up to date ☒ N/A
☒ Completion/Closeout Report ☐ Readily available ☐ Up to date ☐ N/A
☐ Maintenance logs ☐ Readily available ☐ Up to date ☐ N/A

Remarks: The Closeout Report is undergoing DOE review and is scheduled for submittal to the regulators in June 2005._____

3. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
Areal extent_____ Depth_____
Remarks: Excavation is complete. Backfilling is still needed to bring up to grade.
_____

4. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
Areal extent_____ Depth_____
Remarks: Backfilling is still needed._____
_____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
G Trees/Shrubs (indicate size and locations on a diagram)
Remarks: Seeding of area is still needed. _____

6. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks_____
_____

7. **Monitoring Wells** (within the excavated area)

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☒ Needs Maintenance ☐ N/A

Remarks: All of the BNL monitoring wells are secured and locked. Two wells immediately south of the old "D" tanks are bent from the excavation. EWMSD will evaluate for possible repair. Two older USGS monitoring wells were identified at the southwest corner of the facility between Bldg. 811 and Bldg. 923. The tops of the wells are open to the environment and need a top at a minimum. EWMSD Groundwater Compliance Group will be informed.

8. **Other Site Conditions**

Remarks: Inspection attendees include W. Dorsch, V. Racaniello, T. Daniels, T. Doyle, G. Penny, and R. Howe. The Closeout Report will identify that radiological contaminatiopn at depth remains at some locations. The area was excavated to residential soil cleanup levels. `The area near the former "D" tanks is now clean The excavation at the vault area went ~14 fbg, but had top stop due to structural integrity of surrounding structures. There are two facility use agreements at this area, Bldg. 811, and the miscellaneous soils FUA.

VII. SOIL CLEANUP REMEDIES ☒ Applicable ☐ N/A

Location (AOC): OU III AOC 26B Building 96
Date of Inspection: 10/27/05
Name of Inspector(s): R. Howe, K. Conkling, R. Travis, P. Sullivan, R. Lee, K. Klaus
Purpose of Inspection: ☒ Routine (Scheduled Freq of) ☐ Heavy Rainfall ☐ Reported Incident

A. Inspection Checklist

Component	Observed Condition				Further Action Req'd	
	Excell.	Fair	Poor	Not Applic.	Yes (describe)	No
1. Landfill Cap/Soil Covers/ Wetlands:						
Vegetation (e.g. grass)		X			Check grass growth in spring, possible reseed	
Soil (Cap/Cover/Fill)		X			Some minor erosion near culvert	
Other: _____						
2. Drainage Structures:						
Standing Water				X		X
Toe Drain				X		X
Drainage Channels	X					X
French Drains/Outfalls				X		X
Subsurface Drainage				X		X
Pipes/Outfalls				X		X
Manholes				X		X
Berms				X		X
Roof Drains				X		X
Recharge Areas		X			Remove once grass is established	
Other: Silt Fence						
3. Monitoring System:						
Soil Gas Wells				X		X
Groundwater Wells	X					X
Gas Vents				X		X
Other: _____						
4. Site Access:						
Asphalt Access Road				X		X
Crushed-concrete Access Road		X				X
Fence				X		X
Gates/locks				X		X
Radiological Postings				X		X
Other: _____						

5. Evidence of unauthorized work activities and/or unauthorized access has occurred? ☐ Yes ☒ No
If yes, describe evidence:

_____

B. Description of Other Observations

Observed Conditions/Recommendations: Weeds need to be cut, including the Jimson Weed just west of drainage channel. As a best management practice, add sign at the entrance that LUICs in place, and for further info to contact LTRA at x2828. Check contents of the Zebra connex. Is KMnO4 being stored and is the oxidizer sign adequate? Check the Chemical Management System inventory (Bob Petricek or Divine Adika). Modify OU I Soils and OU V LongTerm Monitoring Plan to reflect additional inspections during significant rain events.

VII. SOIL CLEANUP REMEDIES ☒ Applicable ☐ N/A

Location (AOC): OU I AOC 2B Former Chemical Holes (includes Animal Pits and Glass Holes)
Date of Inspection: 11/9/05
Name of Inspector(s): R. Howe, K. Conkling, R. Travis, P. Sullivan
Purpose of Inspection: ☒ Routine (Scheduled Freq of ___) ☐Heavy Rainfall ☐Reported Incident

A. Inspection Checklist

Component	Observed Condition				Further Action Req'd	
	Excell.	Fair	Poor	Not Applic.	Yes (describe)	No
1. Landfill Cap/Soil Covers/Wetlands:						
Vegetation (e.g. grass)			X		Seed in spring '06	
Soil (Cap/Cover/Fill)		X			Spread fill fall '06	
Other: _____						
2. Drainage Structures:						
Standing Water				X		X
Toe Drain				X		X
Drainage Channels				X		X
French Drains/Outfalls				X		X
Subsurface Drainage				X		X
Pipes/Outfalls				X		X
Manholes				X		X
Berms				X		X
Roof Drains				X		X
Recharge Areas						
Other: _____						
3. Monitoring System:						
Soil Gas Wells				X		X
Groundwater Wells	X					X
Gas Vents				X		X
Other: _____						
4. Site Access:						
Asphalt Access Road				X		X
Crushed-concrete Access Road		X				X
Fence				X		X
Gates/locks		X			Remove south gate	
Radiological Postings				X		X
Other: Signs		X			Remove danger signs	

5. Evidence of unauthorized work activities and/or unauthorized access has occurred? ☐ Yes ☒ No
If yes, describe evidence:

_____

B. Description of Other Observations

Observed Conditions/Recommendations: Jersey Barriers are still needed to protect the drop off at the end of the rail car loading ramp (this is an action item for EM from the ERE final walkdown. Note: there are several barriers available at the STP old settling basins). Remove the existing signs (danger and keep out), and the gate at the south entrance to the Chemical Holes area. LUIC Fact Sheet Notes: Under Current Conditions, add the Cesium-137 and mercury residual levels. The map of the area needs to be revised to reflect the former Glass Holes as a soil remediation complete area.

VIII. GROUNDWATER REMEDIES ☒ Applicable ☐ N/A 4/7/05

A. System OU III LIPA/Airport. Inspection attendees include V. Racaniello, K. Klaus, E. Kramer, K. Conkling, C. Ogeka R. Howe. _____

1. **Construction Complete/System Operating** ☒ Yes ☐ No

Remarks: Construction is complete, system operating. ._____

B. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**

☐ Good condition ☐ All required wells properly operating ☒ Needs Maintenance ☐ N/A

Remarks: AP treatment wells RTW 4A and RTW 5A are off-line and currently being redeveloped. Remove concrete rubble adjacent to LIPA vault.

_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**

☒ Good condition ☐ Needs Maintenance

Remarks_____

_____

3. **Spare Parts and Equipment**

☐ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks_____

_____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation

☐ Air stripping ☒ Carbon adsorbers

☐ Filters_____

☐ Additive (*e.g.*, chelation agent, flocculent):

☐ Others_____

☒ Good condition ☐ Needs Maintenance

☒ Sampling ports properly marked and functional

☒ Sampling/maintenance log displayed and up to date

☒ Equipment properly identified

☐ Quantity of groundwater treated annually_____

☐ Quantity of surface water treated annually_____

Remarks_ _____

_____

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☒ Good condition ☐ Needs Maintenance

Remarks:

3. **Tanks, Vaults, Storage Vessels**

☐ N/A ☒ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks: Fence needs to be installed around LIPA vault, and area paved._____

_____

4. **Discharge Structure and Appurtenances**

☐ N/A ☒ Good condition ☐ Needs Maintenance

Remarks_____

_____

5.	**Treatment Building(s)** ☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks: Airport building area needs to be paved. _____
6.	**Monitoring Wells** (pump and treatment remedy) ☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition ☒ All required wells located ☐ Needs Maintenance ☐ N/A Remarks_____ _____
D. Monitoring Data	
1.	Monitoring Data ☒ Is routinely submitted on time ☒ Is of acceptable quality
2.	Monitoring data suggests: ☒ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining Remarks: VOC concentrations at Airport a very low, will begin pulse pumping in late summer 2005.

VIII. GROUNDWATER REMEDIES ☒ Applicable ☐ N/A 4/7/05

A. System OU III North Street/North Street East. Inspection attendees include V. Racaniello, K. Klaus, E. Kramer, K. Conkling, C. Ogeka R. Howe. _____

1. **Construction Complete/System Operating** ☒ Yes ☐ No

Remarks: Construction is complete, system operating. _____

B. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**

☒ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A

Remarks:

_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**

☒ Good condition ☐ Needs Maintenance

Remarks_____

_____

3. **Spare Parts and Equipment**

☐ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks_____

_____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation

☐ Air stripping ☒ Carbon adsorbers

☐ Filters_____

☐ Additive (*e.g.*, chelation agent, flocculent):

☐ Others_____

☒ Good condition ☐ Needs Maintenance

☒ Sampling ports properly marked and functional

☒ Sampling/maintenance log displayed and up to date

☒ Equipment properly identified

☐ Quantity of groundwater treated annually_____

☐ Quantity of surface water treated annually_____

Remarks_____

_____

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☒ Good condition ☐ Needs Maintenance

Remarks:

3. **Tanks, Vaults, Storage Vessels**

☐ N/A ☒ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks_____

_____

4. **Discharge Structure and Appurtenances**

☐ N/A ☒ Good condition ☐ Needs Maintenance

Remarks_____

_____

5.	**Treatment Building(s)** ☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks: _____ _____
6.	**Monitoring Wells** (pump and treatment remedy) ☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition ☒ All required wells located ☐ Needs Maintenance ☐ N/A Remarks_____ _____
D. Monitoring Data	
3.	Monitoring Data ☒ Is routinely submitted on time ☒ Is of acceptable quality
4.	Monitoring data suggests: ☒ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

VIII. GROUNDWATER REMEDIES ☒ Applicable ☐ N/A 4/7/05

A. System OU VI AOC 28 EDB. Inspection attendees include V. Racaniello, K. Klaus, E. Kramer, K. Conkling, C. Ogeka R. Howe. _____

1. **Construction Complete/System Operating** ☒ Yes ☐ No

Remarks: Construction is complete, system operating. _____

B. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**

☒ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A

Remarks:

_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**

☒ Good condition ☐ Needs Maintenance

Remarks_____

_____

3. **Spare Parts and Equipment**

☐ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks_____

_____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation

☐ Air stripping ☒ Carbon adsorbers

☐ Filters_____

☐ Additive (*e.g.*, chelation agent, flocculent):

☐ Others_____

☒ Good condition ☐ Needs Maintenance

☒ Sampling ports properly marked and functional

☒ Sampling/maintenance log displayed and up to date

☒ Equipment properly identified

☐ Quantity of groundwater treated annually_____

☐ Quantity of surface water treated annually_____

Remarks_____

_____

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☒ Good condition ☐ Needs Maintenance

Remarks:

3. **Tanks, Vaults, Storage Vessels**

☐ N/A ☒ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks_____

_____

4. **Discharge Structure and Appurtenances**

☐ N/A ☒ Good condition ☐ Needs Maintenance

Remarks_____

_____

5.	**Treatment Building(s)** ☐ N/A ☒ Good condition (esp. roof and doorways) ☒ Needs repair ☐ Chemicals and equipment properly stored Remarks: The walls and ceiling need to be cleaned of residual mold (from excessive moisture in building during summer), then repainted. Two air conditioners were installed in August (and along with the dehumidifier) provide a significant reduction in the humidity. _____
6.	**Monitoring Wells** (pump and treatment remedy) ☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition ☒ All required wells located ☐ Needs Maintenance ☐ N/A Remarks_____ _____
D. Monitoring Data	
5.	Monitoring Data ☒ Is routinely submitted on time ☒ Is of acceptable quality
6.	Monitoring data suggests: ☒ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

VIII. GROUNDWATER REMEDIES ☒ Applicable ☐ N/A 4/7/05

A. System OU III Industrial Park East. Inspection attendees include V. Racaniello, K. Klaus, E. Kramer, K. Conkling, C. Ogeka R. Howe. _____

1. **Construction Complete/System Operating** ☒ Yes ☐ No

Remarks: Construction is complete, system operating. _____

B. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**

☒ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A

Remarks:

_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**

☒ Good condition ☐ Needs Maintenance

Remarks_____

_____

3. **Spare Parts and Equipment**

☐ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks_____

_____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation

☐ Air stripping ☒ Carbon adsorbers

☐ Filters_____

☐ Additive (*e.g.*, chelation agent, flocculent):

☐ Others_____

☒ Good condition ☐ Needs Maintenance

☒ Sampling ports properly marked and functional

☒ Sampling/maintenance log displayed and up to date

☒ Equipment properly identified

☐ Quantity of groundwater treated annually_____

☐ Quantity of surface water treated annually_____

Remarks_____

_____

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☒ Good condition ☐ Needs Maintenance

Remarks:

3. **Tanks, Vaults, Storage Vessels**

☐ N/A ☒ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks_____

_____

4. **Discharge Structure and Appurtenances**

☐ N/A ☒ Good condition ☐ Needs Maintenance

Remarks_____

_____

5.	**Treatment Building(s)** ☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks: Install air conditioner to reduce the excessive humidity in building during summer. _____
6.	**Monitoring Wells** (pump and treatment remedy) ☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition ☒ All required wells located ☐ Needs Maintenance ☐ N/A Remarks_____ _____
D. Monitoring Data	
7.	Monitoring Data ☒ Is routinely submitted on time ☒ Is of acceptable quality
8.	Monitoring data suggests: ☒ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

VIII. GROUNDWATER REMEDIES ☒ Applicable ☐ N/A 4/7/05

A. System OU III Industrial Park. Inspection attendees include V. Racaniello, K. Klaus, E. Kramer, K. Conkling, C. Ogeka R. Howe. _____

1. **Construction Complete/System Operating** ☒ Yes ☐ No
   Remarks: Construction is complete, system operating. _____

B. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☒ Good condition ☒ All required wells properly operating ☒ Needs Maintenance ☐ N/A
   Remarks: Treatment wells UVB-1 and UVB-5 are off-line and currently being repaired.
   _____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☒ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Spare Parts and Equipment**
   ☐ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks_____
   _____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☒ Air stripping ☒ Carbon adsorbers (vapor phase)
   ☐ Filters_____
   ☐ Additive (*e.g.*, chelation agent, flocculent):
   ☐ Others_____
   ☒ Good condition ☐ Needs Maintenance
   ☒ Sampling ports properly marked and functional
   ☒ Sampling/maintenance log displayed and up to date
   ☒ Equipment properly identified
   ☐ Quantity of groundwater treated annually_____
   ☐ Quantity of surface water treated annually_____
   Remarks_____
   _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☒ Good condition ☐ Needs Maintenance
   Remarks:

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☒ Good condition ☐ Proper secondary containment ☐ Needs Maintenance
   Remarks_____
   _____

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☒ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

5.	**Treatment Building(s)** ☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks: _____
6.	**Monitoring Wells** (pump and treatment remedy) ☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition ☒ All required wells located ☐ Needs Maintenance ☐ N/A Remarks_____ _____
D. Monitoring Data	
9.	Monitoring Data ☒ Is routinely submitted on time ☒ Is of acceptable quality
10.	Monitoring data suggests: ☒ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

VIII. GROUNDWATER REMEDIES ☒ Applicable ☐ N/A 4/7/05

A. System OU III AOC 29 HFBR Tritium Pump and Recharge. Inspection attendees include V. Racaniello, G. Penny, T. Burke, K. Klaus, E. Kramer, P. Sullivan, K. Conkling, C. Ogeka R. Howe.

1. **Construction Complete/System Operating** ☒ Yes ☒ No

Remarks: Construction is complete, but the system has been on standby since 9/00._____

B. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**

☒ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A

Remarks: Well pumps were recently tested and work ok.

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**

☒ Good condition ☐ Needs Maintenance

Remarks_____

3. **Spare Parts and Equipment**

☐ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks_____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☒ Carbon adsorbers
☐ Filters_____
☐ Additive (*e.g.*, chelation agent, flocculent):
☐ Others_____
☒ Good condition ☐ Needs Maintenance
☒ Sampling ports properly marked and functional
☒ Sampling/maintenance log displayed and up to date
☒ Equipment properly identified
☐ Quantity of groundwater treated annually_____
☐ Quantity of surface water treated annually_____

Remarks_____

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☐ Good condition ☒ Needs Maintenance

Remarks: The three well pump electrical panels need to be locked-out. Also need to replace pressure switches and bulbs on the panel._

3. **Tanks, Vaults, Storage Vessels**

☐ N/A ☒ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks_____

4.	**Discharge Structure and Appurtenances** ☐ N/A ☒ Good condition ☐ Needs Maintenance Remarks_____ _____
5.	**Treatment Building(s)** ☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks: _____ _____
6.	**Monitoring Wells** (pump and treatment remedy) ☒ Properly secured/locked ☐ Functioning ☒ Routinely sampled ☒ Good condition ☒ All required wells located ☐ Needs Maintenance ☐ N/A Remarks_____ _____
D. Monitoring Data	
11.	Monitoring Data ☐ Is routinely submitted on time ☐ Is of acceptable quality
12.	Monitoring data suggests: ☐ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

VIII. GROUNDWATER REMEDIES ☒ Applicable ☐ N/A 4/7/05

A. System OU I South Boundary (Bldg. 598) Inspection attendees include V. Racaniello, G. Penny, T. Burke, K. Klaus, E. Kramer, P. Sullivan, K. Conkling, C. Ogeka R. Howe._____

1. **Construction Complete/System Operating** ☒ Yes ☒ No

Remarks: Construction is complete but the system is currently off-line due to pump maintenance work

B. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**

☐ Good condition ☐ All required wells properly operating ☒ Needs Maintenance ☐ N/A

Remarks: Extraction well pump is being repaired._____

_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**

☒ Good condition ☐ Needs Maintenance

Remarks_____

_____

3. **Spare Parts and Equipment**

☐ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks_____

_____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation

☒ Air stripping ☐ Carbon adsorbers

☐ Filters_____

☐ Additive (*e.g.*, chelation agent, flocculent)_sodium polyphosphate is not used_____

☐ Others_____

☒ Good condition ☐ Needs Maintenance

☒ Sampling ports properly marked and functional

☒ Sampling/maintenance log displayed and up to date

☒ Equipment properly identified

☐ Quantity of groundwater treated annually_____

☐ Quantity of surface water treated annually_____

Remarks_____

_____

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☒ Good condition ☐ Needs Maintenance

Remarks_____

_____

3. **Tanks, Vaults, Storage Vessels**

☐ N/A ☒ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks_Former hypochlorite tank will be removed, as well as the polyphosphate once empty.

_____

_____

4. **Discharge Structure and Appurtenances**

☐ N/A ☒ Good condition ☐ Needs Maintenance

Remarks_____

_____

5.	**Treatment Building(s)** ☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks: The sodium polyphosphate tank will be emptied since it is not needed (it will be slowly bled into the system)_____
6.	**Monitoring Wells** (pump and treatment remedy) ☒ Properly secured/locked ☐ Functioning ☒ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks_____ _____
D. Monitoring Data	
13.	Monitoring Data ☒ Is routinely submitted on time ☒ Is of acceptable quality
14.	Monitoring data suggests: ☒ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

VIII. GROUNDWATER REMEDIES ☒ Applicable ☐ N/A 4/7/05

A. System OU III Sr-90 Chemical Holes (Bldg. 670) Inspection attendees include V. Racaniello, G. Penny, T. Burke, K. Klaus, E. Kramer, P. Sullivan, K. Conkling, C. Ogeka, R. Howe

1. **Construction Complete/System Operating** ☒ Yes ☒ No

Remarks: Construction is complete but system is currently off-line in order to implement corrective actions in response to the building flood incident.

B. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☒ Good condition ☐ All required wells properly operating ☒ Needs Maintenance ☐ N/A
Remarks: Adding float switch to sump as corrective action to prevent future flooding (it will be tied directly to electric panel).

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☒ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☒ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☒ Filters:_ion exchange
☐ Additive (*e.g.*, chelation agent, flocculent)
☐ Others
☒ Good condition ☐ Needs Maintenance
☒ Sampling ports properly marked and functional
☒ Sampling/maintenance log displayed and up to date
☒ Equipment properly identified
☐ Quantity of groundwater treated annually
☐ Quantity of surface water treated annually
Remarks

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A ☒ Good condition ☐ Needs Maintenance
Remarks

3. **Tanks, Vaults, Storage Vessels**
☐ N/A ☒ Good condition ☒ Proper secondary containment ☐ Needs Maintenance
Remarks: The three remaining spent resin vessels will be moved to Bldg. 865 and then packaged for off-site disposal.

4.	**Discharge Structure and Appurtenances** ☐ N/A ☒ Good condition ☐ Needs Maintenance Remarks_____ _____
5.	**Treatment Building(s)** ☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks: The floor needs to be cleaned of dirt and empty sample bottles need to be removed to prevent trip hazards._____
6.	**Monitoring Wells** (pump and treatment remedy) ☒ Properly secured/locked ☐ Functioning ☒ Routinely sampled ☒ Good condition ☒ All required wells located ☐ Needs Maintenance ☐ N/A Remarks_____ _____
D. Monitoring Data	
15.	Monitoring Data ☒ Is routinely submitted on time ☒ Is of acceptable quality
16.	Monitoring data suggests: ☒ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

VIII. GROUNDWATER REMEDIES ☒ Applicable ☐ N/A 4/7/05

A. System OU III Sr-90 BGRR/WCF (Bldg. 855) Inspection attendees include V. Racaniello, G. Penny, T. Burke, K. Klaus, E. Kramer, K. Conkling, C. Ogeka, R. Howe _____

1. **Construction Complete/System Operating** ☒ Yes ☒ No

Remarks: Construction is complete, in start-up testing phase, will begin normal operations soon.

B. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**

☒ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A

Remarks_____

_____

_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**

☒ Good condition ☐ Needs Maintenance

Remarks: _____

3. **Spare Parts and Equipment**

☒ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks_____

_____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation

☒ Air stripping ☐ Carbon adsorbers

☒ Filters: ion exchange ___

☐ Additive (*e.g.*, chelation agent, flocculent)_____

☐ Others_____

☒ Good condition ☐ Needs Maintenance

☒ Sampling ports properly marked and functional

☒ Sampling/maintenance log displayed and up to date

☒ Equipment properly identified

☐ Quantity of groundwater treated annually_____

☐ Quantity of surface water treated annually_____

Remarks: Need to install sampling port before air stripper._

_____

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☒ Good condition ☐ Needs Maintenance

Remarks_____

_____

3. **Tanks, Vaults, Storage Vessels**

☐ N/A ☒ Good condition ☒ Proper secondary containment ☐ Needs Maintenance

Remarks_____

_____

4. **Discharge Structure and Appurtenances**

☐ N/A ☒ Good condition ☐ Needs Maintenance

Remarks_____

_____

5.	**Treatment Building(s)** ☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks_____ _____
6.	**Monitoring Wells** (pump and treatment remedy) ☒ Properly secured/locked ☐ Functioning ☒ Routinely sampled ☒ Good condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks_____ _____
D. Monitoring Data	
17.	Monitoring Data ☒ Is routinely submitted on time ☒ Is of acceptable quality
18.	Monitoring data suggests: ☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☒Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☒All required wells located ☐ Needs Maintenance ☐ N/A
Remarks: A portion of each groundwater remedy relies on some natural attenuation._____

IX. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

X. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

With the exception of remaining soil excavation at OU I and the BGRR pile and bioshield removal, all soil, sediment, and groundwater remedies for the seven RODs at the site have been implemented and are functioned as designed. This includes the excavation and off-site disposal of contaminated soils, sediments, tanks, as well as the installation and operations initiated for all groundwater treatment systems. All of the remedies are being implemented in accordance with the RODs and the ESD. The remedies are expected to be protective upon attainment of soil cleanup goals once excavation is complete, and groundwater cleanup goals.

_____

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The VOC treatment systems operated without any significant down time or issues over the last eight years and have consistently met the state equivalency discharge requirements (although there have been a few pH excursions due to the natural groundwater conditions). The systems have been physically inspected typically on a daily basis. However, the frequency of physical inspections will generally be reduced starting in 2005 due to the significant operating history, the increase in the number of systems off of BNL property, and the availability of wireless system monitoring/alarms.

_____

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

- See above. See Five Year Review Section 7.0. To reduce the frequency of system downtime for the Chemical Holes Sr-90 system, the process piping is being redesigned to bypass the holding tanks and use only the extraction well pump to process the water.

_____

D.	Opportunities for Optimization
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Opportunities are routinely identified. See Five Year Review Section 7.0_____ _____

Attachment 4

Interview Records

INTERVIEW RECORD

Site Name: Brookhaven National Laboratory	**EPA ID No.:**
Subject: Five-Year Review	**Time:** 9:05 **Date:** 4/28/05
Type: X Telephone ☐ Visit ☐ Other **Location of Visit:**	☐ Incoming ☐ Outgoing

Contact Made By:

Name: Jen Clodius	**Title:**	**Organization:** CEGPA

Individual Contacted:

Name: Doug Pocze	**Title:**	**Organization:** EPA II
Telephone No.: 212-637-4432 **Fax No.:** **E-Mail Address:** pocze.doug@epa.gov	**Street Address:** 290 Broadway **City, State, Zip:** NY, NY 1007-1866	

Summary of Conversation

Mr. Pocze stated that he thought cleanup at BNL was progressing well. He feels that, for the purpose of the five-year review, particular attention should be paid to the groundwater treatment systems – not only because there are numerous systems, but because many of the systems are off site and in communities. Mr. Pocze feels that the greatest potential risk is the groundwater treatment systems, especially regarding whether the systems' performance would corroborate the modeling.

Although new to BNL's projects, Mr. Pocze said that he felt well informed about the cleanup. He also said that he felt the public is well-informed, and that the site does a lot of outreach work. He specifically noted the number of public info sessions, public meetings, factsheets, and CAC meetings.

Mr. Pocze is not confident that the cleanup will continue to be managed properly. He stated that this is an agency-wide concern for federal facilities. He mentioned concerns about property transfers, long-term land use, and questions about who will oversee the future cleanup work.

Mr. Pocze did not have any suggestions regarding management of the cleanup – he stated that he thought it was going fairly smoothly.

INTERVIEW RECORD

Site Name: Brookhaven National Laboratory	**EPA ID No.:**
Subject: Five-year review	**Time:** 10:30 **Date:** 05/02/05
Type: X Telephone ☐ Visit ☐ Other **Location of Visit:**	☐ Incoming ☐ Outgoing

Contact Made By:

Name: Jen Clodius	**Title:**	**Organization:**

Individual Contacted:

Name: Mary Logan	**Title:**	**Organization:** EPA

Telephone No.: 312-886-4699 **Fax No.:** **E-Mail Address:** logan.mary@epa.gov	**Street Address:** 77 West Jackson Blvd **City, State, Zip:** Chicago, IL 60603-3507

Summary of Conversation

Ms. Logan's overall impression of the cleanup activities at BNL is favorable. She noted that BNL's groundwater group has good history from which to work, and suggests that EPA would like to see "tempo trends over time". She noted that seeing the visual representations of models versus actual data is also helpful, and suggested writing short summaries comparing what was expected to what found in the field.

Ms. Logan feels that she – and the public – are well informed. At the point when she left, she felt that remedies were functioning as expected. She is most concerned about achieving the Sr-90 cleanup.

Ms. Logan suggests keeping an eye on TCE regulations – she thinks she's heard about possible changes but could not recall what she'd heard.

Regarding risk to achieving soil cleanup, Ms. Logan said that construction around the BGRR was a concern – but added that proper planning would help mitigate the risk. Regarding risk to achieving groundwater cleanup, she mentioned the size of the groundwater plumes and the fact that multiple systems are in operation. She suggested careful monitoring of the plumes and changes to the remedy if necessary.

Ms. Logan is, for the immediate future, confident that DOE will continue to manage cleanup. She had no suggestions regarding management of the cleanup.

INTERVIEW RECORD

Site Name: Brookhaven National Laboratory	**EPA ID No.:**
Subject: Five-year Review	**Time:** **Date:**
Type: X Telephone ☐ Visit ☐ Other **Location of Visit:**	☐ Incoming ☐ Outgoing

Contact Made By:

Name: Jen Clodius	**Title:** Sr. Comm Relations Rep	**Organization:** CEGPA

Individual Contacted:

Name: Jim Lister	**Title:**	**Organization:** NYSDEC
Telephone No.: 518-402-9611 **Fax No.:** **E-Mail Address:** jblister@gw.dec.state.ny.us	**Street Address:** **City, State, Zip:**	

Summary of Conversation

Overall, the State is pleased with how cleanup is going. DOE sought stakeholder positions, and has shown willingness to consider those positions. Mr. Lister feels he is well-informed, primarily due to the weekly conference calls. He also feels that the public is well informed.

Mr. Lister knows of no new regulations pending, and is not aware of any specific aspects of the review process that require special attention.

Mr. Lister is most concerned about the risk and difficulty of the BGRR D&D. Risk to workers was mentioned.

The State has greater confidence in DOE's management of cleanup activities than formerly, but he notes that it is the State's role to be vigilant and verify compliance. He said that the State *hoped* to be confident.

Mr. Lister suggested that DOE continue to listen to stakeholders. He recommended that DOE evaluate the concerns of members of the public as well as the regulatory community.

Page __ of ___

INTERVIEW RECORD

Site Name Brookhaven National Laboratory	**EPA ID No.:**
Subject: Five-Year Review	**Time:** 4/28/05 **Date:** 9:35
Type: X Telephone ☐ Visit ☐ Other **Location of Visit:**	☐ Incoming ☐ Outgoing

Contact Made By:

Name: Jen Clodius	**Title:**	**Organization:** CEGPA

Individual Contacted:

Name: Andy Rapiejko	**Title:**	**Organization:** SCDHS
Telephone No.: 631-853-2255 **Fax No.:** **E-Mail Address:**	**Street Address:** **City, State, Zip:**	

Summary of Conversation

Mr. Rapiejko thought the cleanup is progressing well, and said there were no issues that needed particular focus in the review. He thinks he is well informed, as is the public. Mr. Rapiejko felt that it is too soon to assess the effectiveness of most of the RODs – but also said that he had little experience with the early decisions. He asked that Marty Trent be contacted for a broader perspective.

Mr. Rapiejko is not confident that the cleanup will continue to be managed appropriately. He is particularly concerned about the change from ERD to LTRA and the loss of institutional knowledge. He particularly mentioned Skip Medeiros, adding that they have worked together long enough that they have a common knowledge about each others priorities and concerns. Mr. Rapiejko noted that, after he and Mr. Medeiros had hammered out an agreement, they both knew what was going to be done and why. Mr. Rapiejko is concerned that important knowledge is going to be lost.

INTERVIEW RECORD

Site Name: Brookhaven National Laboratory	**EPA ID No.:**
Subject: Five-Year Review	**Time:** 10:35 **Date:** 4/28/05
Type: X Telephone ☐ Visit ☐ Other **Location of Visit:**	☐ Incoming ☐ Outgoing

Contact Made By:

Name: Jen Clodius	**Title:**	**Organization:** CEGPA

Individual Contacted:

Name: Martin Trent	**Title:**	**Organization:** SCDHS
Telephone No.: 631-852-2080 **Fax No.:** **E-Mail Address:**	**Street Address:** **City, State, Zip:**	

Summary of Conversation

Mr. Trent believes that the cleanup plan is a well-thought-out, well-executed plan that has been sensitive both to the environment and to public concerns. He suggests that one area of particular review focus should be residual contamination. He feels that he is well-informed and that interested members of the public are also well-informed.

Mr. Trent thinks that the cleanup is going well so far. He noted that there have been surprises, and adds that the surprises have been fixed and dealt with. He is not aware of any upcoming regulatory changes that might affect cleanup.

Mr. Trent believes that the greatest risk to cleanup is the issue of continued funding. He is not confident – but is hopeful – that DOE will continue to actively manage the long-term cleanup. He added that SCDHS would continue to monitor and verify the work. He noted that the current administration does not have a strong environmental record, and expressed concern that that may affect DOE's ability to fund the cleanup.

Mr. Trent concluded that a strong framework was in place, and that communication between all agencies has improved.

INTERVIEW RECORD

Site Name: Brookhaven National Laboratory	**EPA ID No.:**
Subject: Five-Year Review	**Time:** 9:45 **Date:** 5/10/05
Type: X Telephone ☐ Visit ☐ Other **Location of Visit:**	☐ Incoming ☐ Outgoing

Contact Made By:

Name: Jen Clodius	**Title:**	**Organization:** CEGPA

Individual Contacted:

Name: Gail Penny	**Title:** Project Manager	**Organization:** DOE

Telephone No.: 631-344-4363 **Fax No.:** **E-Mail Address:** gpenny@bnl.gov	**Street Address:** **City, State, Zip:**

Summary of Conversation

Ms. Penny thinks that DOE is doing a good job of the cleanup, and noted that the work is almost complete. She suggests that the review should pay particular attention to the institutional controls for the areas of concern.

Ms. Penny feels well informed about the cleanup, and thinks the public is also well informed. She thinks removing the BGRR pile is the area with greatest risk. She is also concerned about the consistency of funding.

Ms. Penny is confident that DOE will continue to manage the cleanup well, and has no other suggestions or recommendations about the cleanup.

Attachment 5

Poll From May 12, 2005 BNL Community Advisory Council Meeting

Building 130
P.O. Box 5000
Upton, NY 11973-5000
Phone 631 344-2277
Fax 631 344-7098
jdascoli@bnl.gov

June 15, 2005

Mr. William Dorsch
LTRA Group Manager
Brookhaven National Laboratory
Bldg. 51
Upton, New York 11973

Dear Mr. Dorsch:

Since the CAC was formed seven years ago as an advisory group to the Laboratory's Director, the members have closely followed the cleanup activities. They have had an ongoing interest in the environmental projects and have expressed concern that monitoring and surveillance activities continue.

Members of the CAC were polled during the May 12, 2005 meeting to get feedback on whether or not the Lab provided adequate information on cleanup activities and if they believed they had an effect on cleanup decisions.

The survey is attached for inclusion as an addendum to the Five-Year Review. If you have any questions, or would like additional information, please do not hesitate to contact me.

Sincerely,

Jeanne D'Ascoli, Manager
Community Relations

/sj

Enclosure:
As stated

Five-Year CERCLA Review

Community Advisory Council Input
May 12, 2005

CAC members were asked to respond to the following questions:

a. Do you think you have had the opportunity to be adequately informed about Brookhaven Laboratory's cleanup and its progress during your time on the CAC?

b. Do you believe that the CAC has had an effect on the cleanup? On which projects, and how?

Helga Guthy
Wading River Civic Association

"In my mind there's no question, the Lab has been great. With all the people, with all the information we've had, the time schedules have always been brought to our attention. I can't think of any time that they have not supplied us with whatever information we needed to make a decision.

We haven't always agreed on the CAC about what the effects should be or how it should be done but they certainly have given us again every opportunity and I guess the specific one that comes to mind with me is the Peconic River, I think it was Area B at the time. They were going to do a more aggressive cleanup then was thought was the best thing to do for that area. They did go back and change some of it, and did less and so on in order not to damage as much of the property as they were going to. And the concern of the fish, they went back and did some more studies. So I would have to say that it's been done very well."

Sarah Anker
Community, Health & Environment Coalition

"I agree, I think Brookhaven Lab has done a lot of, has spent a lot of time and even money producing all the information that they have. It can be overwhelming and I think you've made it to where we can understand it, which is really important. So as far as giving the opportunity to be informed I'll give you maybe a B+ because there's always room for improvement.

I think we did have an influence on the Graphite Reactor making you guys go a little faster and that was a big step. And also the Peconic River was a good back and forth of ideas being exchanged. The phragmites that Karen Blumer came in to discuss, the pros and cons with that. And again I think you enlightened us and we enlightened you so I think we worked well together."

James Heil
Town of Brookhaven, Senior Representative

"Yes, I think we have been adequately informed both at the conceptual and on the intricate steps on many of the cleanups. They've been very interesting, very well done. I think once again we've had differences on cleanups and I would hope that we've had some effect on the cleanup. I think we have. I could pinpoint the political, technical, and economic process but I think we have especially on the Peconic and the BGRR."

Graham Campbell
Brookhaven Retired Employees Association

"Yes, I think that the Lab has done an excellent job in keeping us informed about the progress of the cleanup and the design of the cleanup before hand.

I believe we have had an impact (tape changed) on the Peconic and groundwater in initially providing a sense of the importance of that in the community and applying a little pressure to get it done. Also, in terms of shaping in a smaller way, various things that happened in the cleanup. I'm thinking of some of the offsite work that the Lab was open to feedback from us on and I think modified plans in conjunction with that."

Rita Biss
Lake Panamoka Civic Association

"I think that we have been adequately informed. What I guess has bothered me is many times things take so long. You seem to come to a conclusion and then a year or a year and a half later suddenly they're starting to work on it. I guess Peconic River is one these where that whole discussion must have gone on for two or three years. You talked about doing different things and then you wouldn't do anything for six months or a year. Granted, it's difficult to work during the winter. But I have found coming here has been very interesting. We try to help, there's many different ideas coming up which I think helps the Lab."

David Sprintzen
Long Island Progressive Coalition

"No. 1, Yes.

No. 2, Peconic, Graphite Reactor, the groundwater cleanup, and increased funding to speed up the cleanup. So the answer's Yes, I think it has been a remarkably successful process and I certainly appreciate the way the Lab has been providing responses and it's been constructive."

Don Garber
Affiliated Brookhaven Civic Organizations

"Definitely yes. First of all I now know more on numerous topics that I never ever thought I would. I also want to very much compliment the Laboratory in briefing us in a timely way as the decision process was developing. It was very refreshing and reinforced. I think we were more than well briefed during the various, numerous cleanup processes.

Do I believe the CAC had an effect on the cleanup? Yes I do. While I may not have been enthusiastic on many of the options, there was obviously controversy amongst us. I think that ultimately where the CAC came down had to help. We should also remember that there was also an initiative where the CAC actually tried and was successful in getting more money for the cleanups. So it has been extremely successful, it's been a model for interaction between the Laboratory and the CAC."

James McLoughlin
Suffolk County Fire, Rescue, and Emergency

"Yes, absolutely, they kept us informed on the cleanup operations.

On the second question do I believe that the CAC has had an effect on the cleanup? Yes, I do. The Lab has always been sensitive to the concerns of the CAC on the cleanup projects.

They've always listened to our concerns and taken them into account and that was certainly so with the Peconic River and some of the other projects."

Jean Jordan-Sweet
National Synchrotron Light Source Users

"A resounding yes. I think Brookhaven has just put great effort into investing a lot of resources into educating the CAC. Not only with BNL people, but with outside speakers as well and documentation, and web postings, and you name it, everything. It's been very impressive. And in the opposite direction, I think it says a lot that the Lab has been very good about taking everything that's been said around this table, not just things that we've come to consensus on and written letters of recommendation about but everything that everybody says around this table is listened to by the Lab and I think that's impressive.

And as far as impact on cleanups, I wanted to mention getting the funding four years ago was important and the other two projects that we had a lot of impact on were groundwater, the Peconic River, and the BGRR."

Michael Giacomaro
East Yaphank Civic Association

"The first question, well to the point of overkill I believe most of the time. More information that you didn't have idea that you really wanted to know. All questions were answered and some were even taken further to analyze all the aspects of the question so that you'd have the appropriate answer. So definitely, the Laboratory analyzes everything and gives you more than you need.

As far as do you believe that we had an effect? There have been times when we have had an effect on the cleanup especially with all the alternatives that are usually put out there that we're able to look at. The one instance that I have, that the Lab, I should say DOE didn't necessarily agree with was the Magothy cleanup, but still they looked at what we had to say. The other one of course was the Peconic River and we did have some thoughts on the cleanup there and were listened to. So yes!"

Robert Conklin
Town of Riverhead

At the onset of the Peconic River sediment removal and restoration, public meetings were held in many communities. Most of the decision making process was presented to the CAC at monthly meetings. A work group was formed that met frequently to address the then current issues and answer individual questions. Many excursions to the impacted sites were arranged.

If a person was interested and willing to put in the time and effort, one would have to say that we were offered a superlative opportunity to interact with the ongoing process.

As the path forward in the process became clear, the working group was phased out, the CAC discussions became less frequent and site visitations less numerous. However, any individual who wanted questions answered was afforded every opportunity. At this point, after many years of discussions and presentations, the CAC might have reached its saturation point with the Peconic River. The important offsite work in Robert Cushman Murphy County Park was not given a strong emphasis.

The dismantling of the BGRR took a similar course, frequent updates to CAC, a working group, and visitations but with the crucial core removal at hand, we have been given little information on the prospective process.

The OU III groundwater remediation had frequent CAC presentations and we were aware of the issues and process.

Did we have an effect on the cleanup? On the Peconic Project, from the CAC, there were very diverse opinions presented on most topics. Consensus was difficult to reach. I am sure that regulators and Lab authorities listened carefully to the public opinions expressed but the effect of these on the final outcome is questionable. For example: we have little knowledge that considerably greater quantities of smartweed were added to the river in former banded sunfish habitats. Will the restored habitat be adequate for sunfish survival? Has the evasive plant issues really been addressed? The pilot project would indicate that this is questionable.

The BGRR project did not involve as much of the unknown of Mother Nature's ecology. It was more a matter of degree of contaminant removal. The Lab authorities and regulators have gone to the wall to satisfy the most stringent public opinions. The CAC seemed to have a more united front and hence, a more potent effect. Final determinations wait in the wings.

Groundwater issues being long term, ongoing, and having limited technologies to apply to projects were less contentious. The CAC expressed a strong hand toward a timely and complete as possible contaminant removal. It would seem that Lab officials are moving in this direction.

Mark Walker
International Brotherhood of Electrical Workers – Local 2230

Ok, part one, absolutely! It's hard to go last, everyone's already said everything. The Lab has been very forthcoming. I feel very informed.

Part two, the CAC has had a tremendous effect on the cleanup. I think back to the earlier days of the accelerated cleanup, I think that was a landmark of community involvement in an institution like this. I think that was just tremendous. The work that was done for the input for the reactor cleanup, the groundwater cleanup, the siting of different things having to do with the groundwater cleanup as far as where it was going to land outside in the community and what side of the street would it go down. I think those are all important things that we did. Just to close I'd like to say that I've been very proud to be a member of this organization and the work that's been done and the commitment by the people that are around here. Thank you all."

Submitted by email:

George Proios
Environmental Economic Roundtable

Since I am unable to make the Thursday meeting, I did want to participate in the survey.
1. YES

2. YES- Positive impact; although I feel the lab at times has been too quick to acquiesce to a small number of vocal activists at the expense of good science. That makes future decisions more difficult to make based on facts. We already have a President who makes decisions not based on facts. We can't afford to have scientists as well, caving in to public pressure or the fight is truly lost.

The Peconic River cleanup has dragged out for several years due to CAC issues and comments. My suggestion to use the guzzler was given due consideration- bio-remediation could have been discounted at the very beginning. My own internal dispute with the County

Health Department over how much damage we do to pristine wetlands for a few micrograms of contaminant (that in all likelihood posed absolutely no threat to humans or wildlife) was somewhat resolved with a compromise plan.
I believe the decision to dismantle the bio-shield of the BGRR is a decision everyone will come to regret!! This is one time when I hope I am wrong.

John Hall
Peconic River Sportsmen's Club

Question 2A, my answer is Yes...I had every opportunity to be informed about BNL cleanups and its progress. I was given every opportunity to visit any on site or off site location to view the progress taking place. BNL could not have been more cooperative towards myself, the Peconic River Sportsmen's Club (PRSC) Board of Directors, and the PRSC environmental lawyers. In the off site locations I have been present without an appointment and have been given every courtesy by cleanup personnel and BNL staff.

Question 2B, my answer is "no", which ones? All of them.

Jean Mannhaupt
NEAR (Neighbors Expecting Accountability & Remediation)

2 a: Yes, I am confident and assured I have been adequately informed and kept abreast of all cleanup polices and procedures as well as changes. The tangible results of our progress are in effect and can be readily pointed out.

2b: Our effect has been on groundwater treatment, soils, air quality, tighter, more pro-active monitoring controls, overlapping site review controls and aggressive community involvement planning.

Ed Kaplan
Friends of Brookhaven

a. BNL has done an incredibly good job of keeping the CAC informed at each step in the remediation process for each operable unit. I can think of no instance where the CAC's requests for information have not been handled expeditiously and in great detail. However, there have been instances where cleanup activities seem to have begun, or would soon start, and where CAC members have felt that they were not given sufficient lead time for their input.

b. The CAC's input has been carefully considered by BNL for each OU. In doing so, I believe that BNL and the CAC have been able to accommodate each other's needs and concerns. For example, during very early discussions of the Peconic River cleanup the CAC requested that several pilot studies be done to better understand the range of potential remediation technologies, and to determine whether proposed revegetation plans were optimal. This led to several pilot studies that shed light on technologies that really could not accomplish the required cleanup, to revegetation activities that could help prevent invasive species, and to ways in which remediation contractors could mitigate the effects of their heavy equipment on the BNL environment.

Anthony Graves
Town of Brookhaven

a. Yes, it is my feeling that BNL has done a fine job of informing the CAC regarding cleanup activities. The staff expertise that BNL has provided to the CAC has been very effective in enabling CAC members to navigate and understand the complex decision making processes that culminate in plans for cleanup of the various Operable Units at BNL. Further, when incidents occur that may affect the community, or be reported in the media, or both, BNL has

done a good job of informing the CAC. This has had the effect of facilitating communication between BNL and the surrounding communities.

b. Yes, I believe the CAC has had an effect on the cleanup. The Peconic River cleanup incorporated suggestions from the CAC to salvage native plants and replant them in the cleanup areas. This addressed a concern that local genotypes be used as much as possible. Also in the cleanup of the Peconic River suggestions for rescuing native wildlife uncovered during cleanup operations were taken by BNL and implemented by the contractor.

Regarding the cleanup of the Brookhaven Graphite Research Reactor I believe the decision to remove rather than entomb large portions of the reactor's components was a direct result of input from the CAC and CAC member organizations.

It is my opinion that the CAC also was instrumental in securing fast-track cleanup funds for BNL, that the CAC had an effect on the standards to which the cleanup was specified, and on post-cleanup monitoring operations.

Tom Talbot
Longwood Alliance

a. I was provided with numerous opportunities to learn about, at CAC meetings, additional CAC work group sessions, as well as several field trips to the affected sites. One on one consultations with BNL personnel were available to discuss and respond to specific concerns and issues by individual CAC members.

b. There is no doubt in my mind that the CAC played an active role in affecting the scope and process employed in several site clean-up efforts.

Peconic River: The CAC was instrumental in the decisions related to which processes were to be employed to perform the clean-ups and to the levels the clean-ups were to achieve. Additionally, the CAC actively participated in the scope and form of the post clean-up restoration program.

BGRR: The CAC had a major role in affecting the overall scope of this clean-up activity. At a specially convened session, the CAC presented its views directly to local elected officials. The CAC was opposed to the original plan of a partial clean-up and actively supported an accelerated effort which ultimately became the approved plan.

Adrienne Esposito
Citizens Campaign for the Environment

a. YES.

b. YES, on all projects except the recent changes to the OUIII ROD which extended the clean up time for strontium 90 in the upper glacial and VOCs in the Magothy.

Iqbal Chaudhary
Science & Technology

A-1. Yes I do think that I have had the opportunity over the last few months to be well informed about the BNL's program and progress on cleanup However given the fact that I joined the CAC only a few months ago and did not have the opportunity of first hand familiarization with what went on in the earlier years I still feel somewhat handicapped particularly when discussions get steered into the events and milestones of the past. Moreover I believe if some site visits can be arranged at different stages of the projects' implementation it can greatly enhance the level of

understanding of the scope of the projects, the practicalities of the solutions and the true dimensions of the issues at hand.

A-2. Certainly so. The CAC has been working in close cooperation with the BNL in the flagging of the Environmental issues-be it the risk of radiation from radionuclides that reside within the hence retired research reactor, the pollution of our rivers, harbors, estuaries, and the air, the damage to our pristine environment e.g. the pine barrens, the beaches, and the fish etc. The CAC-BNL partnership has been a model of success for our mutual benefit. My detailed formal comments and suggestions on the proposed Remedial Action Plan for the BGRR were given proper circulation and due consideration. The Long Island Community has derived satisfaction in having a voice that is being heard and respected. However the cleanup projects probably suffer from lack of speed e.g. the Peconic River cleanup has perhaps dragged for too long. The successful implementation of the recently started project-Remediation of Nuclear Contamination at the decommissioned BGRR site is a tremendous challenge and it is obviously the monstrous project to watch with fingers crossed. CAC can hope to continuously weigh in the maintenance of safeguards during the period of planned and approved remedial actions. Admittedly the DOE/BNL management has done their best to assist the CAC members understand the issues, encouraged them to contribute ideas to help in decision making and then displayed significant amount of respect and accommodation to the views and recommendations of the CAC members. All this is very healthy and assuring.

Submitted at the June 9, 2005 CAC meeting:

Barbara Henigin
Longwood Central School District

1. BNL has done an excellent job in keeping the CAC informed about their cleanup progress. With the detail and scope of Brookhaven's presentations I feel that I am more than adequately informed on these matters.

2. The CAC has had an effect on the cleanup projects here at BNL. The CAC has had a direct impact on the Peconic River cleanup project, with many of our members actually being involved in site visits and evaluations. The CAC was also actively involved in the discussion and recommendations for the various cleanup models for these operations. By being part of the CAC I believe that BNL is working for the best interest of the community while still maintaining the integrity of the Laboratory.

Attachment 6
Land Use and Institutional Controls
Fact Sheets

(These are uncontrolled copies. Controlled versions of these factsheets are available at http://luic.bnl.gov/website/landcontrols/)

Factsheet: AGS Storage Yard 1 (AOC 18) (B3)

History:

The Alternating Gradient Synchrotron (AGS) storage yards (Area of Concern 18)hold steel and equipment that is being stored for potential reuse within the Collider–Accelerator facility complex. The largest of the two yards, Yard 1 adjacent to Building 922, is divided into two sections 1a and 1b and is currently used to store activated steel and equipment. Yard 2, which is no longer in use, was used primarily to store non–contaminated steel but was found to contain contaminated materials.

Since these materials were stored on soil in unsheltered yards, concerns were raised that rusting/oxidizing metals could contaminate soils within the yards.

Remedial Action:

A number of soil samples were collected from the storage yards. No radiological or chemical contamination at levels of concern to human health or the environment was found. The OU I Record of Decision specified implementation of institutional controls and monitoring. No remediation of the soil was required. The Collider Accelerator Department is currently in the process of transferring material storage operations to a new, enclosed facility.

Current Conditions: Yards 1a and 1b are currently being used for storage by the AGS Department and are fenced and posted radiological control areas. Yard 2 is vacant, open and not posted. (See Factsheet A8, for LU/IC information on Yard 2.) No significant levels of radiological materials above background were found in the soil. The Maximum concentration of Cs–137 was 0.51pCi/gm. Residual chemical contaminants meet Federal and State guidelines for public exposure.

Land Use and Institutional Controls:

Land Use Classification: Remediation Complete – Restricted (B)

- Currently suitable for Industrial Use.
- Use of the site for residential purposes requires an additional evaluation/risk assessment, and appropriate DOE/regulatory agency approval.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.
- The area is fenced and posted as a radiological controlled area.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual

letter report submitted to DOE, NYSDEC and EPA.

- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- Restoration of the scrap yard shall be incorporated in the facility plan for decommissioning the area (see SBMS Subject Area "Storage and Transfer of Hazardous and Non-Hazardous Materials").
- Any excavated soils shall be returned to the site and covered as found. If soil cannot be returned, the procedure FS-SOP-1005, Release of Material from Areas Controlled for Radiological Purposes must be followed. The waste soils must be managed in accordance with all Waste Management procedures, and the Environmental and Waste Management Services Division shall review all work requiring the disposal of soil wastes at an approved facility.

Facility Use Agreements:
https://sbms.bnl.gov/private/fua/fa0f/fa0fd011.htm (BNL Internal Use Only)

References:

Operable Units II/VII Remedial Investigation Report. IT Corp. February 1999.

Final Feasibility Study Report Operable Unit I and Radiologically-Contaminates Soils. CDM Federal Programs Corp. March 31, 1999.

Record of Decision Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6,8,10,16,17, and 18). USDOE and BNL. August 25, 1999.

For additional information please contact:

Bill Dorsch
Manager, Long Term Response Actions (LTRA)
631-344-5186
dorsch@bnl.gov

Factsheet: AGS Storage Yard 2 (AOC18) (A7)

History:

The Alternating Gradient Synchrotron (AGS) storage yards (Area of Concern 18)hold steel and equipment that is being stored for potential reuse within the Collider–Accelerator facility complex. The largest of the two yards, Yard 1 adjacent to Building 922, is divided into two sections 1a and 1b and is currently used to store activated steel and equipment. Yard 2, which is no longer in use, was used primarily to store non–contaminated steel but was found to contain contaminated materials.

Since these materials were stored on soil in unsheltered yards, concerns were raised that rusting/oxidizing metals could contaminate soils within the yards.

Remedial Action:

A number of soil samples were collected from the storage yards. No radiological or chemical contamination at levels of concern to human health or the environment was found. The OU I Record of Decision specified implementation of institutional controls and monitoring. No remediation of the soil was required. The Collider Accelerator Department is currently in the process of transferring material storage operations to a new, enclosed facility.

Current Conditions: Yards 1a and 1b are currently being used for storage by the AGS Department and are fenced and posted radiological control areas. Yard 2 is vacant, open and not posted. No significant levels of radiological materials above background were found in the soil.

Land Use and Institutional Controls:

Land Use Classification: Remediation Complete – Unrestricted (A)

- The site has been remediated to a residential use standard, but is currently used for industrial purposes
- With appropriate DOE/regulatory agency approval, the site can be used for residential purposes once industrial activities have ended.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.

- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

Facility Use Agreements:
https://sbms.bnl.gov/private/fua/fa0f/fa0fd011.htm (BNL Internal Use Only) (BNL Internal Use Only)

References:

Operable Units II/VII Remedial Investigation Report. IT Corp. February 1999.

Final Feasibility Study Report Operable Unit I and Radiologically–Contaminates Soils. CDM Federal Programs Corp. March 31, 1999.

Record of Decision Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6,8,10,16,17, and 18). USDOE and BNL. August 25, 1999.

For additional information please contact:

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Factsheet: Alternating Gradient Synchrotron (AGS) g–2/VQ12 Source Area (AOC 16T) (C5)

History:

The g–2 experiment of the Alternating Gradient Synchrotron (AGS) facility operated from 1997 through 2001. Prior to the start of the experiment, BNL constructed a gunite (cement) cap over the beam stop area, the designed beam loss area. During beam line operation, activation of the soils immediately outside of the beam stop was expected due to the creation of secondary particles produced at the stop. The primary radionuclides of concern in the activated soils are tritium and sodium–22.

In November 1999, BNL discovered tritium in groundwater downgradient of the g–2 beam line at concentrations exceeding the 20,000 pCi/L drinking water standard. Sodium–22 was also detected, but at levels below the 400 pCi/L drinking water standard. An investigation into the source of the contamination revealed that the tritium originated from activated soil shielding located adjacent to the g–2 experiment's VQ 12 magnet in the experimental beam line. It was determined that VQ 12 area was not protected by the existing beam stop cap, and that the structures over the VQ 12 area were not effectively controlling stormwater infiltration. The activated soil shielding and the tritium plume were designated Area of Concern 16T under the BNL Environmental Restoration Program.

Controls for other BNL accelerator facility beam loss areas are described in Fact Sheet C6.

Remedial Action:

In December 1999, BNL installed a gunite cap over the VQ 12 magnet region of the beam line. This cap was joined to the previously installed cap over the nearby g–2 beam stop. The groundwater monitoring well network was expanded for improved surveillance of the tritium plume and to verify the effectiveness of the controls.

Current Conditions: The area over the VQ12 source area is capped and the contamination is located well below the land surface. Therefore, there is little chance for workers, visitors and animals to come in contact with the contaminated soil shielding.

Land Use and Institutional Controls:

Land Use Classification: Capped/Controlled Contaminated Soils – Restricted (C)

- BNL accelerator facilities are in active industrial use.
- Additional evaluation/risk assessment and appropriate DOE/regulatory agency approval are required prior to release for unrestricted use.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.
- The g–2/VQ12 source area is fenced and posted. Access to the beam line tunnel is restricted.
- Because the activated soil shielding is located far below land surface, site workers; visitors and wildlife are not exposed to the contamination.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

-

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- Without written authorization, no activities shall be permitted in the g–2/VQ12 source area that could compromise the integrity of the impermeable caps and stormwater management systems.
- Any excavated soil sheilding must be characterized, managed in accordance with all Waste Management procedures. If soil cannot be returned to the g–2/VQ12 source area for reuse, the procedure FS–SOP–1005, Release of Material from Areas Controlled for Radiological Purposes must be followed. The Environmental and Waste Management Services Division shall review all work requiring the disposal of soil wastes at an approved facility.

Facility Use Agreements:
https://shms.bnl.gov/private/fua/fa0f/fa0fd011.htm (BNL Internal Use Only)

References:
Work Plan Characterization and Monitoring of the g–2 Tritium Plume Area AOC 16T. January 24, 2003.

For additional information please contact:

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Factsheet: Ash Pits (AOC 2F) (C3)

History:

The Ash Pits (Area of Concern 2F), received ash and slag from a solid waste incinerator used from World War I to the early 1950's. The Ash Pits were also used for disposal of coal ash from various buildings throughout BNL until 1963. The site occupies approximately 3 acres and is located north and south of East Princeton Avenue and west of Grove Street. According to BNL staff, fill material was deposited on top of the Ash Pits along the north and south sides of East Princeton Avenue in order to build up the road. A portion of the northeast area of the Ash Pits was covered with concrete debris from concrete trucks dumping residual loads. In the late 1990's, the section of East Princeton Avenue that bisects the Ash Pits was raised approximately 10 feet to prevent rainwater runoff from ponding on the road. Also, to mitigate erosion, the north section of the Ash Pits was re-graded, re-vegetated with grass, and 4-inch stone rip-rap was placed in two locations. The northern and southern portions are vegetated with trees, shrubs, and grasses. The ash is currently located below a few inches to 10 feet of clean fill material.

Analysis of the ash pit wastes indicates the presence of lead, copper, and zinc at concentrations above site background levels. Lead was detected in amounts greater than 400 mg/kg in eight of the samples, with a maximum of 2,100 mg/kg. Barium and arsenic were concentrated in the ash up to ten times above site background concentrations, and selenium and chromium were detected above site background in almost all samples. Other contaminants of concern, which included aluminum, cadmium, beryllium, manganese, thallium, and vanadium, were present at concentrations exceeding site background in some samples.

Some radionuclides were also detected above background levels. Cesium-137 was detected in one sample at a concentration of 2.1 pCi/g (which is slightly above the site background concentration of 1.5 pCi/g), and strontium-90 was present at a maximum concentration of 1.5 pCi/g (which is five times above the site background concentration of 0.3 pCi/g).

Remedial Action:

Additional remediation on the filled northern portion of the ash pit was not required. Remediation of the ash pit on the southern portion required removal of some trees, backfilling of soil to even out the grade, covering the site with of 12-inches of topsoil, and finally reseeding of the area with native grasses. The Ash Pit area has been covered with clean fill to prevent site workers, visitors, and wildlife from being exposed to the subsurface contamination.

Radionuclide concentrations were below the target risk range for all future uses, including residential use. The maximum lead concentration of 2,100 mg/kg exceeded the soil screening level of 400 mg/kg for unlimited use.

Land Use and Institutional Controls:

Land Use Classification: Capped/Controlled Contaminated Soils – Restricted (C)

- Industrial and residential uses of the site are currently prohibited due to burried contaminated materials.
- Recreational and open space uses of the site may be permitted with appropriate DOE/regulatory agency approval.
- Additional evaluation/risk assessment and appropriate DOE/regulatory agency approval are required prior to release for unrestricted use.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- The Ash Pit area has been covered with clean fill and seeded to prevent site workers, visitors, and wildlife from being exposed to the subsurface contamination.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- Without written authorization, no activities shall be permitted in the Ash Pit areas that could compromise the integrity of the vegetative caps.

Facility Use Agreements:
N/A (BNL Internal Use Only)

References:

Final Engineering Evaluation/Cost Analysis for Landfill Closure Removal Action VI. CDM Federal Programs Corp. Vol. 1 2. March, 1995.

Final Feasibility Study Report Operable Unit I and Radiologically–Contaminates Soils. CDM Federal Programs Corp. March 31, 1999.

Record of Decision Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6,8,10,16,17, and 18). USDOE and BNL. August 25, 1999.

Final Close Out Report for the Ash Pit OU I AOC 2F. BNL Environmental Management Directorate. February 5, 2004.

For additional information please contact:

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Factsheet: Brookhaven Graphite Research Reactor (FI)

History:
The Brookhaven Graphite Research Reactor (BGRR) was the world's first research reactor constructed solely for the peaceful use of atomic energy. The BGRR operated from 1950 to 1968. The BGRR produced large quantities of neutrons which were used for research in numerous scientific fields. Nuclear physicists used them to probe the centers of atoms. Solid-state physicists used neutrons to study the locations and motions of atoms in materials. Chemists used neutrons to examine many properties of matter. Biologists and medical physicists used neutrons to study the effects of radiation on organic tissues and to create radioisotopes for medical research and treatment.

Remedial Action:

The BGRR decommissioning will be accomplished through CERCLA Removal Actions.
A variety of techniques will be used to achieve desired cleanup levels, such as:

Decontamination: In some cases, contamination can be removed by cleaning surfaces or removing equipment or structures.

Fixing or isolating contaminants: It is sometimes possible to apply coatings or other treatments that stabilize or fix contaminants in place. Also, contaminated areas can be enclosed or sealed off from the environment.

Demolition and dismantlement: Decommissioning can involve tearing down structures and taking apart equipment.

Building conversion and reuse: If buildings are left in place, they can sometimes be converted for other uses after cleanup is completed.

The particular actions to be taken at the BGRR will be chosen after a detailed evaluation of alternatives. This evaluation and the proposed course of action will be presented for public review and input. The selected course of action, upon approval by the U.S. Environmental Protection Agency and the New York State Department of Environmental Conservation, will be documented in a Record of Decision that is placed in the Administrative Record. Waste generated from the DDprocess will be disposed of at a licensed off-site facility.

Land Use and Institutional Controls:

Land Use Classification: Radiological Facility, Restricted Use (F)

- The BGRR is an inactive radiological facility.
- Future land use scenarios to be determined.
- A risk assessment and appropriate DOE/regulatory agency approval are required prior to release for unrestricted use.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.
- The BGRR Building and associated structures are posted Radiologically Controlled areas, and access to these structures is restricted to authorized personnel.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- BGRR Building is used for containment.
- Exterior areas that underwent soil remediation were backfilled with clean soil and paved.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).

- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- Any excavated soils from below or surface soils adjacent to the BGRR structure shall be returned to the site and covered as found. If soil cannot be returned, the procedure FS–SOP–1005, Release of Material from Areas Controlled for Radiological Purposes must be followed. The waste soils must be managed in accordance with all applicable Waste Management procedures, and the Environmental and Waste Management Services Division shall review all work requiring the disposal of soil wastes at an approved facility.
- Any activities involving the BGRR are suject to the National Historic Preservation Act (NHPA), and must be reviewed as part of the National Environmental Policy Act (NEPA) process to determine whether a proposed action could impact features that extend NHPA eligibility to this facility.

Please refer to the BGRR Boundary Complex Area picture from the final BGRR Record of Decision dated January 31, 2005 for more detailed information about the land use and institutional controls for this area.

Facility Use Agreements:
https://sbms.bnl.gov/private/fuu/fa6b/fa6bd011.htm (BNL Internal Use Only)

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Land Use Controls Mapping

BROOKHAVEN NATIONAL LABORATORY

Factsheet: Brookhaven LINAC Isotope Producer (BLIP) (AOC 16K) (C-4)

History:

The BLIP facility has been in operation since 1972. Radionuclides produced at BLIP are processed for pharmaceutical and medical imaging applications. The BLIP targets are located at the bottom of a 30–foot underground tank. During target irradiation, several radionuclides are produced in the cooling water, and activation of the soils immediately occurs outside of the tank due to the creation of secondary particles produced at the target. The types of radionuclides created in the soils include tritium, beryllium–7, carbon–11, nitrogen–13, oxygen–15 and sodium–22. Once present in the soils, some of these radionuclides can be leached downward into groundwater by means of rainwater percolation. These leaching processes are usually quite slow and, therefore, only radionuclides with long half–lives such as tritium (half life of 12.3 years) and sodium–22 (half life of 2.6 years) are likely to be detected in groundwater.

In late 1998, BNL detected tritium in the groundwater downgradient of the BLIP facility at concentrations that exceeded the 20,000 pCi/L drinking water standard. Sodium–22 was also detected, but at concentrations below the 400 pCi/L drinking water standard. A subsequent investigation determined that tritium and sodium–22 were being leached from the activated soils by rainwater that was infiltrating the soils surrounding the BLIP building.

Remedial Action:

Starting in December 1998, BNL made improvements to the stormwater management program at BLIP in an effort to prevent rainwater infiltration of the activated soils below the building. The BLIP building's roof drains were redirected away from the building, paved areas were resealed, and an extensive gunite (cement) cap was installed on three sides of the building. In May–June 2000, BNL undertook additional protective measures by injecting a colloidal silica grout into the activated soils. The grout reduces the permeability of the soils, thus reducing the potential for rainwater to leach radionuclides out of the soils should one of the surface stormwater controls fail. The groundwater monitoring well network was also expanded for improved surveillance of the tritium plume and to verify the effectiveness of the controls.

Current Conditions: The Medical Department currently operates BLIP, which is a posted and controlled radiological area. Levels of primary radiological contaminants of concern (Tritium and Na–22) above background found in the subsurface soil are contained and subject to radioactive decay. Because the activated soil shielding is located far below land surface, site workers; visitors and wildlife are not exposed to the contamination.

Land Use and Institutional Controls:

Land Use Classification: Capped/Controlled Contaminated Soils – Restricted (C)

- BNL accelerator facilities are in active industrial use.
- Additional evaluation/risk assessment and appropriate DOE/regulatory agency approval are required prior to release for unrestricted use.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.
- Access to the LINAC to BLIP beam line is restricted.
- Because the activated soil shielding is located far below land surface, site workers; visitors and wildlife are not exposed to the contamination.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- Stormwater infiltration in the BLIP area is controlled by a combination of roof drains and capping materials, including asphalt, concrete, and gunite.

- The activated soil shielding was impregnated with a colloidal silica grout to reduce its permeability.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- Without written authorization, no activities shall be permitted in the BLIP area that could compromise the integrity of the impermeable caps and stormwater management systems.
- Any excavated soil sheilding must be characterized, managed in accordance with all Waste Management procedures. If soil cannot be returned to the BLIP site for reuse, the procedure FS–SOP–1005, Release of Material from Areas Controlled for Radiological Purposes must be followed. The Environmental and Waste Management Services Division shall review all work requiring the disposal of soil wastes at an approved facility.

Facility Use Agreements:
https://sbms.bnl.gov/private/fua/fa4k/fa4kd011.htm (BNL Internal Use Only)

References:

Operable Units II/VII Remedial Investigation Report. IT Corp. February 1999.

Final Feasibility Study Report Operable Unit I and Radiologically–Contaminated Soils. CDM Federal Programs Corp. March 31, 1999.

Action Memorandum, Brookhaven LINAC Isotope Producer (BLIP) Removal Action. Brookhaven National Laboratory and USDOE. March 10, 2000.

Brookhaven LINAC Isotope Producer (BLIP) Closeout Report, Removal action Area of Concern 16K. Environmental Management Directorate and Environmental Sciences Division. November 14, 2001.

For additional information please contact:

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Factsheet: Bubble Chamber Spill Area (AOC 14) (B12)

History:
The Bubble Chamber Spill Area (AOC 14) was used for the temporary storage of drum and liquid filled scintillation counters. Scintillation oil is mainly composed of mineral oil and trimethylbenzene. Several documented spills of scintillation oil and transformer oil occurred in this area. A July 1989 pipe break resulted in the release of approximately 15 to 20 gallons of scintillation oil to the ground. Most of the free oil and associated contaminated soils were remediated. In August 1987, approximately 100 gallons of transformer oil leaked onto the pavement. The oil contained the PCB Aroclor 1260 at a concentration of 15 ppm. Most of the oil was contained on the pavement, but a small amount was reported to have reached adjacent soils.

Remedial Action:
The Bubble Chamber Spill area was evaluated as part of the Operable Unit III Remedial Investigation and documented in the OU III ROD. Cesspools and septic tanks were removed as part of Removal Action III. Groundwater treatment and monitoring were performed to meet remediation goals.

Land Use and Institutional Controls:

Land Use Classification: Remediation Complete – Restricted Use (B)

- The area has been remediated to an industrial use standard.
- Low–levels of residual chemical contamination might be present in some areas. Use of the site for residential purposes requires an additional evaluation/risk assessment and appropriate DOE/regulatory agency approval.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

References:

Removal Action III – Cesspool/Septic Tanks Action Memorandum. January 1994.

Closeout Report for Removal Action III Cesspool/Septic Tanks. 1999

Operable Unit III Feasibility Study Report. IT Corp. March 1, 1999.

Operable Unit III Record of Decision. April 14, 2000.

For additional information please contact:

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Factsheet: Building 208 Vapor Degreaser (AOC 26) and Warehouse Area (B13)

History:
Building 208 (Area of Concern 26) was located in the Supply and Material (warehouse) area of the site. The northwest section of the building contained a vapor degreasing pit that was in operation until 1988. An investigation of Building 208 was initiated following the discovery of 1,1,1–trichloroethane (TCA) in the sanitary lines leading into the building. A subsequent soil gas study and the collection of soil samples below the vapor degreaser did not show levels of TCA contamination above cleanup levels.

Remedial Action:

Based upon the soil gas and soil sampling results, soil remediation was not required. Building 208 has been demolished, however the foundation and some emptied oil/water separators remain.

Land Use and Institutional Controls:

Land Use Classification: Remediation Complete – Restricted Use (B)

- The area has been remediated to an industrial use standard.
- Low–levels of residual chemical contamination might be present in some areas. Use of the site for residential purposes requires an additional evaluation/risk assessment and appropriate DOE/regulatory agency approval.
- Building 208 has been demolished, however the foundation remains.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

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Factsheet: Building 464 Area Mercury Contaminated Soils (AOC 27) (A-4)

History:

The grass covered field immediately north and east of Building 464, the DOE Site Office, was occupied by a series of buildings that housed the Chemistry Department from 1947 until 1966. The old Chemistry complex was comprised of several old Army era barracks type buildings and was demolished in 1970.

During construction of the east wing addition to Building 464 in 1993, the excavation contractor discovered elemental mercury in old storm water catch basins, interconnecting piping and adjacent soils (AOC 27). Analysis of soil samples showed mercury concentrations as high as 1,070 mg/Kg. PCBs were also identified in soils at concentrations as high as 47 mg/Kg.

The impacted storm drains were not interconnected to the central stormwater disposal system but acted to spread the water over the large field and permit local recharge. Consequently, mercury and PCB contamination was localized to the basins and soils immediately adjacent the basins.

Remedial Action:

A remedial action of 1 mg/Kg for both mercury and PCBs was selected and approved by the IAG agencies. Soils were excavated and segregated by expected levels of contamination. Soils with high levels of mercury (i.e., > 260 mg/Kg) were shipped for mercury recovery and the remainder by landfill. By October 2003, approximately 280 tons of soil contaminated with mercury and PCBs was disposed at the Model City landfill. An additional 2.5 tons (8–55 gallon drums) were shipped for mercury recovery via retort furnace.

Land Use and Institutional Controls:

Land Use Classification: Remediation Complete – Unrestricted Use (A)

- The site has been remediated to a residential use standard, but is currently used for industrial purposes
- With appropriate DOE/regulatory agency approval, the site can be used for residential purposes once industrial activities have ended.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.

- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

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Land Use Controls Mapping

BROOKHAVEN NATIONAL LABORATORY

Factsheet: Building 479 Spill Areas (AOC 25) (A6)

History:
Building 479 (Area of Concern 25) is a heavy machine shop where lubricating oils, cutting oils, and degreasing solvents are used. During a 1992 excavation for an addition to the south side of the building, PCB and petroleum contaminated soils were discovered. The highest PCB and total petroleum hydrocarbon (TPH) levels were 1,300 mg/kg and 22,000 mg/kg, respectively. In addition numerous other small spills have occured inside and outside Building 479.

Remedial Action:
The PCB and hydrocarbon contaminated soils were remediated, and the building addition was constructed over the cleanup area.

Land Use and Institutional Controls:

Land Use Classification: Remediation Complete – Unrestricted Use (A)

- The site has been remediated to a residential use standard, but is currently used for industrial purposes
- With appropriate DOE/regulatory agency approval, the site can be used for residential purposes once industrial activities have ended.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

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Factsheet: Building 650 Reclamation Facility Sump And Sump Outfall (AOC 6) (B1)

History:

Building 650, known as the Former Reclamation Facility, was constructed in the late 1950's for the decontamination of radioactive contaminated clothing and heavy equipment. The facility was designed to perform decontamination operations both inside and outside the building.

In the past, all soiled laundry from BNL was delivered to Building 650, where potentially radioactively contaminated laundry was segregated from routine laundry. The radioactively contaminated laundry was cleaned with dedicated equipment and the residual wash water was transferred to and contained in the facility's underground storage tanks (USTs) until the level radiological activity could be determined. These USTs were located on the north side of the building. The liquid waste was emptied from the USTs about three times a year and taken to the Waste Concentration Facility (WCF) by a tanker truck.

Building 650 also served as a decontamination facility for radioactively contaminated equipment. The radioactively contaminated equipment was steam cleaned on a 30–foot by 30–foot concrete pad on the north side of the building. The radioactively contaminated water from the steam cleaning operation collected in a drain in the middle of the sloping concrete pad, known as the Building 650 Sump. Depending upon the expected level of contamination, the effluent was supposed to be either piped into the sanitary sewer system or into the USTs. An investigation in 1969 revealed that the drainage pipe from the outdoor pad behind Building 650 led to a natural depression in a wooded area about 800 feet northeast of Building 650, rather than the sanitary sewer system or USTs. The practice of decontaminating radioactively contaminated equipment on the concrete pad was discontinued after the 1969 incident. The natural wooded depression is referred to as the Building 650 Sump Outfall Area.

Remedial Action:

The USTs were included under AOC 12 and were removed under Removal Action (RA) II, the UST RA, during the summer of 1994. The action was documented in the OU IV Record of Decision.

Excavation of soils began in March 2002 and was completed in June 2002. Soils, asphalt and concrete debris were excavated from the area behind Building 650 and the Building 650 Sump Outfall Area. In addition to soil excavation at the Building 650 Sump Outfall, approximately 987 feet of storm pipe leading from Building 650 to the Sump Outfall and the 30–foot by 30–foot concrete decontamination pad (and associated soils) behind Building 650 were excavated for disposal at Envirocare of Utah. The work also included the removal and disposal of 8–inch and 15–inch diameter storm pipe, two manholes, and contaminated soil around the pipeline and manholes.

Plans are being prepared to DDBuilding 650 and attached hopper structures.

Current Conditions: The residual Cs–137 activity in the remediated soils is below the cleanup goal of 23 pCi/gm Cs–137, which is the only contaminant of concern remaining. The remaining Cs–137 activity in the soils today will meet residential requirements following 50 years of radioactive decay. A few isolated deep locations and a small section of storm pipe could not be fully remediated. The risk and dose associated with these locations is negligible. Maximum residual concentrations in one isolated deep excavation several feet below normal excavation in the Sump Outfall were 16 to 23 pCi/gm Cs–137, 25–174 pCi/gm U–238 and 2.6 pCi/gm Sr–90. These deep locations were backfilled and the entire outfall area covered with five feet of clean soil. A section of storm pipe that could not be removed showed maximum at one–end concentrations of 38 pCi/gm Cs–137, 16 pCi/gm Sr–90 and 2.6 pCi/gm U–239. This location was remediated to the extent possible in is now under 14 ft. of clean soil. Soils in the pad area at Bldg. 650 are at or below maximum background levels for Cs–137.

Any radionuclides in the groundwater downgradient from this facility are well below the USEPA standards for drinking water. Current conditions meet worker exposure guidelines for radioactivity. The dose and risk to workers are essentially zero. There were no chemical contaminants of concern and soil concentrations for chemicals meet Federal and State guidelines for public exposure.

Land Use and Institutional Controls:

Land Use Classification: Remediation Complete – Restricted Use (B)

- The area has been remediated to an industrial use standard.
- Based upon residual contamination levels, the site will be suitable for residential purposes with 50 years of in situ radioactive decay (i.e., by the year 2055). Use of the site for residential purposes prior to 2055 requires an additional evaluation/risk assessment, and

appropriate DOE/regulatory agency approval.
- Building 650 is undergoing D&D and its use is restricted.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

Facility Use Agreements:
https://sbms.bnl.gov/private/fua/fa7e/fa7ed011.htm (BNL Internal Use Only)

References:

Operable Unit IV Record of Decision. USDOE and BNL Office of Environmental Restoration. March 14, 1996.

Final Feasibility Study Report Operable Unit I and Radiologically–Contaminates Soils. CDM Federal Programs Corp. March 31, 1999.

Record of Decision Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6,8,10,16,17, and 18). USDOE and BNL. August 25, 1999.

Closeout Report Remedial Action Area of Concern 6, Building 650 Reclamation Facility Sump and Sump Outfall. BNL Environmental Restoration, December, 2002.

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Land Use Controls Mapping

BROOKHAVEN NATIONAL LABORATORY

Factsheet: Building 811 Waste Concentration Facility (AOC 10) (B7)

History:

At the Waste Concentration Facility (Area of Concern 10), liquid radioactive waste received from the Brookhaven Graphite Research Reactor, the Hot Laboratory Complex, Building 801, and the High Flux Beam Reactor, was temporarily stored and eventually distilled to remove particulates, and suspended and dissolved solids. The facility contained three 100,00 gallon capacity above ground D–waste tanks (Tanks D–1, D–2 and D–3) that were used to store liquid waste from 1949 to 1987. In addition to the aboveground tanks, six 8,000–gallon stainless steel underground storage tanks were located 50 feet north of Building 811. The six UST were used to store class A and B radioactive wastes.

Documented spills and leaks at the facility have resulted in soil and groundwater contamination. The primary radionuclides of concern in soils are cesium–137 and strontium–90, and strontium–90 in the groundwater.

The Waste Management Division currently uses the facility to manage and store low–level radioactive liquid waste in aboveground storage tanks prior to offsite disposal.

Remedial Action:

All three aboveground D–tanks were dismantled and removed in 1995. The contaminated concrete pads for the D–tanks were given an additional temporary asphalt cover in 1998 to prevent runoff and leaching of contaminants. The six underground storage tanks, associated piping and concrete pads were removed in early 2005 and disposed of at Envirocaire of Utah. Approximately Approximately 4,100 cubic yards of soil, concrete, asphalt, and piping were removed, transported, and disposed of at Envirocaire of Utah. Elevated levels of contamination could not be removed in 2 deep areas (see Current Conditions). To ensure future users are not exposed to residual contamination, a minimum of six inches of clean fill was placed over the remediated area and seeded. All of the debris, including the tanks, piping, concrete pads, asphalt surfaces and contaminated soils were disposed of at a licensed off–site facility. Groundwater is being monitored and treated for Sr–90 down gradient from the facility.

Current Conditions: The average residual Cs–137 activity, which is the primary contaminant of concern remaining in the remediated soils, is 4.56 pCi/g which is below the cleanup goal of 23 pCi/gm Cs–137. The remaining radioactivity in the soils today will meet residential requirements following 50 years of radioactive decay. The dose to a resident after 50 years of institutional controls is 3.75 mrem/yr and the dose to a resident at time zero is 12.79 mrem/yr. This meets both the EPA cleanup criteria of 15 mrem/yr and the New York State Department of Environmental Conservation ALARA cleanup goal of 10 mrem/yr.

Two areas of known contamination were left behind but were still factored into the final dose assessment. They included a small pocket of contaminated soilbelow the active steam and D waste lines and soil that was adjacent to the building 810 foundation. These two areas will be further remediated when the Waste Concentration Facility is decommissioned and are discussed in the Final Closeout Report.

Groundwater is currently being treated for removal of Sr–90 down gradient from the facility for up to 10 years and will be monitored for a period of 60 years.

The facility is currently under control of the Waste Management Division, is fenced and posted as a radiological control area.

Land Use and Institutional Controls:

Land Use Classification: Remediation Completed – Restricted Use (B)

- The area has been remediated to an industrial use standard.
- The WCF is currently active and continues to be used for managing and shipping liquid radioactive waste.
- Based upon residual contamination levels, the site will be suitable for residential purposes with 50 years of in situ radioactive decay (i.e., by the year 2055). Use of the site for residential purposes prior to 2055 requires an additional evaluation/risk assessment, and appropriate DOE/regulatory agency approval.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

- The remediated area is fenced and posted for access control.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- Any excavated soils shall be returned to the site and covered as found. If soil cannot be returned, the procedure FS–SOP–1005, Release of Material from Areas Controlled for Radiological Purposes must be followed. The waste soils must be managed in accordance with all Waste Management procedures, and the Environmental and Waste Management Services Division shall review all work requiring the disposal of soil wastes at an approved facility.

Facility Use Agreements:
https://sbms.bnl.gov/private/fun/fa49/fa49d011.htm (BNL Internal Use Only)

References:

Dames & Moore, 1993. Engineering Evaluation/Cost Analysis (EE/CA) 'D' Tanks Removal Action Project. July 1993.

IT Corp. 1995. Closeout Report for Brookhaven National Laboratory 'D' Tanks Removal Action Upton, New York. November, 1995.

Operable Units II/VII Remedial Investigation Report. IT Corp. February 1999.

Final Feasibility Study Report Operable Unit I and Radiologically–Contaminates Soils. CDM Federal Programs Corp. March 31, 1999.

Record of Decision Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6,8,10,16,17, and 18). USDOE and BNL. August 25, 1999.

URS Corp., 2001. Closeout Report. Removal, Treatment, and Disposal of Radioactive and Mixed Waste Sludge from Building 811 Tanks. October 2001.

Weston Solutions, Inc, 2005. Final Status Survey Report for Building 811 Underground Tank Removal and Soils Remediation.

Closeout Report, Brookhaven National Laboratory, Operable Unit 1 Area of Concern 10, Waste Concentration Facility, September 2005.

For additional information please contact:

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Factsheet: Building 830 Facility, Pipe Leak and USTs (AOCs 11 12) (B5)

History:

This site consists of two areas of concern (Bldg. 830 Pipe Leak –AOC 11 and Bldg. 830 USTs –AOC 12). Operations within Building 830 commenced in 1963, when the High Intensity Radiation Development Laboratory was opened. Hot cells and associated laboratories were used to fabricate high intensity cobalt–60 sources for food irradiation programs. The cells have also been used for the cutting, milling and evaluation of radioactively contaminated and activated material and components from commercial nuclear power plants.

A 1986 inspection of the facility's liquid waste tanks and waste inventory records revealed a 825 to 900 gallon discrepancy between the period of July 1984 and April 1987. Leak tests conducted in 1986 and 1987 revealed that there was a leak in the transfer line located between Building 830 and two, 1,000 gallon capacity underground storage tanks (USTs) that were located approximately 75 feet east of the building. The transfer line leak resulted in radionuclide contamination of the soils adjacent to the line. Low levels of cobalt–60 were also detected in nearby groundwater monitoring wells.

Remedial Action:

The tanks were removed from service in 1986. The contaminated soils along the transfer line were excavated in September and October 1988. The USTs were completely pumped out in November 1994, and the tanks, valve pit pipes and additional contaminated soils were removed in 1999. The excavated areas were backfilled with clean soil and seeded. The Cobalt source in Building 830 was removed and the Gamma Irradiation Facility decommissioned in March 2000. (See Factsheet F4 for LU/IC information on Building 830.)

Current Conditions: The remaining radioactivity in the soils south of the facility today will meet residential requirements following 50 years of radioactive decay. Current conditions meet worker exposure guidelines for radioactivity. Residual chemical contaminants meet Federal and State guidelines for public exposure. Groundwater is currently being monitored down gradient from the facility.

Land Use and Institutional Controls:

Land Use Classification: Remediation Complete – Restricted Use (B)

- The area has been remediated to an industrial use standard.
- Based upon residual contamination levels, the site will be suitable for residential purposes with 50 years of in situ radioactive decay (i.e., by the year 2055). Use of the site for residential purposes prior to 2055 requires an additional evaluation/risk assessment, and appropriate DOE/regulatory agency approval.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.

- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- Any excavated soils shall be returned to the site and covered as found. If soil cannot be returned, the procedure FS–SOP–1005, Release of Material from Areas Controlled for Radiological Purposes must be followed. The waste soils must be managed in accordance with all Waste Management procedures, and the Environmental and Waste Management Services Division shall review all work requiring the disposal of soil wastes at an approved facility.

References:

Final Action Memmorandum for Building 830 UST Removal Action. 1998.

Operable Units II/VII Remedial Investigation Report. IT Corp. February 1999.

Operable Unit III Remedial Investigation Report. IT Corp. March, 1999.

Closeout Report for Building 830 USTs Removal Action (Appendix to OU III RI Report.)

Operable Unit III Feasibility Study Report. IT Corp. March 1, 1999.

Operable Unit III Record of Decision. April 14, 2000.

For additional information please contact:

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Factsheet: Building 96 PCB Soil Contamination (AOC 26B) (B11)

History:
The former Building 96 area was a truck wash and drum and scrap metal storage area for many years (Area of Concern 26B). Spills of volatile organic solvents and polychlorinated biphenyls (PCBs) resulted in soil and groundwater contamination.

Characterization of the former Building 96 scrapyard area was originally performed to identify the source of high concentrations of volatile organic compounds (VOCs) in the Operable Unit III groundwater plume (specifically tetrachloroethylene and 1,1,1–trichloroethane). Analytical results from soil samples collected from the area near Building 96 indicated PCB contamination up to 4,000 ppm. The NYS TAGM level for PCB contamination is 1 ppm for surface soil and 10 ppm for subsurface soil.

Remedial Action:
Excavation of PCB–contaminated soil was initially performed in February 2000 primarily to allow construction of the installation of a treatment system to address VOC contamination of the groundwater. In 2005, additional soil was excavated. The PCB contaminated soils were remediated to levels below the required NYS TAGM levels. A minimum of 12 inches of clean fill was placed over the remediated areas.

Land Use and Institutional Controls:

Land Use Classification: Remediation Completed – Restricted Use (B)

- The area has been remediated to an industrial use standard. In place, covered residual PCB soils should not be disturbed. (See soil map from the Closeout Report.)
- Use of the site for residential purposes requires an additional evaluation/risk assessment and appropriate DOE/regulatory agency approval.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

Facility Use Agreements:
https://sbms.bnl.gov/private/fup/fa6t/fa6td011.htm (BNL Internal Use Only)

References:

Operable Unit III Remedial Investigation Report. IT Corp. 1999.

Operable Unit III Feasibility Study Report. IT Corp. 1999.

Operable Unit III Record of Decision. April 14, 2000.

OU III Building 96 PCB Soil Excavation Closeout Report. March 2005.

Building 96 Groundwater Source Control Treatment System Operation and Maintenance Manual.

For additional information please contact:

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Factsheet: Central Steam Facility – Former Off Load Area (A2)

History:

The Central Steam Facility supplies heating and cooling to all major BNL buildings and includes aboveground fuel tanks connected to a boiler building (Building 610) by aboveground and underground pipes.

During a 1996 upgrade project to the CSF's piping system, several small–scale releases of petroleum occurred. During the remediation of these spills, additional petroleum contaminated soils were encountered just to the north of Tank 611C and south of Temple Place. Available information suggests that these heavily contaminated soils were probably related to historical fuel off–loading operations.

Remedial Action:
In 1996, BNL revoved approximately 1,200 cubic yards of petroleum contaminated soils from the off load spill site. The excavation was then backfilled with clean soil.

Land Use and Institutional Controls:

Land Use Classification: Remediation Complete – Unrestricted Use (A)

- The site has been remediated to a residential use standard, but is currently used for industrial purposes
- With appropriate DOE/regulatory agency approval, the site can be used for residential purposes once industrial activities have ended.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

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Factsheet: Central Steam Facility 1977 Oil/Solvent Spill (AOC 5A) (A1)

History:
The Central Steam Facility supplies heating and cooling to all major BNL buildings and includes aboveground fuel tanks connected to a boiler building (Building 610) by aboveground and underground pipes. In the past, the Central Steam Facility included underground fuel storage tanks.

In November 1977, a spill of about 25,000 gallons of a waste oil/solvent mixture occurred. The spill pooled on about 1.2 acres and was contained with sand berms. Immediately following the initial spill, portable pumps were used to clean up as much of the spill as possible. An unknown quantity of the oil and solvent was recovered from the site. Subsequent groundwater monitoring demonstrated that the 1977 spill had impacted groundwater quality, and soil excavations near the spill site found residual soil contamination.

Remedial Action:

In the 1990's BNL conducted a remedial investigation at the 1977 spill site. In October 1993, a 5,000 gallon–capacity underground storage tank, associated piping and visibly contaminated soil were removed from this area. To address the volatile and semi–volatile contaminants remaining in soils and groundwater, an air sparging/soil vapor extraction system was installed and became operational in November 1997. This system stripped volatile and some semi–volatile contaminants from soils and groundwater into their vapor phase. The vapors were then extracted from the ground and filtered to remove the contaminants. The system was shut down in January 2001 when levels of VOCs in the groundwater and soils dropped to acceptable levels.

Current Conditions: Appendix 1 of the closeout report for the vapor extraction system show 8 organic chemical detected in the in the soil. No samples exceeded the soil cleanup goals for these chemicals.

Land Use and Institutional Controls:

Land Use Classification: Remediation Complete – Unrestricted Use (A)

- The site has been remediated to a residential use standard, but is currently used for industrial purposes
- With appropriate DOE/regulatory agency approval, the site can be used for residential purposes once industrial activities have ended.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.

- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

Facility Use Agreements:
https://sbms.bnl.gov/private/fua/fa76/fa76d011.htm (BNL Internal Use Only)

References:

Operable Unit IV Record of Decision. USDOE and BNL Office of Environmental Restoration. March 14, 1996.

Petition for Closure and Termination of Formal Post Closure Monitoring of OU IV Air Sparge/Soil Vapor Exttraction Remediation System. BNL Enriornmental Restoration. June 2002.

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Factsheet: Chemical/Animal Pits and Glass Holes (AOCs 2B 2C) (B9)

History:

The Chemical/Animal Pits and Glass Holes (Areas of Concern 2B and 2C) consisted of 55 waste pits that were located in a two wooded areas to the east of the Former Landfill. From the late 1950s to 1981, a variety of materials were disposed of in these pits including chemical bottles, laboratory glassware, small gas cylinders, animal matter, needles, and miscellaneous solid and liquid laboratory chemicals. The pits were a source of volatile organic compound and strontium–90 groundwater contamination.

Remedial Action:

In 1997, BNL excavated each of the 55 pits and removed all of the buried waste and associated contaminated soils. The depth of the pits average 18 feet below the surface. Following excavation the materials were stored, sorted and segregated. The pits were backfilled after meeting of remediation goals were confirmed. The excavated waste and contaminated soils were shipped to licensed off–site disposal facilities. The area has been scraped to remove residuals from sorting and processing, covered with clean soil and re–vegetated. Groundwater down gradient from the area contains concentration of Sr–90 above drinking water standards and is currently being treated. (See Factsheet 'Groundwater Contaminated Areas'.)

Current Conditions: The residual Cs–137 activity in the remediated soils is below the residential cleanup goal of 23 pCi/gm Cs–137, and the mercury goal of 1.84 ug/kg which are the primary residual surface contaminants of concern remaining from waste processing activities. Only three of the 55 pits contained residual concentrations of Cs–137 above background at the base of the pits, the maximum being 1.99 pCi/gm. Current soil conditions meet worker exposure guidelines for radioactivity. The remaining Cs–137 activity in the soils meet residential requirements today. The maximum surface residual activity is ___pCi/gm and maximum mercury residual is ___ug/g. There are no other chemical contaminants of concern and soil concentrations for chemicals meet Federal and State guidelines for public exposure.

Land Use and Institutional Controls:

Land Use Classification: Remediation Complete – Restricted (B)

- The area has been remediated to an industrial use standard.
- Based upon residual contamination levels, the site will be suitable for residential purposes with 50 years of in situ radioactive decay (i.e., by the year 2055). Use of the site for residential purposes prior to 2055 requires an additional evaluation/risk assessment, and appropriate DOE/regulatory agency approval.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.

- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- Any excavated soils shall be returned to the site and covered as found. If soil cannot be returned, the procedure FS–SOP–1005, Release of Material from Areas Controlled for Radiological Purposes must be followed. The waste soils must be managed in accordance with all Waste Management procedures, and the Environmental and Waste Management Services Division shall review all work requiring the disposal of soil wastes at an approved facility.

Facility Use Agreements:
N/A (BNL Internal Use Only)

References:

Final Engineering Evaluation/Cost Analysis for Landfill Closure Removal Action VI. CDM Federal Programs Corp. Vol. 1 & 2. March, 1995.

Chemical/Animal Pits and Glass Holes, Final Evaluation of Alternative Report. CDM Federal Programs Corp. April 1997.

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

Animal/Chemical Pits and Glass Holes Remedial Action Closure Report. September 1997.

Record of Decision Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6,8,10,16,17, and 18). USDOE and BNL. August 25, 1999.

Addendum: Animal/Chemical Pits and Glass Holes Remedial Action Closure Report. September 2005.

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Land Use Controls Mapping

BROOKHAVEN NATIONAL LABORATORY

Factsheet: Current Landfill (AOC 3) (C2)

History:

The Current Landfill (Area of Concern 3) occupies about eight acres in the southeast portion of the site. It was used by BNL between 1967 and 1990 for disposal of general office, laboratory, and construction waste. Based upon available records, putrescible waste, sludge from the BNL Water Treatment Plant, anaerobic digester sludge from the Sewage Treatment Plant, and limited quantities of Laboratory waste were disposed in the landfill. Groundwater monitoring results showed low levels of solvents, metals, and radionuclides that exceeded New York State groundwater standards.

Remedial Action:

In 1995 the Current Landfill was capped in accordance with NYCRR Part 360 requirements to prevent rainwater infiltration and potential leaching of contaminants to the groundwater. The landfill was capped with geomembrane fabric, which was then covered with clean soil and seeded. Gas venting pipes were installed to prevent the potential buildup of methane gas. Monitoring wells were installed down gradient of the landfill to monitor groundwater quality. To ensure that the cap remains effective, long–term inspections, cap maintenance, groundwater sampling and methane gas monitoring programs have been established.

Current Conditions:

Contaminated soils and materials are present below the landfill cap. The landfill is currently monitored and maintained by mowing the grass, inspecting the cap, keeping the soil cap intact and monitoring landfill gas and groundwater. Groundwater down gradient of the Current Landfill is contaminated with low–level radioisotopes and chemicals. The landfill area has been capped to prevent site workers, employees, visitors, and wildlife from being exposed to the subsurface contamination.

Land Use and Institutional Controls:

Land Use Classification: Capped/Controlled Contaminated Soils – Restricted (C)

- Industrial and residential uses of the site are currently prohibited due to buried contaminated materials.
- Recreational and open space uses of the site may be permitted with appropriate DOE/regulatory agency approval.
- Additional evaluation/risk assessment and appropriate DOE/regulatory agency approval are required prior to release for unrestricted use.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.
- The landfill area is fenced and posted, with gated roadway access.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- The landfill areas were capped with impermeable geomembrane fabric, and then covered with clean soil and seeded. Gas venting pipes were installed to prevent the potential buildup of methane gas.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in

accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.

- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- Without written authorization, no activities shall be permitted in the landfill areas that could compromise the integrity of the impermeable caps and stormwater management systems.

Facility Use Agreements:
https://sbms.bnl.gov/private/fua/fa000011.htm (BNL Internal Use Only)

References:

Final Engineering Evaluation/Cost Analysis for Landfill Closure Removal Action VI. CDM Federal Programs Corp. Vol. 1 2. March, 1995.

Action Memorandum. Landfill Closure Removal Action Phase I Current Landfill. BNL Office of Environmental Restoration. December, 1994.

Current Landfill Final Operation and Maintenance Manual. CDM Federal Programs Corp., 2 Volumes. March 1996.

Final Construction Certification report for Current Landfill Capping. CDM Federal Programs Corp., 4 Volumes. May 1996.

For additional information please contact:

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Factsheet: Former Hazardous Waste Management Facility (AOC 1) (B10)

History:

The former Hazardous Waste Management Facility (Area of Concern 1) was used from the 1940's to 1997 as the central receiving Resource Conservation and Recovery Act (RCRA) facility for packaging, limited treatment (neutralization), and storage for radioactive waste, RCRA hazardous waste, and mixed waste generated at BNL. Between 15 and 40 tons of solvents, waste oils, solids, caustics, ignitable waste, and various laboratory chemicals were handled at the facility each year. Records also indicate that the former HWMF area was a munitions storage area and livery stable when occupied by the U.S. Army.

Waste handling operations resulted in soil and groundwater contamination. Radionuclides detected in soils at the former HWMF include americium–241, cesium–137, cobalt–60, plutonium–239/240, strontium–90, and uranium–235/238. The non–radiological contaminants of concern at the HWMF include lead and mercury.

Remedial Action:

Remediation of the Former HWMF was completed in 2005. Approximately 31,000 cubic yards of contaminated soil and 3,500 cubic yards of contaminated debris was excavated from the HWMF. Prior to soil excavation, all remaining equipment was removed and buildings in the area were demolished to grade. Industrial land use goals following institutional control were used as the criteria for remediation. Excavated areas were returned to grade with clean fill and re–vegetated to minimize erosion. The adjacent HWMF Wetland was also remediated. (See Former HWMF Wetland Area Factsheet.)

Current Conditions: The facility is currently fenced and posted. The average residual Cs–137 activity, which is the primary contaminant of concern remaining in the remediated soils, is below the cleanup goal of 23 pCi/gm Cs–137 for residential use following the institutional control period. The remaining radioactivity in the soils today will meet industrial requirements today. The average Cs–137 and Sr–90 concentrations following remediation are 7.63 pCi/g and 1.51 pCi/g, respectively. The 95% upper confidence level (UCL) concentrtions for Cs–137 and Sr–90 are 16.6 pCi/g and 5.3 pCi/g respectively.

The dose to an industrial worker after 50 years of institutional controls is 1.8 mrem/yr and 4.0 mrem/yr using the average and 95% UCL concentrations, respectively. These annual dose projections are well below the 15 millirem per year (mrem/yr) cleanup goal in the OU I ROD.

The dose to an industrial worker with no time for radioactive decay (i.e. present day) using the average and 95% UCL conentrations is 5.4 mrem/yr and 11.8 mrem/yr, respectively.The dose to a resident after 50 years of institutional controls using the averageand UCL values are 6.1 mrem/yr and 14.5 mrem/yr. These additional dose projections indicate that the OU I ROD requirements are satisfied by a wide margin.

This AOC was a source of Sr–90, tritium and volatile organic compound contamination in groundwater downgradient of the facility. Groundwater is monitored downgradient from the facility during the period of institutional control. (See Groundwater Contaminated Areas Factsheet.)

Land Use and Institutional Controls:

Land Use Classification: Remediation Complete – Restricted Use (B)

- The area has been remediated to an industrial use standard.
- Based upon residual contamination levels, the site will be suitable for residential purposes with 50 years of *in situ* radioactive decay (i.e., by the year 2055). Use of the site for residential purposes prior to 2055 requires an additional evaluation/risk assessment, and appropriate DOE/regulatory agency approval. Area is currently not suitable for industrial use. Limited activities may be permitted following evaluation and risk assessment.
- Several wetland areas that may contain protected habitats are adjacent to the former HWMF. NYSDEC regulations regulates all work within 100 feet of wetlands with confirmed protected species habitats. Any work activities within 100 feet of a wetland requires DOE and NYSDEC notification and approval.
- BNL limits activities within 850 feet of wetlands with confirmed protected species habitats.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.
- Point of contact sign postings for access will be maintained.
- All facility gates will be kept locked for both personnel and deer access control.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Work Planning: Activities in this area must comply with the BNL Wildlife Management Plan (BNL–71870–2003).
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- Any excavated soils shall be returned to the site and covered as found. If soil cannot be returned, the procedure FS–SOP–1005, Release of Material from Areas Controlled for Radiological Purposes must be followed. The waste soils must be managed in accordance with all Waste Management procedures, and the Environmental and Waste Management Services Division shall review all work requiring the disposal of soil wastes at an approved facility.

Facility Use Agreements:
https://sbms.bnl.gov/private/fua/fa48/fa48d011.htm (BNL Internal Use Only)

References:

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

Final Feasibility Study Report Operable Unit I and Radiologically–Contaminates Soils. CDM Federal Programs Corp. March 31, 1999.

Record of Decision Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6,8,10,16,17, and 18). USDOE and BNL. August 25, 1999.

Natural Resource Management Plan. Brookhaven National Laboratory. (BNL–71870–2003)

Operable Unit I, AOC 1 Remedial Action Work Plan. March 7, 2003.

Closeout Report, OU I AOC 1 Former Hazardous Waste Management Facility Soil Remediation . September 29, 2005.

For additional information please contact:

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Factsheet: Former Hazardous Waste Management Facility (HWMF) Wetland (AOC 1) (G2)

History:

A shallow wetland borders the northwestern fence of the former Hazardous Waste Management Facility. This area seasonally ponds and is known as the HWMF wetland (part of Area of Concern 1 also designated as SubAOC 1J). The HWMF wetland is shown on the National Wetland Inventory Mapping as part of a larger wetland area, and has been delineated as a Federal wetland under section 404 of the Clean Water Act. It is also regulated by the NYSDEC as a Class I wetland due to the presence of the Tiger Salamander, a protected New York State species.

Sediments within the wetland were contaminated with radionuclides and chemicals in stormwater runoff from the paved areas of the HWMF. A focused ecological risk assessment was performed as part of the remedial investigation and feasibility study for OU I identified a low potential for risk to Tiger Salamanders from elevated levels of several metals in the sediments of the wetland.

The Operable Unit I Record of Decision identified concentrations of 13 pCi/g of cesium–137; 36 ug/kg of Aroclor–126; 8,150 mg/kg of aluminum; and 14 mg/kg of zinc present in the wetland sediments. The Feasibility Study identifies a maximum concentration of 1800 pC/g of cesium–137 in the soil.

Remedial Action:

In 2004 the contaminated sediment was excavated from the HWMF Wetland area and disposed of off–site. In 2005 the wetland area was reconstructed by backfilling excavated areas with clean soils and restoring the original grade and depression to ensure that the wetland was able to retain water during the breeding season and that the restored area provides the necessary conditions to support the appropriate habitat. Native vegetation was planted.

Current Conditions: Breeding ponds for Tiger Salamanders include a 500–foot buffer zone surrounding the site as critical habitat with an additional 350 feet for resident adult salamanders. Based on the Ecological Risk Assessment in the OU I/VI Feasibility Study, current concentrations in the wetland indicate the habitat is safe for the Tiger Salamander. This Wetland is a contiguous part of a larger regulated wetland. No radiological materials are present that exceed cleanup goals for industrial land use. Residual chemical contaminants meet Federal and State guidelines for public exposure.

Land Use and Institutional Controls:

Land Use Classification: Biologically/Culturally Sensitive Area – Restricted Use (G)

- This area is designated as open space and protected habitat.
- NYSDEC regulations regulates all work within 100 feet of wetlands. Any work activities within 100 feet of a wetland requires DOE and NYSDEC notification and approval.
- BNL limits activities within 850 feet of wetlands with confirmed protected species habitats.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.
- Point of contact sign postings for access will be maintained.
- All facility gates will be kept locked for personnel and deer access control.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Work Planning: Activities in this area must comply with the BNL Natural Resource Management Plan (BNL–71870–2003).
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager and Natural Resources Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

Facility Use Agreements:
https://sbms.bnl.gov/private/fua/fa48/fa48d011.htm (BNL Internal Use Only)

References:

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

Final Feasibility Study Report Operable Unit I and Radiologically–Contaminates Soils. CDM Federal Programs Corp. March 31, 1999.

Focused Ecological Risk Assessment for OUI/VI, Appendix L in Final Feasibility Study Report Operable Unit I and Radiologically–Contaminates Soils. CDM Federal Programs Corp. March 31, 1999.

Record of Decision Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6,8,10,16,17, and 18). USDOE and BNL. August 25, 1999.

Natural Resource Management Plan. Brookhaven National Laboratory. (BNL–71870–2003)

Operable Unit I, AOC 1 Remedial Action Work Plan. March 7, 2003.

(Not completed) Close Out Report for Operable Unit I, Area of Concern 1. BNL Environmental Management Directorate. _____, 2005.

For additional information please contact:

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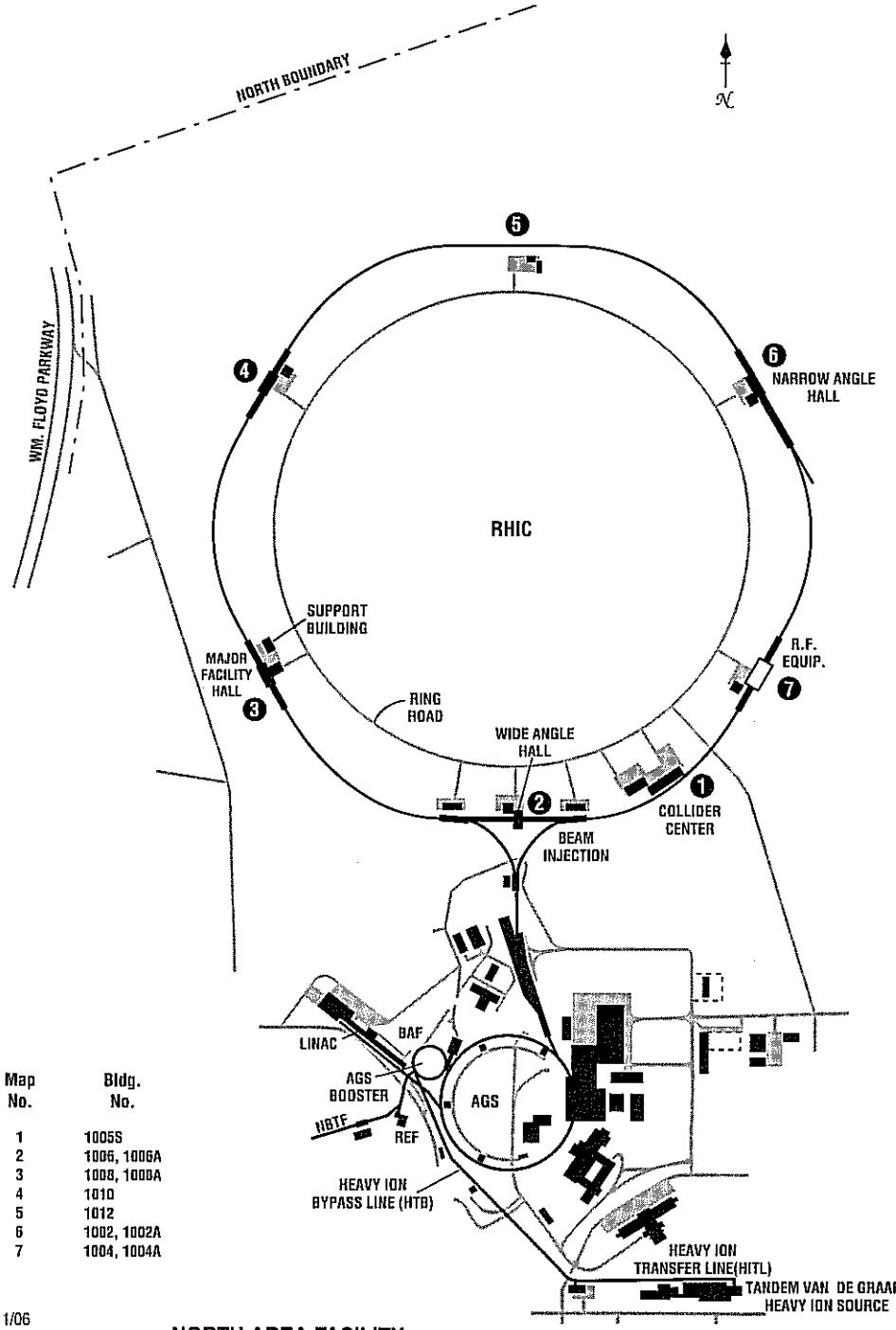
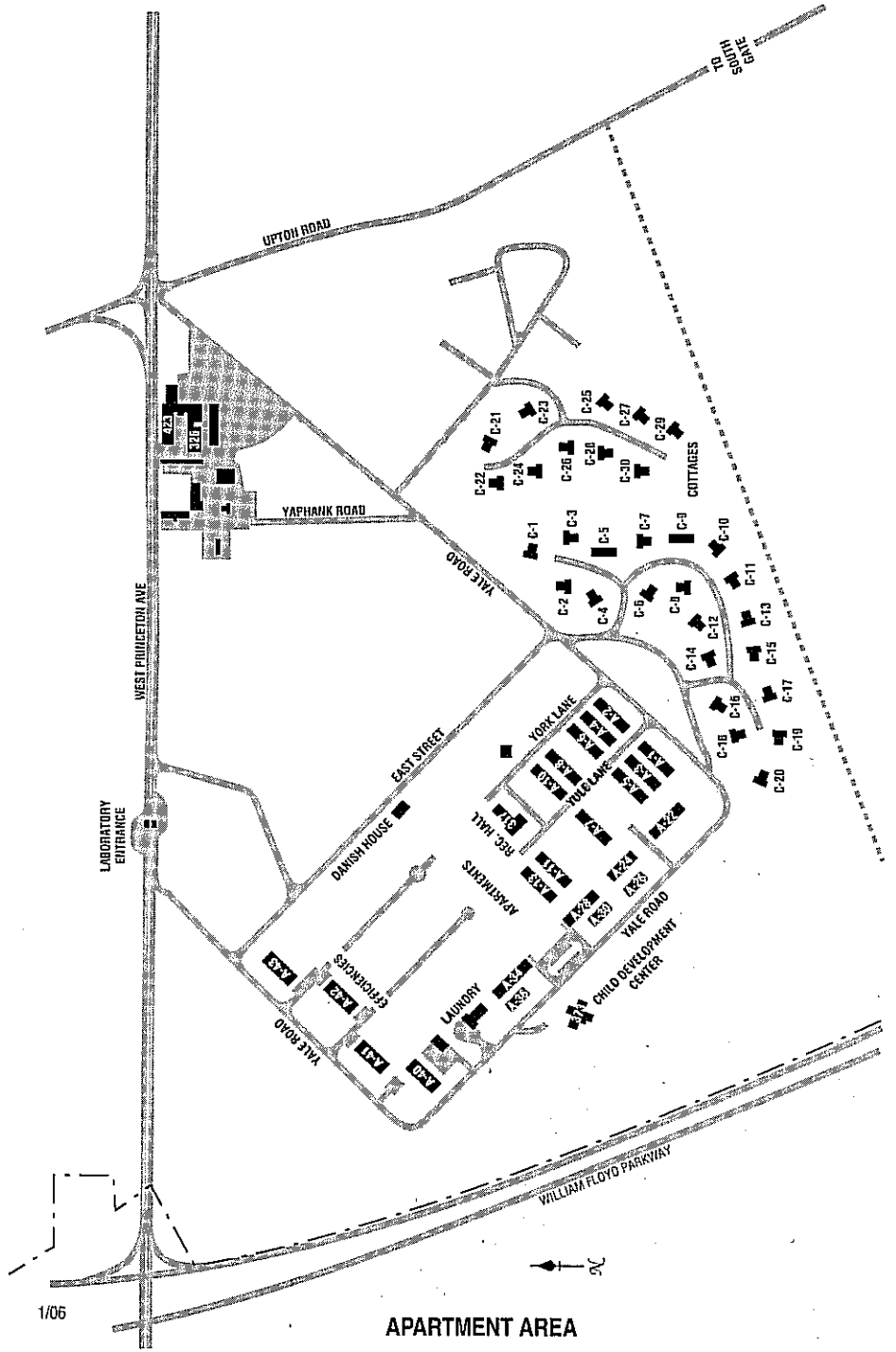
130.199.228.111 (MSIE 6.0) http://luic.bnl.gov/website/landcontrols Jul 14, 2006 -- 3:13 PM



Map No.	Bldg. No.
1	1005S
2	1006, 1006A
3	1008, 1008A
4	1010
5	1012
6	1002, 1002A
7	1004, 1004A

1/06

NORTH AREA FACILITY



1/06

APARTMENT AREA

Factsheet: Former Landfill Area (AOCs 2A, 2D 2E) (CI)

History:

This landfill area consists of the following: the Former Landfill (Area of Concern 2A), the Slit Trench (Area of Concern 2E) and the Interim Landfill (Area of Concern 2D).

Former Landfill is an eight–acre site in the south–central part of the site that was originally operated by the U.S. Army for waste disposal during World War I and World War II. BNL used approximately three acres of the Former Landfill from 1947 through 1966 for disposal of general office, laboratory, and construction wastes. Between 1953 and 1966, the former landfill was also used for the disposal of low–level radioactive waste. A 1983 aerial radiological survey detected cesium–137 contamination on the surface of the Former Landfill, and subsequent groundwater monitoring detected low levels of solvents, metals and radionuclides. Levels of TCA, TCE, PCE, benzene, and strontium–90 exceeded New York State groundwater standards.

The Slit Trench was operated by BNL as a test disposal site from 1960 to 1967 for the disposal of construction debris.

The Interim Landfill was operated by BNL from 1966 to 1967 until the Current Landfill was built. Prior to the constuction of the Current Landfill (Area of Concern 3), BNL used the interim landfill for the disposal of of general office, municipal–type, sanitary, laboratory, and construction wastes. Limited amounts of low– level radioactive waste and some laboratory chemical wastes were also landfilled.

Remedial Action:

In 1996 the three landfill areas were capped to prevent precipitation from entering the landfill waste and possibly leaching contaminants into the groundwater. The landfill areas were capped with impermeable geomembrane fabric, and then covered with clean soil and seeded. Gas venting pipes were installed to prevent the potential buildup of methane gas. To ensure that the cap remains effective, long–term inspections, groundwater and methane gas monitoring and cap maintenance programs have been established.

Current Conditions: Contaminated soils and materials are present below these capped areas. These landfills are currently monitored and maintained by mowing the grass, keeping the cap intact and monitoring landfill gas and groundwater. Groundwater down gradient of the Former Landfill is contaminated with low–level radioisotopes and chemicals. The landfill areas have been capped to prevent site workers, employees, visitors, and wildlife from being exposed to the subsurface contamination.

Land Use and Institutional Controls:

Land Use Classification: Capped/Controlled Contaminated Soils – Restricted (C)

- Industrial and residential uses of the site are currently prohibited due to buried contaminated materials.
- Recreational and open space uses of the site may be permitted with appropriate DOE/regulatory agency approval.
- Additional evaluation/risk assessment and appropriate DOE/regulatory agency approval are required prior to release for unrestricted use.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.
- The landfill areas are posted.
- Roadways to the landfill areas are gated.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- The landfill areas were capped with impermeable geomembrane fabric, and then covered with clean soil and seeded. Gas venting pipes were installed to prevent the potential buildup of methane gas.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- Without written authorization, no activities shall be permitted in the landfill areas that could compromise the integrity of the impermeable caps and stormwater management systems.

Facility Use Agreements:
https://sbms.bnl.gov/private/fua/fa00t011.htm (BNL Internal Use Only)

References:

Final Engineering Evaluation/Cost Analysis for Landfill Closure Removal Action VI. CDM Federal Programs Corp. Vol. 1 2. March, 1995.

Action Memorandum. Landfill Closure Removal Action Former Landfill Area. BNL Office of Environmental Restoration. April 8, 1996.

Former Landfill Operation and Maintenance Manual. CDM Federal Programs Corp., 2 Volumes. May 1996.

Final Construction Certification report for Former Landfill Capping. R.F. Weston. March 1997.

Record of Decision Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6,8,10,16,17, and 18). USDOE and BNL. August 25, 1999.

For additional information please contact:

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Factsheet: Former Reclamation Facility Building 650 (F5)

History:

Building 650, known as the "Hot Laundry" or Reclamation Facility, was constructed in the late 1950's for the decontamination of radioactive contaminated clothing and heavy equipment. The facility was designed to perform decontamination operations both inside and outside the building.

In the past, all soiled laundry from BNL was delivered to Building 650, where potentially radioactively contaminated laundry was segregated from routine laundry. The radioactively contaminated laundry was cleaned with dedicated equipment and the residual wash water was transferred to and contained in the facility's underground storage tanks (USTs) until the level radiological activity could be determined. These USTs were located on the north side of the building. The liquid waste was emptied from the USTs about three times a year and taken to the Waste Concentration Facility (WCF) by a tanker truck.

Building 650 also served as a decontamination facility for radioactively contaminated equipment. The radioactively contaminated equipment was steam cleaned on a 30–foot by 30–foot concrete pad on the north side of the building. The radioactively contaminated water from the steam cleaning operation collected in a drain in the middle of the sloping concrete pad, known as the Building 650 Sump. Depending upon the expected level of contamination, the effluent was supposed to be either piped into the sanitary sewer system or into the USTs. An investigation in 1969 revealed that the drainage pipe from the outdoor pad behind Building 650 led to a natural depression in a wooded area about 800 feet northeast of Building 650, rather than the sanitary sewer system or USTs. The practice of decontaminating radioactively contaminated equipment on the concrete pad was discontinued after the 1969 incident. The natural wooded depression is referred to as the Building 650 Sump Outfall Area.

Remedial Action:

Plans are being prepared for the decontamination and decommissioning of Building 650.

Contaminated soils associated with the sump and sump outfall have been remediated (see Factsheet B1 for Building 650 Reclamation Facility Sump and Sump Outfall).

Land Use and Institutional Controls:

Land Use Classification: Radiological Facility, D&D pending – Restricted Use (F)

- Building 650 is an inactive radiological facility.
- Future land use scenarios to be determined.
- A risk assessment and appropriate DOE/regulatory agency approval are required prior to release for unrestricted use.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.
- Building 650 is a posted Radiologically Controlled area, and access to this building is restricted to authorized personnel.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- The Building 650 structure is used for containment.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.

- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- Any excavated soils from below the Building 650 structure shall be returned to the site and covered as found. If soil cannot be returned, the procedure FS–SOP–1005, Release of Material from Areas Controlled for Radiological Purposes must be followed. The waste soils must be managed in accordance with all Waste Management procedures, and the Environmental and Waste Management Services Division shall review all work requiring the disposal of soil wastes at an approved facility.

Facility Use Agreements:
https://sbms.bnl.gov/private/fua/fa7c/fa7cd011.htm (BNL Internal Use Only)

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Land Use Controls Mapping

BROOKHAVEN NATIONAL LABORATORY

Factsheet: Groundwater Contamination Areas (EI)

History:

Due to past waste handling practices and accidental spills, the soils and groundwater at a number of areas of the BNL site were contaminated with volatile organic compounds and radionuclides. The BNL site was added to the National Priorities List in 1989. To help manage the soil and groundwater remediation efforts, 30 separate Areas of Concern (AOCs) were grouped into six Operable Units (OUs). Remedial Investigation/Feasibility Studies were conducted for each OU. As a result of these investigations, BNL determined the nature and extent of soil and groundwater contamination. Based upon this information, appropriate treatment methods were identified and implemented. Operable Units I, III, IV, V, and VI addressed groundwater contamination issues.

Operable Unit I contains groundwater contamination plumes emanating from the southeastern area of the Laboratory. The main contaminants of concern are volatile organic compounds (VOCs), with lesser amounts of tritium and strontium–90.

Operable Unit III contains groundwater plumes emanating from the central and southern portions of the BNL site. The main contaminants of concern are volatile organic compounds, strontium–90, and tritium. Volatile organic compounds have been found both on and off Laboratory property, while strontium–90 and tritium contaminants are confined to the Laboratory site.

Operable Unit IV included groundwater contamination at BNL's Central Steam Plant. Air sparging successfully treated these contaminants.

Operable Unit V includes groundwater in the eastern–central area of the Laboratory. The primary contaminants of concern are VOCs, with lesser amounts of tritium

Operable Unit VI includes off site groundwater containing the chemical ethylene dibromide (EDB), which had been used by BNL as a fumigant in its agricultural research fields located on the eastern portion of the site.

Note: To obtain the most recent information on the extent of contamination (plume locations, contaminant concentrations, groundwater restoration systems), please refer to the BNL Site Environmental Report and associated Groundwater Status Report.

Remedial Action:

BNL has constructed of a number of groundwater treatment systems located on and off site to treat groundwater contamination. Groundwater monitoring programs have been established to monitor contaminant plume positions and to verify the effectiveness of the restoration activities. Groundwater remediation activities are expected to continue until approximately 2030 to meet the ultimate cleanup objective – which is to reduce contaminant levels in the Upper Glacial aquifer to below drinking water standards. Two remediation systems (the OU IV Air Sparging/Soil Vapor Extraction System, and the Carbon Tetrachloride Treatment System) have met their cleanup objectives, and have been shut down. In addition, the source areas for a number of groundwater contaminant plumes have been excavated and/or controlled (the Former Landfill areas, Current Landfill, 1977 Oil/Solvent Spill Area, former Hazardous Waste Management Facility, Waste Concentration Facility, numerous cesspools, and underground storage tanks).

Public water hookups have been provided to most residents in North Shirley, East Yaphank, and Manorville. Those residents that declined the offer for public water hookups are offered free, periodic water testing of their wells.

Land Use and Institutional Controls:

Land Use Classification: Restricted Groundwater Use (E)

- Use of the land overlying the groundwater contaminant plumes is not impacted by contamination, and is suitable for industrial, residential or recreational purposes, as approved
- Some land use restrictions may apply in areas where groundwater restoration facilities are present (including groundwater monitoring and remediation wells, water piplines, water treatment facility structures and associated utilities)

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.
- Groundwater contaminant plumes are located far below land surface, therefore site workers, visitors and wildlife are not exposed to the contamination unless the impacted water is pumped from a supply well.
- Access to groundwater treament system buildings and wells is restricted
- Drinking water or process supply wells cannot be installed at BNL without DOE/BNL and NYSDEC approval.
- Drinking water or process supply wells cannot be installed in off–site areas without NYSDEC approval.
- There are mandatory public water hookup requirements in off–site areas for all new home/business contruction.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- BNL and off–site municipal water supplies are tested and treated, as required, to ensure pumped water meets NYSDOH drinking water standards.
- BNL has active on–site and off–site groundwater treatment facilities.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Work Planning: All current and future groundwater pumping and recharge activities at BNL that may impact contaminant plume migration or treatment system operations shall be evaluated by the BNL Pump and Recharge Committee. BNL Plant Engineering will maintain a potable/supply well pumping distribution of 75% or greater from the western well field and 25% or less from the eastern well field. This pumping distribution is necessary to prevent the shifting of contaminant plumes located in the central, developed portion of the site (g–2 tritium, BGRR Sr–90, HFBR tritium) outside of the established monitoring well networks.
- Work Planning: "One–Call" system is in place to ensure that utility mark–outs are conducted prior to performing digging operations near off–site groundwater treatment systems.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

Facility Use Agreements:
N/A (BNL Internal Use Only)

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Factsheet: Landscape Soils (AOC 16) (B2)

Land Use and Institutional Controls:

Land Use Classification: Remediation Completed – Restricted Use (B)

- The area has been remediated to an industrial use standard.
- Based upon residual contamination levels, the site will be suitable for residential purposes with 50 years of in situ radioactive decay (i.e., by the year 2055). Use of the site for residential purposes prior to 2055 requires an additional evaluation/risk assessment, and appropriate DOE/regulatory agency approval.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- Any excavated soils shall be returned to the site and covered as found. If soil cannot be returned, the procedure FS-SOP-1005, Release of Material from Areas Controlled for Radiological Purposes must be followed. The waste soils must be managed in accordance with all Waste Management procedures, and the Environmental and Waste Management Services Division shall review all work requiring the disposal of soil wastes at an approved facility.

Facility Use Agreements:
https://sbms.bnl.gov/standard/1h/1h01d011.htm (BNL Internal Use Only)

References:

Operable Units II/VII Remedial Investigation Report. IT Corp. February 1999.

Final Feasibility Study Report Operable Unit I and Radiologically-Contaminates Soils. CDM Federal Programs Corp. March 31, 1999.

Record of Decision Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6,8,10,16,17, and 18). USDOE and BNL. August 25, 1999.

Final Closeout Report for Area of Concern 16 Landscape Soil. April 10 2001.

For additional information please contact:

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Factsheet: Low Mass Criticality Facility (AOC 17) (B4)

History:
The former Low Mass Criticality Facility (Area of Concern 17) was used from 1955 to 1967 for experiments using small amounts of radiological material. Once decontaminated and decommissioned, the facility stood empty until 1983, when it was then used for one year to store 20 drums of ethylene dibromide. No accidents or spills were documented during either period of use. Although a 1983 aerial radiological survey detected contamination in the area, a remedial investigation conducted in the 1990's indicated no radiological contamination above background detection levels. This facility was decontaminated and decommissioned in 1967 and the silo was disassembled in 1994.

Remedial Action:
No chemical or radiological contamination at levels of human health concern was present at the Low Mass Criticality Facility site. Therefore, no cleanup was required.

Land Use and Institutional Controls:

Land Use Classification: Remediation Complete – Restricted Use (B)

- Currently suitable for industrial use
- Use of the site for residential purposes requires an additional evaluation/risk assessment, and appropriate DOE/regulatory agency approval.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

Facility Use Agreements:
https://sbms.bnl.gov/private/fua/fa0u/fa0ud011.htm (BNL Internal Use Only)

References:

Operable Units II/VII Remedial Investigation Report. IT Corp. February 1999.

Final Feasibility Study Report Operable Unit I and Radiologically-Contaminates Soils. CDM Federal Programs Corp. March 31, 1999.

Record of Decision Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6,8,10,16,17, and 18). USDOE and BNL. August 25, 1999.

For additional information please contact:

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Factsheet: Nuclear Waste Management Facility Building 830 (AOC 16R) (F4)

History:

This AOC consists of former Nuclear Waste Management Facility, Radioactive waste Research Program and High–Intensity Radiation Laboratory in Building 830 (AOC 16R). This AOC was identified as part of the Aerial Radiological Survey and monitoring results and was address in the OU II/VII Remedial Investigation Report. Operations within Building 830 commenced in 1963, when the High Intensity Radiation Development Laboratory was opened. Hot cells and associated laboratories were used to fabricate high intensity cobalt–60 sources for food irradiation programs. The cells have also been used for the cutting, milling and evaluation of radioactively contaminated and activated material and components from commercial nuclear power plants. Since it is an active operating facility, it is considered as a future decontamination and demolition activity. Any work in this area shall be coordinated via the Work Planning and Control procedure.

A 1986 inspection of the facility's liquid waste tanks and waste inventory records revealed a 825 to 900 gallon discrepancy between the period of July 1984 and April 1987. Leak tests conducted in 1986 and 1987 revealed that there was a leak in the transfer line located between Building 830 and two, 1,000 gallon capacity underground storage tanks (USTs) that were located approximately 75 feet east of the building (see Factsheet for Bldg 830 Pipe Leaks and USTs, AOCs 11 12).

Remedial Action:

In March of 2000 the Gamma Irradiation Facility in Bldg. 830 was decommissioned. The cobalt–60 sources where shipped for disposal and dismantling and disposal of the gamma pool water and other equipment associated with the facility.

Current Conditions: Building 830 is an active research facility operated by the Environmental Sciences Department. No known sources of radioactivity were found to contaminate the groundwater from the Building. Contamination from pipe leaks and the USTs near the building were addressed in Bldg 830 Pipe Leaks and USTs remediation.

Land Use and Institutional Controls:

Land Use Classification: Radiological Facility, D&D pending – Restricted Use (F)

- Building 830 is a currently an active industrial facility, and continues to be used for research.
- Future land use scenarios to be determined.
- A risk assessment and appropriate DOE/regulatory approval are required prior to release for unrestricted use.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.
- The Nuclear Waste Management section of Building 830 is a posted Radiologically Controlled area, and access to this building is restricted to authorized personnel.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- BMRR Building is used for containment.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon

discovery.

- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- Any excavated soils from below the Nuclear Waste Management section of Building 830 shall be returned to the site and covered as found. If soil cannot be returned, the procedure FS-SOP-1005, Release of Material from Areas Controlled for Radiological Purposes must be followed. The waste soils must be managed in accordance with all Waste Management procedures, and the Environmental and Waste Management Services Division shall review all work requiring the disposal of soil wastes at an approved facility.

Facility Use Agreements:
https://sbms.bnl.gov/private/fua/fa3y/fa3yd011.htm (BNL Internal Use Only)

References:

Operable Units II/VII Remedial Investigation Report. IT Corp. February 1999.

Operable Unit III Remedial Investigation Report. IT Corp. March, 1999.

Decommissioning the Brookhaven National Laboratory Building 830 Gamma Irradiation Facility. B.S. Bowerman and P.T. Sullivan, Environmental Research and Technology Division, Environmental Sciences Department, BNL. April, 2000.

For additional information please contact:

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Factsheet: Old Firehouse Area (AOC 22) (B6)

History:

In the spring of 1985, a routine radiological survey was made of the old firehouse before it was to be demolished. The survey revealed an area of soil contamination beneath the concrete floor that contained radiation levels that were above background levels. Low levels of cesium–137 and strontium–90 were detected in the soils.

Remedial Action:

In 1987 the contaminated soils were excavated to a depth of one foot. Following the removal of the soils, radiation levels dropped to background levels of

Current Conditions: Maximum residual soil level of CS–137 following remediation in 1985 was 7.2 pCi/gm with and average concentration of 2.5 pCi/gm. Three samples taken in 1995 had nondetectable leves of Cs–137.

Land Use and Institutional Controls:

Land Use Classification: Remediation Complete – Restricted Use (B)

- The area is currently suitable for industrial use.
- Use of the site for residential purposes requires an additional evaluation/risk assessment, and appropriate DOE/regulatory agency approval.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

References:

Operable Unit III Remedial Investigation Report. IT Corp. March 1999.

Operable Unit III Feasibility Study Report. IT Corp. 1999.

Operable Unit III Record of Decision. April 14, 2000.

For additional information please contact:

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Land Use Controls Mapping

BROOKHAVEN NATIONAL LABORATORY

Factsheet: Paint Shop Soils Area (AOC 7) (A3)

History:

The area surrounding Buildings 422 and 244 has become known as the Paint Shop Area. Several areas of soil contamination have been identified and addressed over the past 20 years, including old septic systems, outdoor paintbrush cleaning areas, and drywells. The most significant area of contamination was the septic tank serving Bldg. 422. Analytical results dating back to as far as 1983 showed significant contamination with degreasing (e.g., methylene chloride, 1,1,1–trichloroethane) and paint solvents (e.g., toluene, naphtha). The septic tank and cesspools were allegedly remediated in 1988, however investigation in 1998, showed that the septic tank was simply connected to the sanitary sewer, and the cesspools were disconnected and remediated. Significant contamination of sludge within the septic tank remained. The septic tank and its contents were removed in September 1998 and end–point samples showed no residual contamination. A Geoprobe investigation of the cesspools was conducted in 1993 that showed no residual contamination. A second septic tank was located at Bldg. 244 and in 1983 was found to contain high levels of solvents. The septic tank was removed in 1987.

Another area of concern was a small drywell located on the west side of Bldg. 422 that was connected to a trough drain from a paint spray room. The drywell was constructed of a small section of 2–foot diameter clay tile pipe that was back filled with gravel. Investigation showed no substantial impact to soils. The last area was a brush cleaning area on the south side of Bldg. 244.

Remedial Action:

All areas have been remediated to the satisfaction of the regulatory agencies. Septic tanks have been removed and end–point samples show no contamination. Cesspools have been backfilled and investigations conducted inn 1993 showed no impacts to soils. The drywell and former brush cleaning areas have also been excavated to remove physical evidence of contamination. Chemical analyses of endpoint samples show no impact to soil. Groundwater monitoring wells in the area show low–level VOC contamination but it is uncertain if this is due to past Paint shop activities or another upstream VOC source.

Land Use and Institutional Controls:

Land Use Classification: Remediation Complete – Unrestricted Use (A)

- The site has been remediated to a residential use standard, but is currently used for industrial purposes
- With appropriate DOE/regulatory agency approval, the site can be used for residential purposes once industrial activities have ended.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual

letter report submitted to DOE, NYSDEC and EPA.

- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

For additional information please contact:

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Factsheet: Peconic River Remediation Areas (AOC 30) (G7)

History:

The Peconic River receives discharges from the BNL Sewage Treatment Plant (STP)that are regulated by a State Pollution Discharge Elimination System (SPDES) permit. Past wastewater disposal practices at BNL resulted in the discharge of chemical and radiological contaminants to the sanitary system. Some of these contaminants could not be fully treated by the STP, and were subsequently discharged to the Peconic River. These releases resulted in contamination of river sediments and fish. Elevated levels of heavy metals (such as mercury, copper, and silver), and low levels of polychlorinated biphenyls (PCBs), pesticides (such as DDD, a product of DDT degradation) and radionuclides were present in Peconic River sediment. Most of the contaminants were found in the top six inches of the sediment in depositional (low velocity) areas of the river, and decreased in concentration with distance down river from the STP.

Remedial Action:

During 2004 and 2005, BNL removed approximately 14,500 cubic yards of contaminated sediment. Approximately 14,025 linear feet (2.66 miles) of the Peconic River were remediated between the BNL Sewage Treatment Plant (STP) and just downstream of Manor Road in Manorville, NY, encompassing a riverbed area of approximately 19.8 acres.

On BNL property, the response actions described in the ROD for removal of sediment established a cleanup goal to reduce the average mercury concentrations in the Peconic River to less than 1 ppm with a goal that all mercury concentrations in the remediated areas would be less than 2 ppm. The cleanup achieved the remedial objectives by reducing the average mercury concentration on BNL property to 0.2 ppm with all samples less than 2 ppm.

Outside BNL property and upstream of Schultz Road, the cleanup goal was to reduce the average mercury concentrations in the Peconic River to less than 0.75 ppm, with a goal that all mercury concentrations in the remediated areas would be less than 2 ppm. The cleanup achieved the remedial objectives by reducing the average mercury concentration outside BNL property and upstream of Schultz Road to 0.092 ppm with all samples less than 2 ppm.

Outside BNL property and immediately upstream and downstream of Manor Road, the cleanup goal was that all mercury concentrations in sediment be remediated to less than 2 ppm. The cleanup achieved the remedial objectives by reducing the average mercury concentration immediately upstream and downstream of Manor Road to 0.19 ppm with all samples less than 2 ppm. Any other co-located contaminants in these depositional areas were also removed during this process.

The major features of the removal action included stream dewatering, the excavation and removal of the sediment layer, dewatering of removed sediment, disposal of sediment at a licensed off-site landfill facility, wetland restoration (as needed) and the installation of temporary access roads for equipment. Post-excavation sampling will be performed to confirm that cleanup goals have been met. Long-term monitoring of surface water, sediment, and fish will verify the effectiveness of the cleanup action.

Land Use and Institutional Controls:

Land Use Classification: Biologically/Culturally Sensitive – Restricted Use or Activity (G)

- This area is designated as a Scenic River and protected habitat.
- The NYS Fresh Water Wetlands and Wild, Scenic and Recreational Rivers Act governs all development or work activities within one-half mile of regulated waters.
- NYSDEC regulations regulate all work within 100 feet of wetlands with confirmed protected species habitats. Any work activities within 100 feet of a wetland requires DOE and NYSDEC notification and approval.
- BNL limits activities within 850 feet of wetlands with confirmed protected species habitats.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Work Planning: Activities in this area must comply with the BNL Wildlife Management Plan (BNL–71870–2003).
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager and Natural Resources Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

References:

Future Land Use Plan. Brookhaven National Laboratory, Upton, N.Y. BNL, 1995. (BNL–62130).

Final Operable Unit V Remedial Investigation Report. IT Corp. May 1998.

Final Operable Unit V Feasibility Study Report. IT Corp. September 1998.

Natural Resource Management Plan. Brookhaven National Laboratory. (BNL–71870–2003)

Engineering Evaluation/Cost Analysis and Action Memorandum: Peconic River Removal Action for Sediment on BNL Property. 2003

Final Feasibility Study Addendum Operable Unit V: Peconic River, Brookhaven National

Laboratory, Upton, N.Y. May 14, 2004

Action Memorandum: Peconic River Removal Action for Sediment outside BNL Property. Brookhaven National Laboratory, Upton, N.Y. September 2, 2004.

Final Operable Unit V Record of Decision for Area of Concern 30 (Peconic River) Brookhaven Science Associates and U.S. Department of Energy November 3, 2004.

Final Closeout Report: Peconic River Remediation Phases 1 and 2. Envirocon Inc., Brookhaven National Laboratory, Upton, NY, 2004.

For additional information please contact:

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Factsheet: Recharge Basins (AOCs 24B, 24C, 24D, 24E) (G3)

History:

Wastewater effluents are routinely generated as a result of BNL's operations and research activities. A portion of the wastewater, mainly stormwater runoff, cooling tower blowdown and once through cooling water, is directly discharged to recharge basins located throughout the site. While these wastewaters have little potential to impact groundwater quality, and the health of aquatic and terrestrial organisms, to ensure that these discharges comply with regulatory requirements and result in minimal environmental impact, they are frequently monitored in accordance with the Laboratory's State Pollutant Discharge Elimination System (SPDES) permit and Department of Energy Orders.

Due to contaminant discharges over the years of operation, several of BNL's recharge basins were evaluated as part of the BNL environmental restoration program. The Laboratory discharges storm and cooling water to the following recharge basis.

- Recharge Basins HN (Outfall 002) (AOC 24C) and HT (Outfall 006) (AOC 24 ??)receive once–through cooling water discharges generated at the Alternating Gradient Synchrotron (AGS), as well as cooling tower blowdown and stormwater runoff.

- Recharge Basin HS (Outfall 005) (AOC 24E) receives predominantly stormwater runoff, once–through cooling water from Building 555 (Chemistry), and minimal cooling tower blowdown from the National Synchrotron Light Source.

- Basin HX (Outfall 007) receives filter backwash water from the Water Treatment Plant. Basin HP (Outfall 004) (AOC 24 B)received once–through cooling water from the Brookhaven Medical Research Reactor (BMRR). This discharge ceased with the shutdown of the BMRR in 2000.

- Recharge Basin HO (Outfall 003) (AOC 24 D) receives once through cooling water from the AGS and cooling tower discharges from the High Flux Beam Reactor, as well as stormwater runoff. Discharges from the AGS consist of once–through domestic water used to cool the main magnet heat exchanger located in Building 911.

- In addition, several other recharge areas are used exclusively for discharging stormwater runoff. These include Basin HW (Outfall 008), the Central Steam Facility storm water outlet (Outfall 010), Outfall 011 located within the Former Hazardous Waste Management Facility, and Basin HZ (Outfall 012).

Remedial Action:

Contamination was not detected in any of the recharge basins at levels that warranted remedial action.

All stormwater and cooling water discharges continue to be regulated under the New York State SPDES permit.

Land Use and Institutional Controls:

Land Use Classification: Biologically Sensitive Area – Restricted Use (G)

- Currently in industrial use. These areas are used for stormwater and cooling water recharge, and may contain protected habitats.
- Activities in some of the recharge basin areas are restricted because they contain protected plant of animal habitats. NYSDEC regulations regulate all work within 100 feet of wetlands with protected species habitats.
- BNL limits activities within 850 feet of wetlands with confirmed protected species habitats.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.
- No specific postings are required for these areas.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Work Planning: Discharges to the recharge basins must comply with NYS SPDES Permit requirements.
- Work Planning: Activities in this area must comply with the BNL Natural Resources Management Plan (BNL–71870–2003).
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

Facility Use Agreements:
N/A (BNL Internal Use Only)

References:

Record of Decision Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6,8,10,16,17, and 18). USDOE and BNL, August 25, 1999.

Operable Unit III Record of Decision. USDOE and BNL, April 14, 2000.

Operable Unit IV Record of Decision. USDOE and BNL Office of Environmental Restoration. March 14, 1996.

New York State Pollutant Discharge Elimination System (SPDES Permit No. 0005835)

Natural Resource Management Plan. Brookhaven National Laboratory. (BNL–71870–2003)

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Land Use Controls Mapping

BROOKHAVEN NATIONAL LABORATORY

Factsheet: Sewage Treatment Plant (AOCs 4 21) (B8)

History:

This area consists of: the Sludge Drying Beds (AOC 4A), Sand Filter Beds (AOC 4B), former Imhoff Tanks (AOC 4C), Hold–up Ponds (AOC 4D), the Satellite Disposal Area (AOC 4E) and Abandoned Former Sewerlines (AOC 21).

The STP processes sanitary sewage for the BNL facilities. STP operations in this area initially started when Camp Upton was established during World War I. The original STP was replaced with a World War II facility, which was constructed in stages from 1940 through 1944. With the continued growth of the Laboratory, the original sewage plant to handle the increased flow, it was expanded in February 1967. In conjunction with portions of the old plant that are still in service, the treatment plant was upgraded to a hydraulic capacity of 2.3 MGD. In 1993, the STP was further upgraded with: modular aeration tanks and secondary clarifiers to provide suspended growth activated sludge treatment for BOD and nitrogen control; an aerobic digester for improved management of wastewater treatment residuals; and significant piping upgrades and repair. Although the capacity of the STP was increased to 3.0 MGD, significant wastewater conservation efforts have reduced the current average flow to approximately 0.4 MGD, with peak instantaneous flows of approximately 1.0 MGD in the summer.

The STP has two, two million gallon capacity emergency holding ponds. These ponds are sealed with dual plastic membrane liners with interstitial space monitors. The ponds provide storage of up to four days' average sanitary flow in the event of an accidental release of a contaminant into the sanitary system.

The effluent from the Sewage Treatment Plant is discharged into the headwaters of the Peconic River, which flows east from the Laboratory into the Peconic Bay. The Laboratory's Environmental and Waste Management Services and Plant Engineering Divisions regularly monitor influent and effluent at the plant. Radioactive and chemical contaminants are precluded at the source via monitoring and administrative controls. The existing sewage treatment process provides solids removal via screening, primary clarification, aerobic treatment, secondary clarification, sand filtration and aerobic sludge digestion. Routine monitoring of the plant effluent shows that the discharge continually meets all applicable effluent discharge standards. Constant monitoring of performance parameters, such as dissolved oxygen, settleable solids, mixed liquor suspended solids, biological oxygen demand (BOD), coliform, conductivity, and pH ensures optimum plant performance to meet the requirements of the Laboratory's New York State (SPDES) operating permit.

The historical release of contaminants to the sanitary system resulted in the soil, sediment, and groundwater contamination. The primary contaminants that had been contained in historical releases to the STP included metals, radionuclides, and solvents. Metals (primarily mercury) and radionuclides (primarily cesium–137) were deposited in the sand filter beds, and solvents and tritium have been detected in the groundwater. Metals, PCBs, and low levels of radionuclides have been detected in the sediments of the Peconic River (see Fact Sheet for Peconic River Remediation Areas). No contaminants were detected above cleanup levels at the Satellite Disposal Area and the Holding Ponds.

Remedial Action:

Remediation of the STP involved the excavation of twelve cleanup areas resulting in 1,350 cubic yards of contaminated soils. The Imhoff tanks were emptied and removed. The contaminated areas of the sand filter beds and sludge drying beds were excavated to levels that allow for continued industrial use without controls, and potential future residential land use after 50 years of institutional controls. A minimum of six inches of clean fill was placed over the remediated areas.

Current Conditions: The maximum residual soil concentration of Cs–137 remaining following remediation of the STP AOC 4 is 6.7 pCi/gm which is below the concentration for unrestricted land use today. Concentrations of mercury following remediation are below the 2.0 mg/gm clean–up goal.

Land Use and Institutional Controls:

Land Use Classification: Remediation Complete – Restricted (B)

- The area has been remediated to an industrial use standard.
- The STP is an active waste water treatment facility.
- Based upon residual contamination levels, the site will be suitable for residential purposes with 50 years of in situ radioactive decay (i.e., by the year 2055). Use of the site for residential purposes prior to 2055 requires an additional evaluation/risk assessment, and appropriate DOE/regulatory agency approval.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.
- The areas around the STP buildings and emergency holding ponds are fenced.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- Any excavated soils shall be returned to the site and covered as found. If soil cannot be returned, the procedure FS–SOP–1005, Release of Material from Areas Controlled for Radiological Purposes must be followed. The waste soils must be managed in accordance with all Waste Management procedures, and the Environmental and Waste Management Services Division shall review all work requiring the disposal of soil wastes at an approved facility.

Facility Use Agreements:
https://sbms.bnl.gov/standard/1h/1h01d011.htm (BNL Internal Use Only)

References:

Final Operable Unit V Remedial Investigation Report. IT Corp. May 1998.

Final Operable Unit V Feasibility Study Report. IT Corp. September 1998.

Operable Unit V – Record of Decision AOC 4 (Sewage Treatment Plant); AOC 21 (Sewer Lines) AOC 23 (Eastern Offsite Tritium Plume) . July 24, 2001.

Final Completion Report: Remedial Action AOC 4, STP and AOC 21, abandoned Former Sewer lines. November 17, 2004.

For additional information please contact:

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Factsheet: TCE Spill Area (AOC 19) (A5)

History:
The TCE spill area was reported to have been located near the present day courtyard of Building 515. Between 1951 and 1953 it was reported that approximately 5 gallons of trichloroethylene (TCE) was discharged to the ground at a frequency of every two days – which would amount to approximately 1,800 gallons of TCE for the time period.

Remedial Action:

Based upon a review of historical records, the location of the probable spill area was identified as the present day courtyard of Building 515 (Physics). As part of the Operable Unit III Remedial Investigation, soil and groundwater samples were collected in this area. No residual contamination was detected in the soils, and groundwater samples did not indicate the presence of residual TCE contamination.

Land Use and Institutional Controls:

Land Use Classification: Remediation Complete – Unrestricted Use (A)

- The site has been remediated to a residential use standard, but is currently used for industrial purposes
- With appropriate DOE/regulatory agency approval, the site can be used for residential purposes once industrial activities have ended.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

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130.199.228.111 (MSIE 6.0) http://huic.bnl.gov/website/landcontrols Jul 14, 2006 — 3:56 PM

Factsheet: Upland Recharge/ Meadow Marsh (AOC 8) (G1)

History:

The meadow marsh ponds and two upland recharge basins (Area of Concern 8) were used for experiments from 1973 to 1975 on the use of natural ecosystems for treatment of sewage and recharge to groundwater. These ponds are currently breeding grounds for the Tiger Salamander, a New York State endangered species. This area is classified as Class I Wetlands based on the presence of this species.

Analysis of the sediments in the ponds detected elevated levels of heavy metals including copper, aluminum, and zinc in the surface water and sediments. An ecological risk assessment prepared for the OU I Feasibility Study showed potential for impact to the Tiger Salamander. No contaminants of concern were found that exceed remediation goals for impacting human health.

Remedial Action:

In 2003, the contaminated sediments were excavated and the underlying PVC liners removed from the two eastern ponds. The wastes were disposed of off–site. The excavated wetlands were restored to a single pond designed to support the desired ecological habitat for Tiger Salamanders.

Current Conditions: Based on the Ecological Risk Assessment method used in the OU I/VI Feasibility Study, current concentrations of metals in the remediated and restored meadow marsh pond indicate that the pond is safe for the Tiger Salamander. No radiological materials are present that exceed cleanup goals. Residual chemical contaminants meet Federal and State guidelines for public exposure.

Land Use and Institutional Controls:

Land Use: Biologically/Culturally Sensitive – Restricted Land Use (G)

- The area is designated as open space and a protected habitat.
- NYSDEC regulations regulates all work within 100 feet of wetlands with confirmed protected species habitats. Any work activities within 100 feet of a wetland requires DOE and NYSDEC notification and approval.
- BNL limits activities within 850 feet of wetlands with confirmed protected species habitats.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.
- No specific postings are required for this area.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Work Planning: Activities in this area must comply with the BNL Wildlife Management Plan (BNL–71870–2003).
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager and Natural Resources Manager immediately upon discovery.

- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

Facility Use Agreements:
N/A (BNL Internal Use Only)

References:

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

Final Feasibility Study Report Operable Unit I and Radiologically-Contaminates Soils. CDM Federal Programs Corp. March 31, 1999.

Record of Decision Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6,8,10,16,17, and 18). USDOE and BNL. August 25, 1999.

Natural Resource Management Plan. Brookhaven National Laboratory. (BNL-71870-2003)

Close Out Report for the Meadow Marsh, Operable Unit I, Area of Concern 8. BNL Environmental Management Directorate. February 6, 2004.

For additional information please contact:

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Factsheet: Wooded Wetlands by Current Landfill Area (AOC 3A) (G8)

History:
The Wooded Wetland (*SubArea* of Concern 3A) is located adjacent to the eastern edge of the Current Landfill (AOC 3). Prior to capping of the landfill, runoff, which was contaminated with leachate, drained into the wetland from the landfill. Elevated concentrations of aluminum and copper were found below those of human health concern. These levels were a concern for protection of wetlands serving as a breeding habitat for the Tiger Salamander, a New York State endangered species.

Remedial Action:

Capping of the Current Landfill in 1995 corrected the runoff into the wetland. The OU I Record of Decision stipulated institutional control and monitoring metal concentrations in the surface water and sediments of the Wooded Wetland.

Current Conditions: Based on the Ecological Risk Assessment in the OU I/VI Feasibility Study, current concentrations in the wetland indicate the habitat is safe for the Tiger Salamander. The Wooded Wetland is a contiguous part of a larger regulated wetland. No radiological materials are present that exceed cleanup goals. Residual chemical contaminants meet Federal and State guidelines for public exposure.

Land Use and Institutional Controls:

Land Use Classification: Biologically/Culturally Sensitive – Restricted Use or Activity (G)

- This area contains a protected habitat.
- NYSDEC regulations regulate all work within 100 feet of wetlands with confirmed protected species habitats. Any work activities within 100 feet of a wetland requires DOE and NYSDEC notification and approval.
- BNL limits activities within 850 feet of wetlands with confirmed protected species habitats.

Institutional Controls

Access:

- Site Security Limits public access to the BNL Site.
- Specific postings for this area are not required.

Land Use:

- Federal ownership and control of the site is expected to continue.
- The Land Use and Institutional Controls Program Description in SBMS interfaces with the Site Master Planning process.

Engineered Controls:

- None.

Administrative Controls:

- Work Planning: Any work in these areas shall be coordinated with the Work Planning and Control Procedure.
- Work Planning: Activities in this area must comply with the BNL Wildlife Management Plan (BNL–71870–2003).
- Ownership: Any transfer of this site from DOE ownership must meet the requirements of CERCLA 120(h).
- Change Management: Proposed changes to land use and ICs must be coordinated with DOE, NYSDEC and EPA in accordance with the LUCMP prior to implementation and reported annually to the DOE, NYSDEC and EPA.
- Reporting: Breaches of Institutional and Engineered Controls must be reported to the LTRA Manager and Natural Resources Manager immediately upon discovery.
- Reporting: Implementation, maintenance and changes to land us and institutional controls will be documented in an annual letter report submitted to DOE, NYSDEC and EPA.
- Reporting: Five Year Reviews will be prepared and submitted to the DOE, EPA and NYSDEC. The Five Year Review will include inspections and a summary of site conditions to assure that ICs are working.
- Monitoring and Maintenance: Details on required monitoring and maintenance can be obtained from the LTRA Manager.

Other:

- None.

References:

Final Engineering Evaluation/Cost Analysis for Landfill Closure Removal Action VI. CDM Federal Programs Corp. Vol. 1 & 2. March, 1995.

Record of Decision Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6,8,10,16,17, and 18). USDOE and BNL. August 25, 1999.

OU I Wooded Wetlands Supplemental Sampling and Analysis Plan.

Landfill Gas and Surface Leachate Monitoring Current Landfill – Wooded Wetland Monitoring

Natural Resources Management Plan. Brookhaven National Laboratory. (BNL–71870–2003)

November 20, 2003 http://intranet.bnl.gov/esh/esd/internal/Docs/EMP05pdffiles/EMP05Ch13.pdf

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Attachment 7
Operable Unit Cleanup Levels Matrix

Attachment 7
Operable Unit Cleanup Levels Matrix

Operable Unit	Contaminants of Concern	Cleanup Levels			Note any Changes to Cleanup Levels	Remedial Action Objectives
		Soil		Groundwater		
		Residential	Industrial			
I	Cesium-137	23 pCi/g	67 pCi/g			Prevent or minimize: 1. Leaching of contaminants from soil into groundwater, 2. Human exposure from surface and subsurface soil, 3. Uptake to ecological receptors. Rad soil cleanup levels are based on 15 mrem/year above background. ALARA goal is 10 mrem/year above background.
	Strontium-90	15 pCi/g	15 pCi/g	8 pCi/L		
	Radium-226	5 pCi/g	5 pCi/g			
	Lead	400 mg/kg				
	Mercury	1.84 mg/kg				
	1,2-Dichloroethane			5 µg/L		
	Chloroethane			5 µg/L		
II	Cesium-137	23 pCi/g	67 pCi/g			Documented in the OU I and III RODs.
	Tritium			20,000 pCi/L		
	Sodum-22			400 pCi/L		
III	1,1,1-Trichloroethane			5 µg/L		1. Meet MCLs for VOCs and tritium in Upper Glacial aquifer within 30 years, 2. Meet MCLs for VOCs in Magothy aquifer within 65 years, 3. Meet MCLs for Sr-90 in Upper Glacial aquifer within 40 years and 70 years at Chemical Holes and BGRR/WCF plumes, respectively.
	Tetrachloroethylene			5 µg/L		
	Carbon tetrachloride			5 µg/L		
	Tritium			20,000 pCi/L		
	Strontium-90			8 pCi/L		
	PCBs	1 mg/kg - Surface NYSDEC TAGM	10 mg/kg - Subsurf. NYSDEC TAGM			
IV	Ethylbenzene			5 µg/L		Restore groundwater quality to MCLs or background, and prevent or minimize: 1. Leaching of contaminants from soil into groundwater, 2. Human exposure from surface and subsurface soil, 3, Uptake of contaminants in soil by plants and animals.
	Toluene			5 µg/L		
	Strontium-90			8 pCi/L		
V	Mercury	2 mg/kg				Protect public health and the sole source aquifer, monitor the groundwater, and prevent
	Cesium-137	23 pCi/g				

Attachment 7
Operable Unit Cleanup Levels Matrix

Operable Unit	Contaminants of Concern	Cleanup Levels			Note any Changes to Cleanup Levels	Remedial Action Objectives
	Trichloroethene			5 µg/L		or minimize: 1. Migration of contaminants present in surface soil via surface runoff, 2. Human and environmental exposure from surface and subsurface soil. 3. Reduce site-related contaminants (e.g., mercury) in sediment to levels that are protective of human health, 4. Reduce or mitigate, to the extent practicable, existing and potential adverse ecological effects of contaminants in the Peconic River, 5. Prevent or reduce the migration of contaminants off the BNL property.
VI	Ethylene dibromide			0.05 µg/L		1. Meet MCLs for EDB in the Upper Glacial aquifer within 30 years, 2. Pevent or minimize further migration of EDB in groundwater vertically and horizontally.
BGRR	Strontium-90	ALARA (1)	ALARA	8 pCi/L		1. Ensure protection of human health and the environment from the potential hazards posed by the radiological inventory that resides in the BGRR complex, 2. Use ALARA while implementing the remedial action, 3. Implement long-term monitoring, maintenance, and institutional controls to manage potential hazards.
	Cesium-137	ALARA	ALARA			

(1) ALARA - as low as reasonably achievable.

Attachment 8
Soil Vapor Intrusion Screenings

OU I South Boundary - on-site Plume

IV. TIER 1 - Primary Screening

Primary Screening is designed to help quickly screen out sites at which the vapor intrusion pathway does not ordinarily need further consideration, and point out the sites that do typically need further consideration. This evaluation involves determining whether any potential exists at a specific site for vapor intrusion to result in unacceptable indoor inhalation risks and, if so, whether immediate action may be warranted. Recommended criteria for making these determinations are presented in Questions 1 through 3, which focus on identifying:

a) if chemicals of sufficient volatility and toxicity are present or reasonably suspected to be present (Question 1);
b) if inhabited buildings are located (or will be constructed under future development scenarios – except for Environmental Indicator determinations, see section IV.C below) above or in close proximity to subsurface contamination (Question 2); and
c) if current conditions warrant immediate action (Question 3).

This primary screening process is illustrated in a flow diagram included in Appendix C.

A. Primary Screening – Question #1

Q1: Are chemicals of sufficient volatility and toxicity known or reasonably suspected to be present in the subsurface (e.g., in unsaturated soils, soil gas, or the uppermost portions of the ground water and/or capillary fringe – see Table 1)? (We recommend this consideration involve DQOs (see Appendix A) used in acquiring the site data as well as an appropriately scaled Conceptual Site Model (CSM) for vapor intrusion (see Appendix B).)

✓ If **YES** - check here, check off the relevant chemicals on Table 1, and continue with Question 2. The chemicals identified here (and any degradation products) are evaluated as constituents of potential concern in subsequent questions.

____ If **NO** - check here, provide the rationale and references below, and then go to the Summary Page to document that the subsurface vapor to indoor air pathway is incomplete (i.e., no further consideration of this pathway is needed); or

____ If sufficient data are not available, go to the Summary Page and document the need for more information. After collecting the necessary data, Question 1 can then be revisited with the newly collected data to re-evaluate the completeness of the vapor intrusion pathway.

1. What is the goal of this question?

This question is designed to help quickly screen out sites at which the vapor intrusion pathway generally does not need further consideration. This evaluation involves determining whether or not any potential exists at a specific site for the vapor intrusion

pathway to result in unacceptable indoor air inhalation risks. Table 1 lists chemicals that may be found at hazardous waste sites and indicates whether, in our judgment, they are sufficiently volatile (Henry's Law Constant > 10^{-5} atm m^3/mol) to result in potentially significant vapor intrusion and sufficiently toxic (either an incremental lifetime cancer risk greater than 10^{-6} or a non-cancer hazard index greater than 1, or in some cases both) to result in potentially unacceptable indoor air inhalation risks. The approach used to develop Table 1 is documented in Appendix D and can be used, where appropriate, to evaluate volatile chemicals not included in the Table. We recommend that if any of the chemicals listed in Table 1 that are sufficiently volatile and toxic are present at a site, those chemicals become constituents of potential concern for the vapor intrusion pathway and are evaluated in subsequent questions in this guidance. If the chemicals listed in Table 1 are not present at a site, and no other volatile chemicals are present, we suggest that the vapor intrusion pathway be considered incomplete and no further consideration of this pathway is needed.

2. What should you keep in mind?

In evaluating the available site data, we recommend the DQOs used in collecting the data be reviewed to ensure those objectives are consistent with the DQOs for the vapor intrusion pathway (see Appendix A). We recommend the detection limits associated with the available groundwater data be reviewed to ensure they are not too high to detect volatile contaminants of potential concern. Also, we suggest that the adequacy of the definition of the nature and extent of contamination in groundwater and/or the vadose zone be assessed to ensure that all contaminants of concern and areas of contamination have been identified. Additionally, we recommend groundwater concentrations be measured or reasonably estimated using samples collected from wells screened at, or across the top of the water table. We recommend users read Appendices B (Conceptual Site Model for the Vapor Intrusion Pathway) and E (Relevant Methods and Techniques) to obtain a greater understanding of the important considerations in evaluating data for use in screening assessments of the vapor intrusion pathway.

3. Rationale and References:

VOCs are present in uppermost portion of groundwater table for the Current Landfill plume. The downgradient portion of the OU1 PSB plume has a clean layer of groundwater above.

B. Primary Screening – Question #2

Q2: Are currently (or potentially) inhabited buildings or areas of concern under future development scenarios located *near* (see discussion below) subsurface contaminants found in Table 1?

____ If **YES** – check here, identify buildings and/or areas of concern below, and document on the Summary Page whether the potential for impacts from the vapor intrusion pathway applies to currently inhabited buildings or areas of concern under reasonably anticipated future development scenarios, or both. (Note that for EI considerations, we recommend only current risks be evaluated.) Then proceed with Question 3.

_✓_ If **NO** – check here, describe the rationale below, and then go to the Summary Page to document that there is no potential for the vapor intrusion pathway to impact either currently inhabited buildings or areas of concern under future development scenarios (i.e., no further evaluation of this pathway is needed). (Note that for EI considerations, only current risks are evaluated.); or

____ If sufficient data are not available – check here and document the need for more information on the Summary Page. After collecting the necessary data, Question 2 can then be revisited with the newly collected data to re-evaluate the completeness of the vapor intrusion pathway.

1. What is the goal of this question?

The goal of this question is to help determine whether inhabited buildings currently are located (or may be reasonably expected to be located under future development scenarios) above or in close proximity to subsurface contamination that potentially could result in unacceptable indoor air inhalation risks. If inhabited buildings and/or future development are not located "near" the area of concern, we suggest that the vapor intrusion pathway be considered incomplete and no further consideration of the pathway should be needed.

For the purposes of this question, **"inhabited buildings"** are structures with enclosed air space that are designed for human occupancy. Table 1, discussed above in Question 1, lists the **"subsurface contaminants demonstrating sufficient volatility and toxicity"** to potentially pose an inhalation risk. We recommend that an inhabited building generally be considered **"near"** subsurface contaminants if it is located within approximately 100 ft laterally or vertically of known or interpolated soil gas or groundwater contaminants listed in Table 1 (or others not included in table 1 – see Question 1) and the contamination occurs in the unsaturated zone and/or the uppermost saturated zone. If the source of contamination is groundwater, we recommend migration of the contaminant plume be considered when evaluating the potential for future risks. The distance suggested above (100 feet) may not be appropriate for all sites (or contaminants) and,

consequently, we recommend that professional judgment be used when evaluating the potential for vertical and horizontal vapor migration.

2. *How did we develop the suggested distance?*

The recommended distance is designed to allow for the assessment to focus on buildings (or areas with the potential to be developed for human habitation) most likely to have a complete vapor intrusion pathway. Vapor concentrations generally decrease with increasing distance from a subsurface vapor source, and eventually at some distance the concentrations become negligible. The distance at which concentrations are negligible is a function of the mobility, toxicity and persistence of the chemical, as well as the geometry of the source, subsurface materials, and characteristics of the buildings of concern. Available information suggests that 100 feet laterally and vertically is a reasonable criterion when considering vapor migration fundamentals, typical sampling density, and uncertainty in defining the actual contaminant spatial distribution. The recommended lateral distance is supported by empirical data from Colorado sites where the vapor intrusion pathway has been evaluated. At these sites, no significant indoor air concentrations have been found in residences at a distance greater than one house lot (approximately 100 feet) from the interpolated edge of ground water plumes. Considering the nature of diffusive vapor transport and the typical anisotropy in soil permeability, in our judgment a similar criterion of 100 feet for vertical transport is generally conservative. These recommended distances will be re-evaluated and, if necessary, adjusted by EPA as additional empirical data are compiled.

3. *What should you keep in mind when evaluating this criterion?*

It is important to consider whether **significant preferential pathways** could allow vapors to migrate more than 100 feet laterally. For the purposes of this guidance, a "significant" preferential pathway is a naturally occurring or anthropogenic subsurface pathway that is expected to have a high gas permeability and be of sufficient volume and proximity to a building so that it may be reasonably anticipated to influence vapor intrusion into the building. Examples include fractures, macropores, utility conduits, and subsurface drains that intersect vapor sources or vapor migration pathways. Note that naturally occurring fractures and macropores may serve as preferential pathways for either vertical or horizontal vapor migration, whereas anthropogenic features such as utility conduits are relatively shallow features and would likely serve only as a preferential pathway for horizontal migration. In either case, we recommend that buildings with significant preferential pathways be evaluated even if they are further than 100 ft from the contamination.

We also recommend that the potential for mobile "vapor clouds" (gas plumes) emanating from near-surface sources of contamination into the subsurface be considered when evaluating site data. Examples of such mobile "vapor clouds" include: 1) those originating in landfills where methane may serve as a carrier gas; and 2) those originating in commercial/industrial settings (such as dry cleaning facilities) where vapor can be released within an enclosed space and the density of the chemicals' vapor may result in

significant advective transport of the vapors downward through cracks/openings in floors and into the vadose zone. In these cases, diffusive transport of vapors is usually overridden by advective transport, and the vapors may be transported in the vadose zone several hundred feet from the source of contamination.

Finally, this guidance is intended to be applied to existing groundwater plumes as they are currently defined (e.g., MCLs, State Standards, or Risk-Based Concentrations). However, it is very important to recognize that some non-potable aquifers may have plumes that have been defined by threshold concentrations significantly higher than drinking-water concentrations. In these cases, contamination that is not technically considered part of the plume may still pose significant risks via the vapor intrusion pathway and, consequently, the plume definition may need to be expanded. Similarly, we recommend evaluating the technologies used to obtain soil gas and indoor air concentrations to determine if appropriate methods were used to ensure adequate data quality at the time analyses were conducted.

4. ***Identify Inhabited Buildings (or Areas With Potential for Future Residential Development) Within Distances of Possible Concern:***

None. The closest office building to the Current Landfill plume is ~1000 feet upgradient of the contaminant plume. Therefore, the subsurface vapor to indoor pathway is incomplete.

C. **Primary Screening Stage— Question #3**

Q3: Does evidence suggest immediate action may be warranted to mitigate current risks?

_____ If **YES** – check here and proceed with appropriate actions to verify or eliminate imminent risks. Some examples of actions may include but are not limited to indoor air quality monitoring, engineered containment or ventilation systems, or relocation of people. The action(s) should be appropriate for the site-specific situation.

__✓__ If **NO** – check here and continue with Question 4.

1. What is the goal of this question?

This question is intended to help determine whether immediate action may be warranted for those buildings identified in Question 2 as located within the areas of concern. For the purposes of this guidance, "immediate action" means such action is necessary to verify or abate imminent and substantial threats to human health.

2. What are the qualitative criteria generally considered sufficient to indicate a need for immediate actions?

Odors reported by occupants, particularly if described as "chemical," or "solvent," or "gasoline." The presence of odors does not necessarily correspond to adverse health and/or safety impacts and the odors could be the result of indoor vapor sources; however, we believe it is generally prudent to investigate any reports of odors as the odor threshold for some chemicals exceeds their respective acceptable target breathing zone concentrations.

Physiological effects reported by occupants (dizziness, nausea, vomiting, confusion, etc.) may, or may not be due to subsurface vapor intrusion or even other indoor vapor sources, but, should generally be evaluated.

Wet basements, in areas **where chemicals of sufficient volatility and toxicity** (see Table 1) **are known to be present in groundwater and the water table is shallow enough that the basements are prone to groundwater intrusion or flooding.** This has been proven to be especially important where there is evidence of light, non-aqueous phase liquids (LNAPLs) floating on the water table directly below the building, and/or any direct evidence of contamination (liquid chemical or dissolved in water) inside the building.

Short-term safety concerns are known, or are reasonably suspected to exist, including: a) measured or likely explosive or acutely toxic concentrations of vapors in the building or connected utility conduits, sumps, or other subsurface drains directly connected to the

building and b) measured or likely vapor concentrations that may be flammable/combustible, corrosive, or chemically reactive.

3. ***Rationale and Reference(s):***

VII. VAPOR INTRUSION PATHWAY SUMMARY PAGE

Facility Name: OU I South Boundary - on-site

Facility Address: BNL

Primary Screening Summary

☐ *Q1: Constituents of concern Identified?*

✓ *Yes*

_____ *No* (If NO, skip to the conclusion section below and check NO to indicate the pathway is *incomplete.)*

☐ *Q2: Currently inhabited buildings near subsurface contamination?*

_____ *Yes*

✓ *No*

Areas of future concern near subsurface contamination?

_____ *Yes*

✓ *No* (If NO, skip to the conclusion section below and check NO to indicate the pathway is *incomplete.)*

☐ *Q3: Immediate Actions Warranted?*

_____ *Yes*

✓ *No*

Secondary Screening Summary

☐ *Vapor source identified:*

_____ *Groundwater*

_____ *Soil*

_____ *Insufficient data*

☐ *Indoor air data available?*

_____ *Yes*

_____ *No*

☐ *Indoor air concentrations exceed target levels?*

_____ *Yes*

_____ *No*

☐ *Subsurface data evaluation: (Circle appropriate answers below)*

Medium	Q4 Levels Exceeded?	Q5 Levels Exceeded?	Data Indicates Pathway is Complete?
Groundwater	YES / NO / NA / INS	YES / NO / NA / INS	YES / NO / INS
Soil Gas	YES / NO / NA / INS	YES / NO / NA / INS	YES / NO / INS

NA = not applicable
INS = insufficient data available to make a determination

Site-Specific Summary

☐ *Have the nature and extent of subsurface contamination, potential preferential pathways and overlying building characteristics been adequately characterized to identify the most-likely-to-be-impacted buildings?*

_____ *Yes*

_____ *No*

_____ *N/A*

EPA recommends that if a model was used, it be an appropriate and applicable model that represents the conceptual site model. If other means were used, document how you determined the potentially most impacted areas to sample. EPA recommends that predictive modeling can be used to support Current Human Exposures Under Control EI determinations without confirmatory sampling to support this determination. Current Human Exposures Under Control EI determinations are intended to reflect a reasonable conclusion by EPA or the State that current human exposures are under control with regard to the vapor intrusion pathway and current land use conditions. Therefore, if conducting evaluation for an EI determination, document that the **Pathway is Incomplete** and/or does not pose an unacceptable risk to human health for EI determinations.

☐ *Are you making an EI determination based on modeling and does the model prediction indicate that determination is expected to be adequately protective to support Current Human Exposures Under Control EI determinations?*

_____ *Yes*

_____ *No*

_____ *N/A*

☐ *Do subslab vapor concentrations exceed target levels?*

_____ *Yes*

_____ *No*

_____ *N/A*

☐ *Do indoor air concentrations exceed target levels?*

_____ *Yes*

_____ *No*

Conclusion

Is there a Complete Pathway for subsurface vapor intrusion to indoor air?

Below, check the appropriate conclusion for the Subsurface Vapor to Indoor Air Pathway evaluation and attach supporting documentation as well as a map of the facility.

✓ NO - the "Subsurface Vapor Intrusion to Indoor Air Pathway" has been verified to be incomplete for the OU I South Boundary on-site facility, EPA ID #_____, located at BNL.
This determination is based on a review of site information, as suggested in this guidance, check as appropriate:

✓ for current and reasonably expected conditions, or

_____ based on performance monitoring evaluations for engineered exposure controls. This determination may be re-evaluated, where appropriate, when the Agency/State becomes aware of any significant changes at the facility.

_____ YES –The "Subsurface Vapor to Indoor Air Pathway" is Complete. Engineered controls, avoidance actions, or removal actions taken include: _____

_____

_____

_____ UNKNOWN - More information is needed to make a determination.

Locations where References may be found:

_____

_____

_____

_____

_____

Contact telephone and e-mail numbers:

(name) R Have 3/13/06

(phone #) _____

(e-mail) _____

Carbon Tetrachloride (CCl_4) Plume

IV. TIER 1 - Primary Screening

Primary Screening is designed to help quickly screen out sites at which the vapor intrusion pathway does not ordinarily need further consideration, and point out the sites that do typically need further consideration. This evaluation involves determining whether any potential exists at a specific site for vapor intrusion to result in unacceptable indoor inhalation risks and, if so, whether immediate action may be warranted. Recommended criteria for making these determinations are presented in Questions 1 through 3, which focus on identifying:

a) if chemicals of sufficient volatility and toxicity are present or reasonably suspected to be present (Question 1);
b) if inhabited buildings are located (or will be constructed under future development scenarios – except for Environmental Indicator determinations, see section IV.C below) above or in close proximity to subsurface contamination (Question 2); and
c) if current conditions warrant immediate action (Question 3).

This primary screening process is illustrated in a flow diagram included in Appendix C.

A. Primary Screening – Question #1

Q1: Are chemicals of sufficient volatility and toxicity known or reasonably suspected to be present in the subsurface (e.g., in unsaturated soils, soil gas, or the uppermost portions of the ground water and/or capillary fringe – see Table 1)? (We recommend this consideration involve DQOs (see Appendix A) used in acquiring the site data as well as an appropriately scaled Conceptual Site Model (CSM) for vapor intrusion (see Appendix B).)

✓ If **YES** - check here, check off the relevant chemicals on Table 1, and continue with Question 2. The chemicals identified here (and any degradation products) are evaluated as constituents of potential concern in subsequent questions.

____ If **NO** - check here, provide the rationale and references below, and then go to the Summary Page to document that the subsurface vapor to indoor air pathway is incomplete (i.e., no further consideration of this pathway is needed); or

____ If sufficient data are not available, go to the Summary Page and document the need for more information. After collecting the necessary data, Question 1 can then be revisited with the newly collected data to re-evaluate the completeness of the vapor intrusion pathway.

1. What is the goal of this question?

This question is designed to help quickly screen out sites at which the vapor intrusion pathway generally does not need further consideration. This evaluation involves determining whether or not any potential exists at a specific site for the vapor intrusion

pathway to result in unacceptable indoor air inhalation risks. Table 1 lists chemicals that may be found at hazardous waste sites and indicates whether, in our judgment, they are sufficiently volatile (Henry's Law Constant > 10^{-5} atm m^3/mol) to result in potentially significant vapor intrusion and sufficiently toxic (either an incremental lifetime cancer risk greater than 10^{-6} or a non-cancer hazard index greater than 1, or in some cases both) to result in potentially unacceptable indoor air inhalation risks. The approach used to develop Table 1 is documented in Appendix D and can be used, where appropriate, to evaluate volatile chemicals not included in the Table. We recommend that if any of the chemicals listed in Table 1 that are sufficiently volatile and toxic are present at a site, those chemicals become constituents of potential concern for the vapor intrusion pathway and are evaluated in subsequent questions in this guidance. If the chemicals listed in Table 1 are not present at a site, and no other volatile chemicals are present, we suggest that the vapor intrusion pathway be considered incomplete and no further consideration of this pathway is needed.

2. *What should you keep in mind?*

In evaluating the available site data, we recommend the DQOs used in collecting the data be reviewed to ensure those objectives are consistent with the DQOs for the vapor intrusion pathway (see Appendix A). We recommend the detection limits associated with the available groundwater data be reviewed to ensure they are not too high to detect volatile contaminants of potential concern. Also, we suggest that the adequacy of the definition of the nature and extent of contamination in groundwater and/or the vadose zone be assessed to ensure that all contaminants of concern and areas of contamination have been identified. Additionally, we recommend groundwater concentrations be measured or reasonably estimated using samples collected from wells screened at, or across the top of the water table. We recommend users read Appendices B (Conceptual Site Model for the Vapor Intrusion Pathway) and E (Relevant Methods and Techniques) to obtain a greater understanding of the important considerations in evaluating data for use in screening assessments of the vapor intrusion pathway.

3. *Rationale and References:*

Carbon tetrachloride is present in wells screened across the water table, exceeding Table 2 criteria of 5 ppb.

B. Primary Screening – Question #2

Q2: Are currently (or potentially) inhabited buildings or areas of concern under future development scenarios located *near* (see discussion below) subsurface contaminants found in Table 1?

_____ If **YES** – check here, identify buildings and/or areas of concern below, and document on the Summary Page whether the potential for impacts from the vapor intrusion pathway applies to currently inhabited buildings or areas of concern under reasonably anticipated future development scenarios, or both. (Note that for EI considerations, we recommend only current risks be evaluated.) Then proceed with Question 3.

✓ If **NO** – check here, describe the rationale below, and then go to the Summary Page to document that there is no potential for the vapor intrusion pathway to impact either currently inhabited buildings or areas of concern under future development scenarios (i.e., no further evaluation of this pathway is needed). (Note that for EI considerations, only current risks are evaluated.); or

_____ If sufficient data are not available – check here and document the need for more information on the Summary Page. After collecting the necessary data, Question 2 can then be revisited with the newly collected data to re-evaluate the completeness of the vapor intrusion pathway.

1. What is the goal of this question?

The goal of this question is to help determine whether inhabited buildings currently are located (or may be reasonably expected to be located under future development scenarios) above or in close proximity to subsurface contamination that potentially could result in unacceptable indoor air inhalation risks. If inhabited buildings and/or future development are not located "near" the area of concern, we suggest that the vapor intrusion pathway be considered incomplete and no further consideration of the pathway should be needed.

For the purposes of this question, **"inhabited buildings"** are structures with enclosed air space that are designed for human occupancy. Table 1, discussed above in Question 1, lists the **"subsurface contaminants demonstrating sufficient volatility and toxicity"** to potentially pose an inhalation risk. We recommend that an inhabited building generally be considered **"near"** subsurface contaminants if it is located within approximately 100 ft laterally or vertically of known or interpolated soil gas or groundwater contaminants listed in Table 1 (or others not included in table 1 – see Question 1) and the contamination occurs in the unsaturated zone and/or the uppermost saturated zone. If the source of contamination is groundwater, we recommend migration of the contaminant plume be considered when evaluating the potential for future risks. The distance suggested above (100 feet) may not be appropriate for all sites (or contaminants) and,

consequently, we recommend that professional judgment be used when evaluating the potential for vertical and horizontal vapor migration.

2. *How did we develop the suggested distance?*

The recommended distance is designed to allow for the assessment to focus on buildings (or areas with the potential to be developed for human habitation) most likely to have a complete vapor intrusion pathway. Vapor concentrations generally decrease with increasing distance from a subsurface vapor source, and eventually at some distance the concentrations become negligible. The distance at which concentrations are negligible is a function of the mobility, toxicity and persistence of the chemical, as well as the geometry of the source, subsurface materials, and characteristics of the buildings of concern. Available information suggests that 100 feet laterally and vertically is a reasonable criterion when considering vapor migration fundamentals, typical sampling density, and uncertainty in defining the actual contaminant spatial distribution. The recommended lateral distance is supported by empirical data from Colorado sites where the vapor intrusion pathway has been evaluated. At these sites, no significant indoor air concentrations have been found in residences at a distance greater than one house lot (approximately 100 feet) from the interpolated edge of ground water plumes. Considering the nature of diffusive vapor transport and the typical anisotropy in soil permeability, in our judgment a similar criterion of 100 feet for vertical transport is generally conservative. These recommended distances will be re-evaluated and, if necessary, adjusted by EPA as additional empirical data are compiled.

3. *What should you keep in mind when evaluating this criterion?*

It is important to consider whether **significant preferential pathways** could allow vapors to migrate more than 100 feet laterally. For the purposes of this guidance, a "significant" preferential pathway is a naturally occurring or anthropogenic subsurface pathway that is expected to have a high gas permeability and be of sufficient volume and proximity to a building so that it may be reasonably anticipated to influence vapor intrusion into the building. Examples include fractures, macropores, utility conduits, and subsurface drains that intersect vapor sources or vapor migration pathways. Note that naturally occurring fractures and macropores may serve as preferential pathways for either vertical or horizontal vapor migration, whereas anthropogenic features such as utility conduits are relatively shallow features and would likely serve only as a preferential pathway for horizontal migration. In either case, we recommend that buildings with significant preferential pathways be evaluated even if they are further than 100 ft from the contamination.

We also recommend that the potential for mobile "vapor clouds" (gas plumes) emanating from near-surface sources of contamination into the subsurface be considered when evaluating site data. Examples of such mobile "vapor clouds" include: 1) those originating in landfills where methane may serve as a carrier gas; and 2) those originating in commercial/industrial settings (such as dry cleaning facilities) where vapor can be released within an enclosed space and the density of the chemicals' vapor may result in

significant advective transport of the vapors downward through cracks/openings in floors and into the vadose zone. In these cases, diffusive transport of vapors is usually overridden by advective transport, and the vapors may be transported in the vadose zone several hundred feet from the source of contamination.

Finally, this guidance is intended to be applied to existing groundwater plumes as they are currently defined (e.g., MCLs, State Standards, or Risk-Based Concentrations). However, it is very important to recognize that some non-potable aquifers may have plumes that have been defined by threshold concentrations significantly higher than drinking-water concentrations. In these cases, contamination that is not technically considered part of the plume may still pose significant risks via the vapor intrusion pathway and, consequently, the plume definition may need to be expanded. Similarly, we recommend evaluating the technologies used to obtain soil gas and indoor air concentrations to determine if appropriate methods were used to ensure adequate data quality at the time analyses were conducted.

4. ***Identify Inhabited Buildings (or Areas With Potential for Future Residential Development) Within Distances of Possible Concern:***

None.
The closest building to the carbon tetrachloride plume is Bldg. 630, the service station. It is ~150 feet away, however it is not inhabitated and has no basement. The workers are only present during the day and they keep the bay doors open.
The next closest building is Bldg 600. However there is a clean layer of groundwater above.
Bldg 659 is not inhabitated and is a storage building.
Bldg 463 (Bio Lagy) is located ~350 feet upgradient of the plume. This building is inhabitated but is located too far away to be a concern.

C. Primary Screening Stage— Question #3

Q3: Does evidence suggest immediate action may be warranted to mitigate current risks?

_____ If **YES** – check here and proceed with appropriate actions to verify or eliminate imminent risks. Some examples of actions may include but are not limited to indoor air quality monitoring, engineered containment or ventilation systems, or relocation of people. The action(s) should be appropriate for the site-specific situation.

__✓__ If **NO** – check here and continue with Question 4.

1. What is the goal of this question?

This question is intended to help determine whether immediate action may be warranted for those buildings identified in Question 2 as located within the areas of concern. For the purposes of this guidance, "immediate action" means such action is necessary to verify or abate imminent and substantial threats to human health.

2. What are the qualitative criteria generally considered sufficient to indicate a need for immediate actions?

Odors reported by occupants, particularly if described as "chemical," or "solvent," or "gasoline." The presence of odors does not necessarily correspond to adverse health and/or safety impacts and the odors could be the result of indoor vapor sources; however, we believe it is generally prudent to investigate any reports of odors as the odor threshold for some chemicals exceeds their respective acceptable target breathing zone concentrations.

Physiological effects reported by occupants (dizziness, nausea, vomiting, confusion, etc.) may, or may not be due to subsurface vapor intrusion or even other indoor vapor sources, but, should generally be evaluated.

Wet basements, in areas **where chemicals of sufficient volatility and toxicity** (see Table 1) **are known to be present in groundwater and the water table is shallow enough that the basements are prone to groundwater intrusion or flooding.** This has been proven to be especially important where there is evidence of light, non-aqueous phase liquids (LNAPLs) floating on the water table directly below the building, and/or any direct evidence of contamination (liquid chemical or dissolved in water) inside the building.

Short-term safety concerns are known, or are reasonably suspected to exist, including: a) measured or likely explosive or acutely toxic concentrations of vapors in the building or connected utility conduits, sumps, or other subsurface drains directly connected to the

building and b) measured or likely vapor concentrations that may be flammable/combustible, corrosive, or chemically reactive.

3. ***Rationale and Reference(s):***
None. No basement in Bldg 630

VII. VAPOR INTRUSION PATHWAY SUMMARY PAGE

Facility Name: Carbon Tetrachloride Plume

Facility Address: BNL

Primary Screening Summary

☐ *Q1: Constituents of concern Identified?*

✓ *Yes*

_____ *No* (If NO, skip to the conclusion section below and check NO to indicate the pathway is *incomplete.)*

☐ *Q2: Currently inhabited buildings near subsurface contamination?*

_____ *Yes*

✓ *No*

Areas of future concern near subsurface contamination?

_____ *Yes*

_____ *No* (If NO, skip to the conclusion section below and check NO to indicate the pathway is *incomplete.)*

☐ *Q3: Immediate Actions Warranted?*

_____ *Yes*

✓ *No*

Secondary Screening Summary

☐ *Vapor source identified:*

_____ *Groundwater*

_____ *Soil*

_____ *Insufficient data*

☐ *Indoor air data available?*

_____ *Yes*

_____ *No*

☐ *Indoor air concentrations exceed target levels?*

_____ *Yes*

_____ *No*

☐ *Subsurface data evaluation: (Circle appropriate answers below)*

Medium	Q4 Levels Exceeded?	Q5 Levels Exceeded?	Data Indicates Pathway is Complete?
Groundwater	YES / NO / NA / INS	YES / NO / NA / INS	YES / NO / INS
Soil Gas	YES / NO / NA / INS	YES / NO / NA / INS	YES / NO / INS

NA = not applicable
INS = insufficient data available to make a determination

Site-Specific Summary

☐ *Have the nature and extent of subsurface contamination, potential preferential pathways and overlying building characteristics been adequately characterized to identify the most-likely-to-be-impacted buildings?*

_____ *Yes*

_____ *No*

_____ *N/A*

EPA recommends that if a model was used, it be an appropriate and applicable model that represents the conceptual site model. If other means were used, document how you determined the potentially most impacted areas to sample. EPA recommends that predictive modeling can be used to support Current Human Exposures Under Control EI determinations without confirmatory sampling to support this determination. Current Human Exposures Under Control EI determinations are intended to reflect a reasonable conclusion by EPA or the State that current human exposures are under control with regard to the vapor intrusion pathway and current land use conditions. Therefore, if conducting evaluation for an EI determination, document that the **Pathway is Incomplete** and/or does not pose an unacceptable risk to human health for EI determinations.

☐ *Are you making an EI determination based on modeling and does the model prediction indicate that determination is expected to be adequately protective to support Current Human Exposures Under Control EI determinations?*

_____ *Yes*

_____ *No*

_____ *N/A*

☐ *Do subslab vapor concentrations exceed target levels?*

_____ *Yes*

_____ *No*

_____ *N/A*

☐ *Do indoor air concentrations exceed target levels?*

_____ *Yes*

_____ *No*

Conclusion

Is there a Complete Pathway for subsurface vapor intrusion to indoor air?

Below, check the appropriate conclusion for the Subsurface Vapor to Indoor Air Pathway evaluation and attach supporting documentation as well as a map of the facility.

✓ NO - the "Subsurface Vapor Intrusion to Indoor Air Pathway" has been verified to be incomplete for the Carbon Tetrachloride Plume facility, EPA ID #_____, located at BKL.
This determination is based on a review of site information, as suggested in this guidance, check as appropriate:

✓ for current and reasonably expected conditions, or

_____ based on performance monitoring evaluations for engineered exposure controls. This determination may be re-evaluated, where appropriate, when the Agency/State becomes aware of any significant changes at the facility.

_____ YES –The "Subsurface Vapor to Indoor Air Pathway" is Complete. Engineered controls, avoidance actions, or removal actions taken include: _____

_____

_____

_____ UNKNOWN - More information is needed to make a determination.

Locations where References may be found:

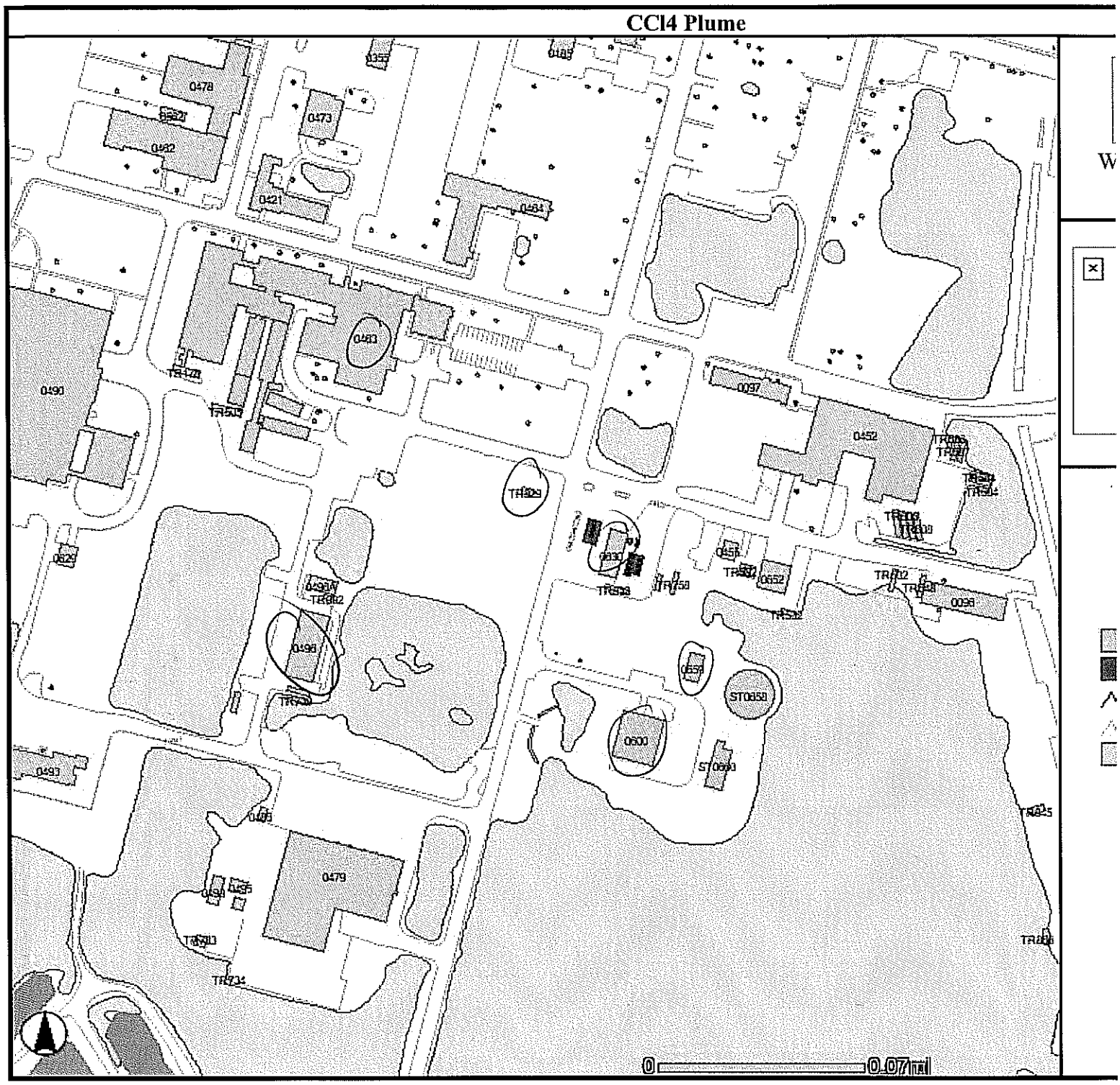
Annual Groundwater Status Report

Contact telephone and e-mail numbers:

(name) R Have 3/13/06

(phone #) _____

(e-mail) _____


CCl4 Plume
0478
0473
0482
0421
0484
0490
0463
0097
0452
0456
0652
0096
0498
0659
ST0659
0600
ST0600
0493
0479
0
0.07

Building 96 Plume

IV. TIER 1 - Primary Screening

Primary Screening is designed to help quickly screen out sites at which the vapor intrusion pathway does not ordinarily need further consideration, and point out the sites that do typically need further consideration. This evaluation involves determining whether any potential exists at a specific site for vapor intrusion to result in unacceptable indoor inhalation risks and, if so, whether immediate action may be warranted. Recommended criteria for making these determinations are presented in Questions 1 through 3, which focus on identifying:

a) if chemicals of sufficient volatility and toxicity are present or reasonably suspected to be present (Question 1);
b) if inhabited buildings are located (or will be constructed under future development scenarios – except for Environmental Indicator determinations, see section IV.C below) above or in close proximity to subsurface contamination (Question 2); and
c) if current conditions warrant immediate action (Question 3).

This primary screening process is illustrated in a flow diagram included in Appendix C.

A. Primary Screening – Question #1

Q1: Are chemicals of sufficient volatility and toxicity known or reasonably suspected to be present in the subsurface (e.g., in unsaturated soils, soil gas, or the uppermost portions of the ground water and/or capillary fringe – see Table 1)? (We recommend this consideration involve DQOs (see Appendix A) used in acquiring the site data as well as an appropriately scaled Conceptual Site Model (CSM) for vapor intrusion (see Appendix B).)

_✓_ If **YES** - check here, check off the relevant chemicals on Table 1, and continue with Question 2. The chemicals identified here (and any degradation products) are evaluated as constituents of potential concern in subsequent questions.

_____ If **NO** - check here, provide the rationale and references below, and then go to the Summary Page to document that the subsurface vapor to indoor air pathway is incomplete (i.e., no further consideration of this pathway is needed); or

_____ If sufficient data are not available, go to the Summary Page and document the need for more information. After collecting the necessary data, Question 1 can then be revisited with the newly collected data to re-evaluate the completeness of the vapor intrusion pathway.

1. What is the goal of this question?

This question is designed to help quickly screen out sites at which the vapor intrusion pathway generally does not need further consideration. This evaluation involves determining whether or not any potential exists at a specific site for the vapor intrusion

pathway to result in unacceptable indoor air inhalation risks. Table 1 lists chemicals that may be found at hazardous waste sites and indicates whether, in our judgment, they are sufficiently volatile (Henry's Law Constant > 10^{-5} atm m^3/mol) to result in potentially significant vapor intrusion and sufficiently toxic (either an incremental lifetime cancer risk greater than 10^{-6} or a non-cancer hazard index greater than 1, or in some cases both) to result in potentially unacceptable indoor air inhalation risks. The approach used to develop Table 1 is documented in Appendix D and can be used, where appropriate, to evaluate volatile chemicals not included in the Table. We recommend that if any of the chemicals listed in Table 1 that are sufficiently volatile and toxic are present at a site, those chemicals become constituents of potential concern for the vapor intrusion pathway and are evaluated in subsequent questions in this guidance. If the chemicals listed in Table 1 are not present at a site, and no other volatile chemicals are present, we suggest that the vapor intrusion pathway be considered incomplete and no further consideration of this pathway is needed.

2. *What should you keep in mind?*

In evaluating the available site data, we recommend the DQOs used in collecting the data be reviewed to ensure those objectives are consistent with the DQOs for the vapor intrusion pathway (see Appendix A). We recommend the detection limits associated with the available groundwater data be reviewed to ensure they are not too high to detect volatile contaminants of potential concern. Also, we suggest that the adequacy of the definition of the nature and extent of contamination in groundwater and/or the vadose zone be assessed to ensure that all contaminants of concern and areas of contamination have been identified. Additionally, we recommend groundwater concentrations be measured or reasonably estimated using samples collected from wells screened at, or across the top of the water table. We recommend users read Appendices B (Conceptual Site Model for the Vapor Intrusion Pathway) and E (Relevant Methods and Techniques) to obtain a greater understanding of the important considerations in evaluating data for use in screening assessments of the vapor intrusion pathway.

3. *Rationale and References:*

PCE is present in well 095-84 screened across the water table, exceeding Table 2 criteria of 5 ppb.

consequently, we recommend that professional judgment be used when evaluating the potential for vertical and horizontal vapor migration.

2. How did we develop the suggested distance?

The recommended distance is designed to allow for the assessment to focus on buildings (or areas with the potential to be developed for human habitation) most likely to have a complete vapor intrusion pathway. Vapor concentrations generally decrease with increasing distance from a subsurface vapor source, and eventually at some distance the concentrations become negligible. The distance at which concentrations are negligible is a function of the mobility, toxicity and persistence of the chemical, as well as the geometry of the source, subsurface materials, and characteristics of the buildings of concern. Available information suggests that 100 feet laterally and vertically is a reasonable criterion when considering vapor migration fundamentals, typical sampling density, and uncertainty in defining the actual contaminant spatial distribution. The recommended lateral distance is supported by empirical data from Colorado sites where the vapor intrusion pathway has been evaluated. At these sites, no significant indoor air concentrations have been found in residences at a distance greater than one house lot (approximately 100 feet) from the interpolated edge of ground water plumes. Considering the nature of diffusive vapor transport and the typical anisotropy in soil permeability, in our judgment a similar criterion of 100 feet for vertical transport is generally conservative. These recommended distances will be re-evaluated and, if necessary, adjusted by EPA as additional empirical data are compiled.

3. What should you keep in mind when evaluating this criterion?

It is important to consider whether **significant preferential pathways** could allow vapors to migrate more than 100 feet laterally. For the purposes of this guidance, a "significant" preferential pathway is a naturally occurring or anthropogenic subsurface pathway that is expected to have a high gas permeability and be of sufficient volume and proximity to a building so that it may be reasonably anticipated to influence vapor intrusion into the building. Examples include fractures, macropores, utility conduits, and subsurface drains that intersect vapor sources or vapor migration pathways. Note that naturally occurring fractures and macropores may serve as preferential pathways for either vertical or horizontal vapor migration, whereas anthropogenic features such as utility conduits are relatively shallow features and would likely serve only as a preferential pathway for horizontal migration. In either case, we recommend that buildings with significant preferential pathways be evaluated even if they are further than 100 ft from the contamination.

We also recommend that the potential for mobile "vapor clouds" (gas plumes) emanating from near-surface sources of contamination into the subsurface be considered when evaluating site data. Examples of such mobile "vapor clouds" include: 1) those originating in landfills where methane may serve as a carrier gas; and 2) those originating in commercial/industrial settings (such as dry cleaning facilities) where vapor can be released within an enclosed space and the density of the chemicals' vapor may result in

B. Primary Screening – Question #2

Q2: Are currently (or potentially) inhabited buildings or areas of concern under future development scenarios located *near* (see discussion below) subsurface contaminants found in Table 1?

_____ If **YES** – check here, identify buildings and/or areas of concern below, and document on the Summary Page whether the potential for impacts from the vapor intrusion pathway applies to currently inhabited buildings or areas of concern under reasonably anticipated future development scenarios, or both. (Note that for EI considerations, we recommend only current risks be evaluated.) Then proceed with Question 3.

__✓__ If **NO** – check here, describe the rationale below, and then go to the Summary Page to document that there is no potential for the vapor intrusion pathway to impact either currently inhabited buildings or areas of concern under future development scenarios (i.e., no further evaluation of this pathway is needed). (Note that for EI considerations, only current risks are evaluated.); or

_____ If sufficient data are not available – check here and document the need for more information on the Summary Page. After collecting the necessary data, Question 2 can then be revisited with the newly collected data to re-evaluate the completeness of the vapor intrusion pathway.

1. What is the goal of this question?

The goal of this question is to help determine whether inhabited buildings currently are located (or may be reasonably expected to be located under future development scenarios) above or in close proximity to subsurface contamination that potentially could result in unacceptable indoor air inhalation risks. If inhabited buildings and/or future development are not located "near" the area of concern, we suggest that the vapor intrusion pathway be considered incomplete and no further consideration of the pathway should be needed.

For the purposes of this question, **"inhabited buildings"** are structures with enclosed air space that are designed for human occupancy. Table 1, discussed above in Question 1, lists the **"subsurface contaminants demonstrating sufficient volatility and toxicity"** to potentially pose an inhalation risk. We recommend that an inhabited building generally be considered **"near"** subsurface contaminants if it is located within approximately 100 ft laterally or vertically of known or interpolated soil gas or groundwater contaminants listed in Table 1 (or others not included in table 1 – see Question 1) and the contamination occurs in the unsaturated zone and/or the uppermost saturated zone. If the source of contamination is groundwater, we recommend migration of the contaminant plume be considered when evaluating the potential for future risks. The distance suggested above (100 feet) may not be appropriate for all sites (or contaminants) and,

significant advective transport of the vapors downward through cracks/openings in floors and into the vadose zone. In these cases, diffusive transport of vapors is usually overridden by advective transport, and the vapors may be transported in the vadose zone several hundred feet from the source of contamination.

Finally, this guidance is intended to be applied to existing groundwater plumes as they are currently defined (e.g., MCLs, State Standards, or Risk-Based Concentrations). However, it is very important to recognize that some non-potable aquifers may have plumes that have been defined by threshold concentrations significantly higher than drinking-water concentrations. In these cases, contamination that is not technically considered part of the plume may still pose significant risks via the vapor intrusion pathway and, consequently, the plume definition may need to be expanded. Similarly, we recommend evaluating the technologies used to obtain soil gas and indoor air concentrations to determine if appropriate methods were used to ensure adequate data quality at the time analyses were conducted.

4. ***Identify Inhabited Buildings (or Areas With Potential for Future Residential Development) Within Distances of Possible Concern:***

None. The closest building is upgradient of the plume by ~350 feet (Bldg 452), and to the east ~350 feet away at Bldg 87. These buildings are utilities, maintenance and a warehouse, respectively. Bldg 196 is located ~100 feet upgradient of the plume but is used for storage only, and is not inhabitated. The Bldg treatment buildings for this plume (TR-845, 866, 867, 868) are not inhabitated.

C. Primary Screening Stage— Question #3

Q3: Does evidence suggest immediate action may be warranted to mitigate current risks?

_____ If **YES** – check here and proceed with appropriate actions to verify or eliminate imminent risks. Some examples of actions may include but are not limited to indoor air quality monitoring, engineered containment or ventilation systems, or relocation of people. The action(s) should be appropriate for the site-specific situation.

__✓__ If **NO** – check here and continue with Question 4.

1. What is the goal of this question?

This question is intended to help determine whether immediate action may be warranted for those buildings identified in Question 2 as located within the areas of concern. For the purposes of this guidance, "immediate action" means such action is necessary to verify or abate imminent and substantial threats to human health.

2. What are the qualitative criteria generally considered sufficient to indicate a need for immediate actions?

Odors reported by occupants, particularly if described as "chemical," or "solvent," or "gasoline." The presence of odors does not necessarily correspond to adverse health and/or safety impacts and the odors could be the result of indoor vapor sources; however, we believe it is generally prudent to investigate any reports of odors as the odor threshold for some chemicals exceeds their respective acceptable target breathing zone concentrations.

Physiological effects reported by occupants (dizziness, nausea, vomiting, confusion, etc.) may, or may not be due to subsurface vapor intrusion or even other indoor vapor sources, but, should generally be evaluated.

Wet basements, in areas **where chemicals of sufficient volatility and toxicity** (see Table 1) **are known to be present in groundwater and the water table is shallow enough that the basements are prone to groundwater intrusion or flooding.** This has been proven to be especially important where there is evidence of light, non-aqueous phase liquids (LNAPLs) floating on the water table directly below the building, and/or any direct evidence of contamination (liquid chemical or dissolved in water) inside the building.

Short-term safety concerns are known, or are reasonably suspected to exist, including: a) measured or likely explosive or acutely toxic concentrations of vapors in the building or connected utility conduits, sumps, or other subsurface drains directly connected to the

building and b) measured or likely vapor concentrations that may be flammable/combustible, corrosive, or chemically reactive.

3. ***Rationale and Reference(s):***

None

VII. VAPOR INTRUSION PATHWAY SUMMARY PAGE

Facility Name: Building 96 Plume

Facility Address: BNL

Primary Screening Summary

☐ *Q1: Constituents of concern Identified?*

✓ *Yes*

_____ *No* (If NO, skip to the conclusion section below and check NO to indicate the pathway is *incomplete.)*

☐ *Q2: Currently inhabited buildings near subsurface contamination?*

_____ *Yes*

✓ *No*

Areas of future concern near subsurface contamination?

_____ *Yes*

✓ *No* (If NO, skip to the conclusion section below and check NO to indicate the pathway is *incomplete.)*

☐ *Q3: Immediate Actions Warranted?*

_____ *Yes*

✓ *No*

Secondary Screening Summary

☐ *Vapor source identified:*

_____ *Groundwater*

_____ *Soil*

_____ *Insufficient data*

☐ *Indoor air data available?*

_____ *Yes*

_____ *No*

☐ *Indoor air concentrations exceed target levels?*

_____ *Yes*

_____ *No*

☐ *Subsurface data evaluation: (Circle appropriate answers below)*

Medium	Q4 Levels Exceeded?	Q5 Levels Exceeded?	Data Indicates Pathway is Complete?
Groundwater	YES / NO / NA / INS	YES / NO / NA / INS	YES / NO / INS
Soil Gas	YES / NO / NA / INS	YES / NO / NA / INS	YES / NO / INS

NA = not applicable
INS = insufficient data available to make a determination

Site-Specific Summary

☐ *Have the nature and extent of subsurface contamination, potential preferential pathways and overlying building characteristics been adequately characterized to identify the most-likely-to-be-impacted buildings?*

_____ *Yes*

_____ *No*

_____ *N/A*

EPA recommends that if a model was used, it be an appropriate and applicable model that represents the conceptual site model. If other means were used, document how you determined the potentially most impacted areas to sample. EPA recommends that predictive modeling can be used to support Current Human Exposures Under Control EI determinations without confirmatory sampling to support this determination. Current Human Exposures Under Control EI determinations are intended to reflect a reasonable conclusion by EPA or the State that current human exposures are under control with regard to the vapor intrusion pathway and current land use conditions. Therefore, if conducting evaluation for an EI determination, document that the **Pathway is Incomplete** and/or does not pose an unacceptable risk to human health for EI determinations.

☐ *Are you making an EI determination based on modeling and does the model prediction indicate that determination is expected to be adequately protective to support Current Human Exposures Under Control EI determinations?*

_____ *Yes*

_____ *No*

_____ *N/A*

☐ *Do subslab vapor concentrations exceed target levels?*

_____ *Yes*

_____ *No*

_____ *N/A*

☐ *Do indoor air concentrations exceed target levels?*

_____ *Yes*

_____ *No*

Conclusion

Is there a Complete Pathway for subsurface vapor intrusion to indoor air?

Below, check the appropriate conclusion for the Subsurface Vapor to Indoor Air Pathway evaluation and attach supporting documentation as well as a map of the facility.

__✓__ NO - the "Subsurface Vapor Intrusion to Indoor Air Pathway" has been verified to be incomplete for the Bldg. 96 plume facility, EPA ID #_____, located at BNL.
This determination is based on a review of site information, as suggested in this guidance, check as appropriate:

__✓__ for current and reasonably expected conditions, or

_____ based on performance monitoring evaluations for engineered exposure controls. This determination may be re-evaluated, where appropriate, when the Agency/State becomes aware of any significant changes at the facility.

_____ YES –The "Subsurface Vapor to Indoor Air Pathway" is Complete. Engineered controls, avoidance actions, or removal actions taken include: _____

_____

_____

_____ UNKNOWN - More information is needed to make a determination.

Locations where References may be found:

_____

_____

_____

_____

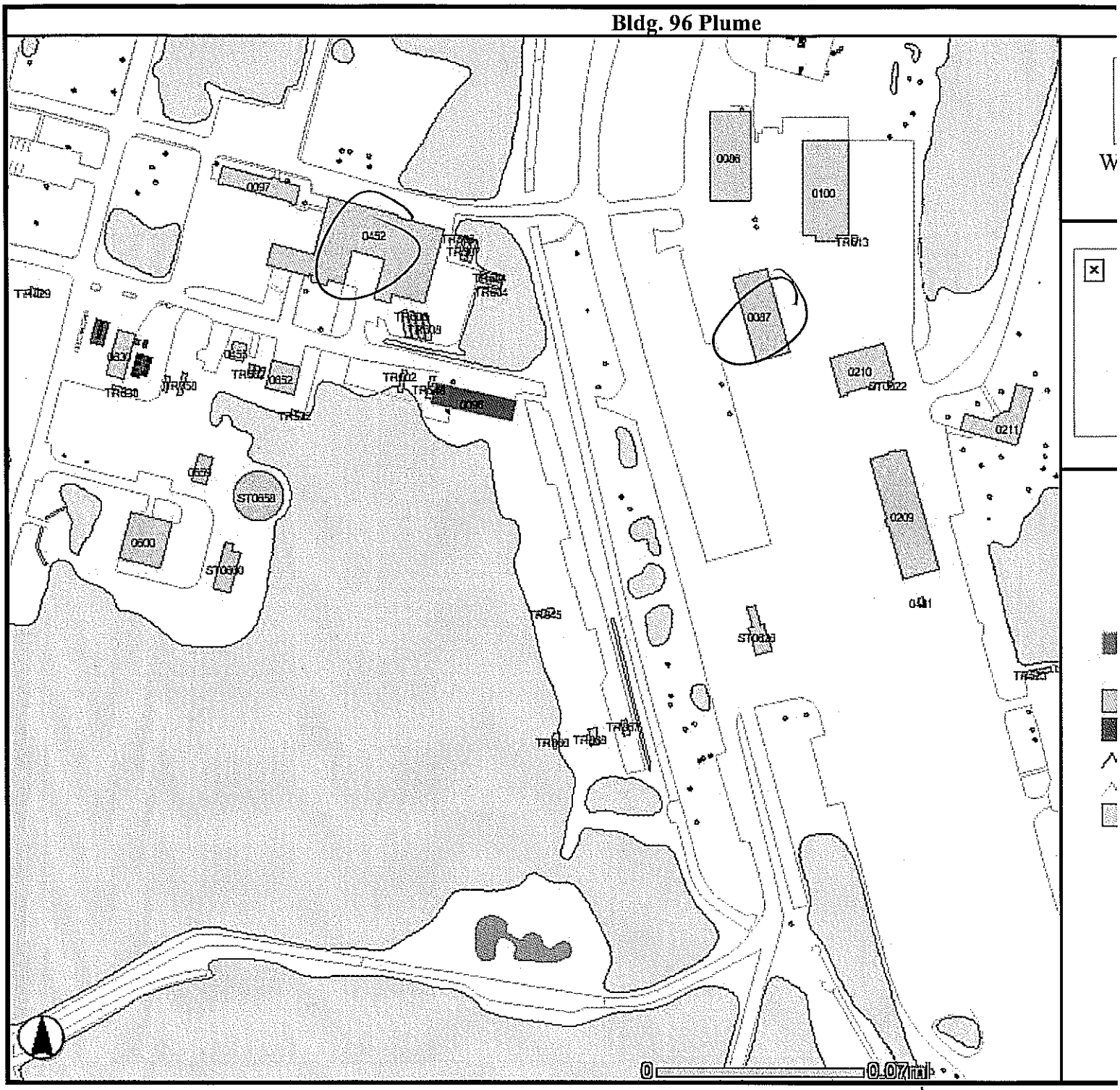
_____

Contact telephone and e-mail numbers:

(name) _____ R Hare 3/16/06

(phone #) _____

(e-mail) _____


Bldg. 96 Plume
0452
0097
0100
0206
0210
0211
0209
0600
0441
0 0.07 mi
370'

Western South Boundary Plume

IV. TIER 1 - Primary Screening

Primary Screening is designed to help quickly screen out sites at which the vapor intrusion pathway does not ordinarily need further consideration, and point out the sites that do typically need further consideration. This evaluation involves determining whether any potential exists at a specific site for vapor intrusion to result in unacceptable indoor inhalation risks and, if so, whether immediate action may be warranted. Recommended criteria for making these determinations are presented in Questions 1 through 3, which focus on identifying:

a) if chemicals of sufficient volatility and toxicity are present or reasonably suspected to be present (Question 1);
b) if inhabited buildings are located (or will be constructed under future development scenarios – except for Environmental Indicator determinations, see section IV.C below) above or in close proximity to subsurface contamination (Question 2); and
c) if current conditions warrant immediate action (Question 3).

This primary screening process is illustrated in a flow diagram included in Appendix C.

A. Primary Screening – Question #1

Q1: Are chemicals of sufficient volatility and toxicity known or reasonably suspected to be present in the subsurface (e.g., in unsaturated soils, soil gas, or the uppermost portions of the ground water and/or capillary fringe – see Table 1)? (We recommend this consideration involve DQOs (see Appendix A) used in acquiring the site data as well as an appropriately scaled Conceptual Site Model (CSM) for vapor intrusion (see Appendix B).)

_____ If **YES** - check here, check off the relevant chemicals on Table 1, and continue with Question 2. The chemicals identified here (and any degradation products) are evaluated as constituents of potential concern in subsequent questions.

__✓__ If **NO** - check here, provide the rationale and references below, and then go to the Summary Page to document that the subsurface vapor to indoor air pathway is incomplete (i.e., no further consideration of this pathway is needed); or

_____ If sufficient data are not available, go to the Summary Page and document the need for more information. After collecting the necessary data, Question 1 can then be revisited with the newly collected data to re-evaluate the completeness of the vapor intrusion pathway.

1. What is the goal of this question?

This question is designed to help quickly screen out sites at which the vapor intrusion pathway generally does not need further consideration. This evaluation involves determining whether or not any potential exists at a specific site for the vapor intrusion

pathway to result in unacceptable indoor air inhalation risks. Table 1 lists chemicals that may be found at hazardous waste sites and indicates whether, in our judgment, they are sufficiently volatile (Henry's Law Constant > 10^{-5} atm m^3/mol) to result in potentially significant vapor intrusion and sufficiently toxic (either an incremental lifetime cancer risk greater than 10^{-6} or a non-cancer hazard index greater than 1, or in some cases both) to result in potentially unacceptable indoor air inhalation risks. The approach used to develop Table 1 is documented in Appendix D and can be used, where appropriate, to evaluate volatile chemicals not included in the Table. We recommend that if any of the chemicals listed in Table 1 that are sufficiently volatile and toxic are present at a site, those chemicals become constituents of potential concern for the vapor intrusion pathway and are evaluated in subsequent questions in this guidance. If the chemicals listed in Table 1 are not present at a site, and no other volatile chemicals are present, we suggest that the vapor intrusion pathway be considered incomplete and no further consideration of this pathway is needed.

2. *What should you keep in mind?*

In evaluating the available site data, we recommend the DQOs used in collecting the data be reviewed to ensure those objectives are consistent with the DQOs for the vapor intrusion pathway (see Appendix A). We recommend the detection limits associated with the available groundwater data be reviewed to ensure they are not too high to detect volatile contaminants of potential concern. Also, we suggest that the adequacy of the definition of the nature and extent of contamination in groundwater and/or the vadose zone be assessed to ensure that all contaminants of concern and areas of contamination have been identified. Additionally, we recommend groundwater concentrations be measured or reasonably estimated using samples collected from wells screened at, or across the top of the water table. We recommend users read Appendices B (Conceptual Site Model for the Vapor Intrusion Pathway) and E (Relevant Methods and Techniques) to obtain a greater understanding of the important considerations in evaluating data for use in screening assessments of the vapor intrusion pathway.

3. *Rationale and References:*

There is a layer of clean groundwater above the plume.

B. Primary Screening – Question #2

Q2: Are currently (or potentially) inhabited buildings or areas of concern under future development scenarios located *near* (see discussion below) subsurface contaminants found in Table 1?

_____ If **YES** – check here, identify buildings and/or areas of concern below, and document on the Summary Page whether the potential for impacts from the vapor intrusion pathway applies to currently inhabited buildings or areas of concern under reasonably anticipated future development scenarios, or both. (Note that for EI considerations, we recommend only current risks be evaluated.) Then proceed with Question 3.

__✓__ If **NO** – check here, describe the rationale below, and then go to the Summary Page to document that there is no potential for the vapor intrusion pathway to impact either currently inhabited buildings or areas of concern under future development scenarios (i.e., no further evaluation of this pathway is needed). (Note that for EI considerations, only current risks are evaluated.); or

_____ If sufficient data are not available – check here and document the need for more information on the Summary Page. After collecting the necessary data, Question 2 can then be revisited with the newly collected data to re-evaluate the completeness of the vapor intrusion pathway.

1. What is the goal of this question?

The goal of this question is to help determine whether inhabited buildings currently are located (or may be reasonably expected to be located under future development scenarios) above or in close proximity to subsurface contamination that potentially could result in unacceptable indoor air inhalation risks. If inhabited buildings and/or future development are not located "near" the area of concern, we suggest that the vapor intrusion pathway be considered incomplete and no further consideration of the pathway should be needed.

For the purposes of this question, **"inhabited buildings"** are structures with enclosed air space that are designed for human occupancy. Table 1, discussed above in Question 1, lists the **"subsurface contaminants demonstrating sufficient volatility and toxicity"** to potentially pose an inhalation risk. We recommend that an inhabited building generally be considered **"near"** subsurface contaminants if it is located within approximately 100 ft laterally or vertically of known or interpolated soil gas or groundwater contaminants listed in Table 1 (or others not included in table 1 – see Question 1) and the contamination occurs in the unsaturated zone and/or the uppermost saturated zone. If the source of contamination is groundwater, we recommend migration of the contaminant plume be considered when evaluating the potential for future risks. The distance suggested above (100 feet) may not be appropriate for all sites (or contaminants) and,

consequently, we recommend that professional judgment be used when evaluating the potential for vertical and horizontal vapor migration.

2. *How did we develop the suggested distance?*

The recommended distance is designed to allow for the assessment to focus on buildings (or areas with the potential to be developed for human habitation) most likely to have a complete vapor intrusion pathway. Vapor concentrations generally decrease with increasing distance from a subsurface vapor source, and eventually at some distance the concentrations become negligible. The distance at which concentrations are negligible is a function of the mobility, toxicity and persistence of the chemical, as well as the geometry of the source, subsurface materials, and characteristics of the buildings of concern. Available information suggests that 100 feet laterally and vertically is a reasonable criterion when considering vapor migration fundamentals, typical sampling density, and uncertainty in defining the actual contaminant spatial distribution. The recommended lateral distance is supported by empirical data from Colorado sites where the vapor intrusion pathway has been evaluated. At these sites, no significant indoor air concentrations have been found in residences at a distance greater than one house lot (approximately 100 feet) from the interpolated edge of ground water plumes. Considering the nature of diffusive vapor transport and the typical anisotropy in soil permeability, in our judgment a similar criterion of 100 feet for vertical transport is generally conservative. These recommended distances will be re-evaluated and, if necessary, adjusted by EPA as additional empirical data are compiled.

3. *What should you keep in mind when evaluating this criterion?*

It is important to consider whether **significant preferential pathways** could allow vapors to migrate more than 100 feet laterally. For the purposes of this guidance, a "significant" preferential pathway is a naturally occurring or anthropogenic subsurface pathway that is expected to have a high gas permeability and be of sufficient volume and proximity to a building so that it may be reasonably anticipated to influence vapor intrusion into the building. Examples include fractures, macropores, utility conduits, and subsurface drains that intersect vapor sources or vapor migration pathways. Note that naturally occurring fractures and macropores may serve as preferential pathways for either vertical or horizontal vapor migration, whereas anthropogenic features such as utility conduits are relatively shallow features and would likely serve only as a preferential pathway for horizontal migration. In either case, we recommend that buildings with significant preferential pathways be evaluated even if they are further than 100 ft from the contamination.

We also recommend that the potential for mobile "vapor clouds" (gas plumes) emanating from near-surface sources of contamination into the subsurface be considered when evaluating site data. Examples of such mobile "vapor clouds" include: 1) those originating in landfills where methane may serve as a carrier gas; and 2) those originating in commercial/industrial settings (such as dry cleaning facilities) where vapor can be released within an enclosed space and the density of the chemicals' vapor may result in

significant advective transport of the vapors downward through cracks/openings in floors and into the vadose zone. In these cases, diffusive transport of vapors is usually overridden by advective transport, and the vapors may be transported in the vadose zone several hundred feet from the source of contamination.

Finally, this guidance is intended to be applied to existing groundwater plumes as they are currently defined (e.g., MCLs, State Standards, or Risk-Based Concentrations). However, it is very important to recognize that some non-potable aquifers may have plumes that have been defined by threshold concentrations significantly higher than drinking-water concentrations. In these cases, contamination that is not technically considered part of the plume may still pose significant risks via the vapor intrusion pathway and, consequently, the plume definition may need to be expanded. Similarly, we recommend evaluating the technologies used to obtain soil gas and indoor air concentrations to determine if appropriate methods were used to ensure adequate data quality at the time analyses were conducted.

4. ***Identify Inhabited Buildings (or Areas With Potential for Future Residential Development) Within Distances of Possible Concern:***

None. The closest building is in the industrial park south of the LIE.

C. Primary Screening Stage— Question #3

Q3: Does evidence suggest immediate action may be warranted to mitigate current risks?

_____ If **YES** – check here and proceed with appropriate actions to verify or eliminate imminent risks. Some examples of actions may include but are not limited to indoor air quality monitoring, engineered containment or ventilation systems, or relocation of people. The action(s) should be appropriate for the site-specific situation.

__✓__ If **NO** – check here and continue with Question 4.

1. What is the goal of this question?

This question is intended to help determine whether immediate action may be warranted for those buildings identified in Question 2 as located within the areas of concern. For the purposes of this guidance, "immediate action" means such action is necessary to verify or abate imminent and substantial threats to human health.

2. What are the qualitative criteria generally considered sufficient to indicate a need for immediate actions?

Odors reported by occupants, particularly if described as "chemical," or "solvent," or "gasoline." The presence of odors does not necessarily correspond to adverse health and/or safety impacts and the odors could be the result of indoor vapor sources; however, we believe it is generally prudent to investigate any reports of odors as the odor threshold for some chemicals exceeds their respective acceptable target breathing zone concentrations.

Physiological effects reported by occupants (dizziness, nausea, vomiting, confusion, etc.) may, or may not be due to subsurface vapor intrusion or even other indoor vapor sources, but, should generally be evaluated.

Wet basements, in areas **where chemicals of sufficient volatility and toxicity** (see Table 1) **are known to be present in groundwater and the water table is shallow enough that the basements are prone to groundwater intrusion or flooding.** This has been proven to be especially important where there is evidence of light, non-aqueous phase liquids (LNAPLs) floating on the water table directly below the building, and/or any direct evidence of contamination (liquid chemical or dissolved in water) inside the building.

Short-term safety concerns are known, or are reasonably suspected to exist, including: a) measured or likely explosive or acutely toxic concentrations of vapors in the building or connected utility conduits, sumps, or other subsurface drains directly connected to the

building and b) measured or likely vapor concentrations that may be flammable/combustible, corrosive, or chemically reactive.

3. ***Rationale and Reference(s):***

None

VII. VAPOR INTRUSION PATHWAY SUMMARY PAGE

Facility Name: Western South Boundary

Facility Address: BNL

Primary Screening Summary

☐ *Q1: Constituents of concern Identified?*

_____ *Yes*

__✓__ *No* (If NO, skip to the conclusion section below and check NO to indicate the pathway is *incomplete.)*

☐ *Q2: Currently inhabited buildings near subsurface contamination?*

_____ *Yes*

__✓__ *No*

Areas of future concern near subsurface contamination?

_____ *Yes*

__✓__ *No* (If NO, skip to the conclusion section below and check NO to indicate the pathway is *incomplete.)*

☐ *Q3: Immediate Actions Warranted?*

_____ *Yes*

__✓__ *No*

Secondary Screening Summary

☐ *Vapor source identified:*

_____ *Groundwater*

_____ *Soil*

_____ *Insufficient data*

☐ *Indoor air data available?*

_____ *Yes*

_____ *No*

☐ *Indoor air concentrations exceed target levels?*

_____ *Yes*

_____ *No*

☐ *Subsurface data evaluation: (Circle appropriate answers below)*

Medium	Q4 Levels Exceeded?	Q5 Levels Exceeded?	Data Indicates Pathway is Complete?
Groundwater	YES / NO / NA / INS	YES / NO / NA / INS	YES / NO / INS
Soil Gas	YES / NO / NA / INS	YES / NO / NA / INS	YES / NO / INS

NA = not applicable
INS = insufficient data available to make a determination

Site-Specific Summary

☐ *Have the nature and extent of subsurface contamination, potential preferential pathways and overlying building characteristics been adequately characterized to identify the most-likely-to-be-impacted buildings?*

_____ *Yes*

_____ *No*

_____ *N/A*

EPA recommends that if a model was used, it be an appropriate and applicable model that represents the conceptual site model. If other means were used, document how you determined the potentially most impacted areas to sample. EPA recommends that predictive modeling can be used to support Current Human Exposures Under Control EI determinations without confirmatory sampling to support this determination. Current Human Exposures Under Control EI determinations are intended to reflect a reasonable conclusion by EPA or the State that current human exposures are under control with regard to the vapor intrusion pathway and current land use conditions. Therefore, if conducting evaluation for an EI determination, document that the **Pathway is Incomplete** and/or does not pose an unacceptable risk to human health for EI determinations.

☐ *Are you making an EI determination based on modeling and does the model prediction indicate that determination is expected to be adequately protective to support Current Human Exposures Under Control EI determinations?*

_____ *Yes*

_____ *No*

_____ *N/A*

☐ *Do subslab vapor concentrations exceed target levels?*

_____ *Yes*

_____ *No*

_____ *N/A*

☐ *Do indoor air concentrations exceed target levels?*

_____ *Yes*

_____ *No*

Conclusion

Is there a Complete Pathway for subsurface vapor intrusion to indoor air?

Below, check the appropriate conclusion for the Subsurface Vapor to Indoor Air Pathway evaluation and attach supporting documentation as well as a map of the facility.

__✓__ NO - the "Subsurface Vapor Intrusion to Indoor Air Pathway" has been verified to be incomplete for the Western South Boundary facility, EPA ID #_____, located at BNL.
This determination is based on a review of site information, as suggested in this guidance, check as appropriate:

__✓__ for current and reasonably expected conditions, or

_____ based on performance monitoring evaluations for engineered exposure controls. This determination may be re-evaluated, where appropriate, when the Agency/State becomes aware of any significant changes at the facility.

_____ YES –The "Subsurface Vapor to Indoor Air Pathway" is Complete. Engineered controls, avoidance actions, or removal actions taken include: _____

_____

_____

_____ UNKNOWN - More information is needed to make a determination.

Locations where References may be found:

_____

_____

_____

_____

_____

Contact telephone and e-mail numbers:

(name) _____ R Have 3/17/06

(phone #) _____

(e-mail) _____

Middle Road and OU III South Boundary Plumes

IV. TIER 1 - Primary Screening

Primary Screening is designed to help quickly screen out sites at which the vapor intrusion pathway does not ordinarily need further consideration, and point out the sites that do typically need further consideration. This evaluation involves determining whether any potential exists at a specific site for vapor intrusion to result in unacceptable indoor inhalation risks and, if so, whether immediate action may be warranted. Recommended criteria for making these determinations are presented in Questions 1 through 3, which focus on identifying:

a) if chemicals of sufficient volatility and toxicity are present or reasonably suspected to be present (Question 1);
b) if inhabited buildings are located (or will be constructed under future development scenarios – except for Environmental Indicator determinations, see section IV.C below) above or in close proximity to subsurface contamination (Question 2); and
c) if current conditions warrant immediate action (Question 3).

This primary screening process is illustrated in a flow diagram included in Appendix C.

A. Primary Screening – Question #1

Q1: Are chemicals of sufficient volatility and toxicity known or reasonably suspected to be present in the subsurface (e.g., in unsaturated soils, soil gas, or the uppermost portions of the ground water and/or capillary fringe – see Table 1)? (We recommend this consideration involve DQOs (see Appendix A) used in acquiring the site data as well as an appropriately scaled Conceptual Site Model (CSM) for vapor intrusion (see Appendix B).)

_____ If **YES** - check here, check off the relevant chemicals on Table 1, and continue with Question 2. The chemicals identified here (and any degradation products) are evaluated as constituents of potential concern in subsequent questions.

_✓_ If **NO** - check here, provide the rationale and references below, and then go to the Summary Page to document that the subsurface vapor to indoor air pathway is incomplete (i.e., no further consideration of this pathway is needed); or

_____ If sufficient data are not available, go to the Summary Page and document the need for more information. After collecting the necessary data, Question 1 can then be revisited with the newly collected data to re-evaluate the completeness of the vapor intrusion pathway.

1. What is the goal of this question?

This question is designed to help quickly screen out sites at which the vapor intrusion pathway generally does not need further consideration. This evaluation involves determining whether or not any potential exists at a specific site for the vapor intrusion

pathway to result in unacceptable indoor air inhalation risks. Table 1 lists chemicals that may be found at hazardous waste sites and indicates whether, in our judgment, they are sufficiently volatile (Henry's Law Constant > 10^{-5} atm m^3/mol) to result in potentially significant vapor intrusion and sufficiently toxic (either an incremental lifetime cancer risk greater than 10^{-6} or a non-cancer hazard index greater than 1, or in some cases both) to result in potentially unacceptable indoor air inhalation risks. The approach used to develop Table 1 is documented in Appendix D and can be used, where appropriate, to evaluate volatile chemicals not included in the Table. We recommend that if any of the chemicals listed in Table 1 that are sufficiently volatile and toxic are present at a site, those chemicals become constituents of potential concern for the vapor intrusion pathway and are evaluated in subsequent questions in this guidance. If the chemicals listed in Table 1 are not present at a site, and no other volatile chemicals are present, we suggest that the vapor intrusion pathway be considered incomplete and no further consideration of this pathway is needed.

2. *What should you keep in mind?*

In evaluating the available site data, we recommend the DQOs used in collecting the data be reviewed to ensure those objectives are consistent with the DQOs for the vapor intrusion pathway (see Appendix A). We recommend the detection limits associated with the available groundwater data be reviewed to ensure they are not too high to detect volatile contaminants of potential concern. Also, we suggest that the adequacy of the definition of the nature and extent of contamination in groundwater and/or the vadose zone be assessed to ensure that all contaminants of concern and areas of contamination have been identified. Additionally, we recommend groundwater concentrations be measured or reasonably estimated using samples collected from wells screened at, or across the top of the water table. We recommend users read Appendices B (Conceptual Site Model for the Vapor Intrusion Pathway) and E (Relevant Methods and Techniques) to obtain a greater understanding of the important considerations in evaluating data for use in screening assessments of the vapor intrusion pathway.

3. *Rationale and References:*

There is no contamination at the water table.

B. **Primary Screening – Question #2**

Q2: **Are currently (or potentially) inhabited buildings or areas of concern under future development scenarios located *near* (see discussion below) subsurface contaminants found in Table 1?**

_____ If **YES** – check here, identify buildings and/or areas of concern below, and document on the Summary Page whether the potential for impacts from the vapor intrusion pathway applies to currently inhabited buildings or areas of concern under reasonably anticipated future development scenarios, or both. (Note that for EI considerations, we recommend only current risks be evaluated.) Then proceed with Question 3.

__✓__ If **NO** – check here, describe the rationale below, and then go to the Summary Page to document that there is no potential for the vapor intrusion pathway to impact either currently inhabited buildings or areas of concern under future development scenarios (i.e., no further evaluation of this pathway is needed). (Note that for EI considerations, only current risks are evaluated.); or

_____ If sufficient data are not available – check here and document the need for more information on the Summary Page. After collecting the necessary data, Question 2 can then be revisited with the newly collected data to re-evaluate the completeness of the vapor intrusion pathway.

1. What is the goal of this question?

The goal of this question is to help determine whether inhabited buildings currently are located (or may be reasonably expected to be located under future development scenarios) above or in close proximity to subsurface contamination that potentially could result in unacceptable indoor air inhalation risks. If inhabited buildings and/or future development are not located "near" the area of concern, we suggest that the vapor intrusion pathway be considered incomplete and no further consideration of the pathway should be needed.

For the purposes of this question, **"inhabited buildings"** are structures with enclosed air space that are designed for human occupancy. Table 1, discussed above in Question 1, lists the **"subsurface contaminants demonstrating sufficient volatility and toxicity"** to potentially pose an inhalation risk. We recommend that an inhabited building generally be considered **"near"** subsurface contaminants if it is located within approximately 100 ft laterally or vertically of known or interpolated soil gas or groundwater contaminants listed in Table 1 (or others not included in table 1 – see Question 1) and the contamination occurs in the unsaturated zone and/or the uppermost saturated zone. If the source of contamination is groundwater, we recommend migration of the contaminant plume be considered when evaluating the potential for future risks. The distance suggested above (100 feet) may not be appropriate for all sites (or contaminants) and,

consequently, we recommend that professional judgment be used when evaluating the potential for vertical and horizontal vapor migration.

2. How did we develop the suggested distance?

The recommended distance is designed to allow for the assessment to focus on buildings (or areas with the potential to be developed for human habitation) most likely to have a complete vapor intrusion pathway. Vapor concentrations generally decrease with increasing distance from a subsurface vapor source, and eventually at some distance the concentrations become negligible. The distance at which concentrations are negligible is a function of the mobility, toxicity and persistence of the chemical, as well as the geometry of the source, subsurface materials, and characteristics of the buildings of concern. Available information suggests that 100 feet laterally and vertically is a reasonable criterion when considering vapor migration fundamentals, typical sampling density, and uncertainty in defining the actual contaminant spatial distribution. The recommended lateral distance is supported by empirical data from Colorado sites where the vapor intrusion pathway has been evaluated. At these sites, no significant indoor air concentrations have been found in residences at a distance greater than one house lot (approximately 100 feet) from the interpolated edge of ground water plumes. Considering the nature of diffusive vapor transport and the typical anisotropy in soil permeability, in our judgment a similar criterion of 100 feet for vertical transport is generally conservative. These recommended distances will be re-evaluated and, if necessary, adjusted by EPA as additional empirical data are compiled.

3. What should you keep in mind when evaluating this criterion?

It is important to consider whether **significant preferential pathways** could allow vapors to migrate more than 100 feet laterally. For the purposes of this guidance, a "significant" preferential pathway is a naturally occurring or anthropogenic subsurface pathway that is expected to have a high gas permeability and be of sufficient volume and proximity to a building so that it may be reasonably anticipated to influence vapor intrusion into the building. Examples include fractures, macropores, utility conduits, and subsurface drains that intersect vapor sources or vapor migration pathways. Note that naturally occurring fractures and macropores may serve as preferential pathways for either vertical or horizontal vapor migration, whereas anthropogenic features such as utility conduits are relatively shallow features and would likely serve only as a preferential pathway for horizontal migration. In either case, we recommend that buildings with significant preferential pathways be evaluated even if they are further than 100 ft from the contamination.

We also recommend that the potential for mobile "vapor clouds" (gas plumes) emanating from near-surface sources of contamination into the subsurface be considered when evaluating site data. Examples of such mobile "vapor clouds" include: 1) those originating in landfills where methane may serve as a carrier gas; and 2) those originating in commercial/industrial settings (such as dry cleaning facilities) where vapor can be released within an enclosed space and the density of the chemicals' vapor may result in

significant advective transport of the vapors downward through cracks/openings in floors and into the vadose zone. In these cases, diffusive transport of vapors is usually overridden by advective transport, and the vapors may be transported in the vadose zone several hundred feet from the source of contamination.

Finally, this guidance is intended to be applied to existing groundwater plumes as they are currently defined (e.g., MCLs, State Standards, or Risk-Based Concentrations). However, it is very important to recognize that some non-potable aquifers may have plumes that have been defined by threshold concentrations significantly higher than drinking-water concentrations. In these cases, contamination that is not technically considered part of the plume may still pose significant risks via the vapor intrusion pathway and, consequently, the plume definition may need to be expanded. Similarly, we recommend evaluating the technologies used to obtain soil gas and indoor air concentrations to determine if appropriate methods were used to ensure adequate data quality at the time analyses were conducted.

4. ***Identify Inhabited Buildings (or Areas With Potential for Future Residential Development) Within Distances of Possible Concern:***

No inhabited buildings.

C. Primary Screening Stage— Question #3

Q3: Does evidence suggest immediate action may be warranted to mitigate current risks?

_____ If **YES** – check here and proceed with appropriate actions to verify or eliminate imminent risks. Some examples of actions may include but are not limited to indoor air quality monitoring, engineered containment or ventilation systems, or relocation of people. The action(s) should be appropriate for the site-specific situation.

__✓__ If **NO** – check here and continue with Question 4.

1. What is the goal of this question?

This question is intended to help determine whether immediate action may be warranted for those buildings identified in Question 2 as located within the areas of concern. For the purposes of this guidance, "immediate action" means such action is necessary to verify or abate imminent and substantial threats to human health.

2. What are the qualitative criteria generally considered sufficient to indicate a need for immediate actions?

Odors reported by occupants, particularly if described as "chemical," or "solvent," or "gasoline." The presence of odors does not necessarily correspond to adverse health and/or safety impacts and the odors could be the result of indoor vapor sources; however, we believe it is generally prudent to investigate any reports of odors as the odor threshold for some chemicals exceeds their respective acceptable target breathing zone concentrations.

Physiological effects reported by occupants (dizziness, nausea, vomiting, confusion, etc.) may, or may not be due to subsurface vapor intrusion or even other indoor vapor sources, but, should generally be evaluated.

Wet basements, in areas **where chemicals of sufficient volatility and toxicity** (see Table 1) **are known to be present in groundwater and the water table is shallow enough that the basements are prone to groundwater intrusion or flooding.** This has been proven to be especially important where there is evidence of light, non-aqueous phase liquids (LNAPLs) floating on the water table directly below the building, and/or any direct evidence of contamination (liquid chemical or dissolved in water) inside the building.

Short-term safety concerns are known, or are reasonably suspected to exist, including: a) measured or likely explosive or acutely toxic concentrations of vapors in the building or connected utility conduits, sumps, or other subsurface drains directly connected to the

building and b) measured or likely vapor concentrations that may be flammable/combustible, corrosive, or chemically reactive.

3. ***Rationale and Reference(s):***

None.

VII. VAPOR INTRUSION PATHWAY SUMMARY PAGE

Facility Name: Middle Road and OU III South Boundary

Facility Address: BNL

Primary Screening Summary

☐ *Q1: Constituents of concern Identified?*

_____ *Yes*

__✓__ *No* (If NO, skip to the conclusion section below and check NO to indicate the pathway is *incomplete.)*

☐ *Q2: Currently inhabited buildings near subsurface contamination?*

_____ *Yes*

__✓__ *No*

Areas of future concern near subsurface contamination?

_____ *Yes*

__✓__ *No* (If NO, skip to the conclusion section below and check NO to indicate the pathway is *incomplete.)*

☐ *Q3: Immediate Actions Warranted?*

_____ *Yes*

__✓__ *No*

Secondary Screening Summary

☐ *Vapor source identified:*

_____ *Groundwater*

_____ *Soil*

_____ *Insufficient data*

☐ *Indoor air data available?*

_____ *Yes*

_____ *No*

☐ *Indoor air concentrations exceed target levels?*

_____ *Yes*

_____ *No*

☐ *Subsurface data evaluation: (Circle appropriate answers below)*

Medium	Q4 Levels Exceeded?	Q5 Levels Exceeded?	Data Indicates Pathway is Complete?
Groundwater	YES / NO / NA / INS	YES / NO / NA / INS	YES / NO / INS
Soil Gas	YES / NO / NA / INS	YES / NO / NA / INS	YES / NO / INS

NA = not applicable
INS = insufficient data available to make a determination

Site-Specific Summary

☐ *Have the nature and extent of subsurface contamination, potential preferential pathways and overlying building characteristics been adequately characterized to identify the most-likely-to-be-impacted buildings?*

_____ *Yes*

_____ *No*

_____ *N/A*

EPA recommends that if a model was used, it be an appropriate and applicable model that represents the conceptual site model. If other means were used, document how you determined the potentially most impacted areas to sample. EPA recommends that predictive modeling can be used to support Current Human Exposures Under Control EI determinations without confirmatory sampling to support this determination. Current Human Exposures Under Control EI determinations are intended to reflect a reasonable conclusion by EPA or the State that current human exposures are under control with regard to the vapor intrusion pathway and current land use conditions. Therefore, if conducting evaluation for an EI determination, document that the **Pathway is Incomplete** and/or does not pose an unacceptable risk to human health for EI determinations.

☐ *Are you making an EI determination based on modeling and does the model prediction indicate that determination is expected to be adequately protective to support Current Human Exposures Under Control EI determinations?*

_____ *Yes*

_____ *No*

_____ *N/A*

☐ *Do subslab vapor concentrations exceed target levels?*

_____ *Yes*

_____ *No*

_____ *N/A*

☐ *Do indoor air concentrations exceed target levels?*

_____ *Yes*

_____ *No*

Conclusion

Is there a Complete Pathway for subsurface vapor intrusion to indoor air?

Below, check the appropriate conclusion for the Subsurface Vapor to Indoor Air Pathway evaluation and attach supporting documentation as well as a map of the facility.

__✓__ NO - the "Subsurface Vapor Intrusion to Indoor Air Pathway" has been verified to be incomplete for the Middle Road and OU III South Boundary facility, EPA ID #_____, located at BNL.
This determination is based on a review of site information, as suggested in this guidance, check as appropriate:

__✓__ for current and reasonably expected conditions, or

_____ based on performance monitoring evaluations for engineered exposure controls. This determination may be re-evaluated, where appropriate, when the Agency/State becomes aware of any significant changes at the facility.

_____ YES –The "Subsurface Vapor to Indoor Air Pathway" is Complete. Engineered controls, avoidance actions, or removal actions taken include: _____

_____

_____

_____ UNKNOWN - More information is needed to make a determination.

Locations where References may be found:

_____

_____

_____

_____

_____

Contact telephone and e-mail numbers:

(name) _____ R Hare 3/08/06

(phone #) _____

(e-mail) _____

Off-site Plumes

IV. TIER 1 - Primary Screening

Primary Screening is designed to help quickly screen out sites at which the vapor intrusion pathway does not ordinarily need further consideration, and point out the sites that do typically need further consideration. This evaluation involves determining whether any potential exists at a specific site for vapor intrusion to result in unacceptable indoor inhalation risks and, if so, whether immediate action may be warranted. Recommended criteria for making these determinations are presented in Questions 1 through 3, which focus on identifying:

a) if chemicals of sufficient volatility and toxicity are present or reasonably suspected to be present (Question 1);
b) if inhabited buildings are located (or will be constructed under future development scenarios – except for Environmental Indicator determinations, see section IV.C below) above or in close proximity to subsurface contamination (Question 2); and
c) if current conditions warrant immediate action (Question 3).

This primary screening process is illustrated in a flow diagram included in Appendix C.

A. Primary Screening – Question #1

Q1: Are chemicals of sufficient volatility and toxicity known or reasonably suspected to be present in the subsurface (e.g., in unsaturated soils, soil gas, or the uppermost portions of the ground water and/or capillary fringe – see Table 1)? (We recommend this consideration involve DQOs (see Appendix A) used in acquiring the site data as well as an appropriately scaled Conceptual Site Model (CSM) for vapor intrusion (see Appendix B).)

_____ If **YES** - check here, check off the relevant chemicals on Table 1, and continue with Question 2. The chemicals identified here (and any degradation products) are evaluated as constituents of potential concern in subsequent questions.

_✓_ If **NO** - check here, provide the rationale and references below, and then go to the Summary Page to document that the subsurface vapor to indoor air pathway is incomplete (i.e., no further consideration of this pathway is needed); or

_____ If sufficient data are not available, go to the Summary Page and document the need for more information. After collecting the necessary data, Question 1 can then be revisited with the newly collected data to re-evaluate the completeness of the vapor intrusion pathway.

1. What is the goal of this question?

This question is designed to help quickly screen out sites at which the vapor intrusion pathway generally does not need further consideration. This evaluation involves determining whether or not any potential exists at a specific site for the vapor intrusion

pathway to result in unacceptable indoor air inhalation risks. Table 1 lists chemicals that may be found at hazardous waste sites and indicates whether, in our judgment, they are sufficiently volatile (Henry's Law Constant > 10^{-5} atm m^3/mol) to result in potentially significant vapor intrusion and sufficiently toxic (either an incremental lifetime cancer risk greater than 10^{-6} or a non-cancer hazard index greater than 1, or in some cases both) to result in potentially unacceptable indoor air inhalation risks. The approach used to develop Table 1 is documented in Appendix D and can be used, where appropriate, to evaluate volatile chemicals not included in the Table. We recommend that if any of the chemicals listed in Table 1 that are sufficiently volatile and toxic are present at a site, those chemicals become constituents of potential concern for the vapor intrusion pathway and are evaluated in subsequent questions in this guidance. If the chemicals listed in Table 1 are not present at a site, and no other volatile chemicals are present, we suggest that the vapor intrusion pathway be considered incomplete and no further consideration of this pathway is needed.

2. *What should you keep in mind?*

In evaluating the available site data, we recommend the DQOs used in collecting the data be reviewed to ensure those objectives are consistent with the DQOs for the vapor intrusion pathway (see Appendix A). We recommend the detection limits associated with the available groundwater data be reviewed to ensure they are not too high to detect volatile contaminants of potential concern. Also, we suggest that the adequacy of the definition of the nature and extent of contamination in groundwater and/or the vadose zone be assessed to ensure that all contaminants of concern and areas of contamination have been identified. Additionally, we recommend groundwater concentrations be measured or reasonably estimated using samples collected from wells screened at, or across the top of the water table. We recommend users read Appendices B (Conceptual Site Model for the Vapor Intrusion Pathway) and E (Relevant Methods and Techniques) to obtain a greater understanding of the important considerations in evaluating data for use in screening assessments of the vapor intrusion pathway.

3. *Rationale and References:*

VOCs are present in groundwater but not at the top of the water table. There is clean groundwater above the plumes.

B. **Primary Screening – Question #2**

Q2: **Are currently (or potentially) inhabited buildings or areas of concern under future development scenarios located *near* (see discussion below) subsurface contaminants found in Table 1?**

_____ If **YES** – check here, identify buildings and/or areas of concern below, and document on the Summary Page whether the potential for impacts from the vapor intrusion pathway applies to currently inhabited buildings or areas of concern under reasonably anticipated future development scenarios, or both. (Note that for EI considerations, we recommend only current risks be evaluated.) Then proceed with Question 3.

__✓__ If **NO** – check here, describe the rationale below, and then go to the Summary Page to document that there is no potential for the vapor intrusion pathway to impact either currently inhabited buildings or areas of concern under future development scenarios (i.e., no further evaluation of this pathway is needed). (Note that for EI considerations, only current risks are evaluated.); or

_____ If sufficient data are not available – check here and document the need for more information on the Summary Page. After collecting the necessary data, Question 2 can then be revisited with the newly collected data to re-evaluate the completeness of the vapor intrusion pathway.

1. What is the goal of this question?

The goal of this question is to help determine whether inhabited buildings currently are located (or may be reasonably expected to be located under future development scenarios) above or in close proximity to subsurface contamination that potentially could result in unacceptable indoor air inhalation risks. If inhabited buildings and/or future development are not located "near" the area of concern, we suggest that the vapor intrusion pathway be considered incomplete and no further consideration of the pathway should be needed.

For the purposes of this question, **"inhabited buildings"** are structures with enclosed air space that are designed for human occupancy. Table 1, discussed above in Question 1, lists the **"subsurface contaminants demonstrating sufficient volatility and toxicity"** to potentially pose an inhalation risk. We recommend that an inhabited building generally be considered **"near"** subsurface contaminants if it is located within approximately 100 ft laterally or vertically of known or interpolated soil gas or groundwater contaminants listed in Table 1 (or others not included in table 1 – see Question 1) and the contamination occurs in the unsaturated zone and/or the uppermost saturated zone. If the source of contamination is groundwater, we recommend migration of the contaminant plume be considered when evaluating the potential for future risks. The distance suggested above (100 feet) may not be appropriate for all sites (or contaminants) and,

consequently, we recommend that professional judgment be used when evaluating the potential for vertical and horizontal vapor migration.

2. How did we develop the suggested distance?

The recommended distance is designed to allow for the assessment to focus on buildings (or areas with the potential to be developed for human habitation) most likely to have a complete vapor intrusion pathway. Vapor concentrations generally decrease with increasing distance from a subsurface vapor source, and eventually at some distance the concentrations become negligible. The distance at which concentrations are negligible is a function of the mobility, toxicity and persistence of the chemical, as well as the geometry of the source, subsurface materials, and characteristics of the buildings of concern. Available information suggests that 100 feet laterally and vertically is a reasonable criterion when considering vapor migration fundamentals, typical sampling density, and uncertainty in defining the actual contaminant spatial distribution. The recommended lateral distance is supported by empirical data from Colorado sites where the vapor intrusion pathway has been evaluated. At these sites, no significant indoor air concentrations have been found in residences at a distance greater than one house lot (approximately 100 feet) from the interpolated edge of ground water plumes. Considering the nature of diffusive vapor transport and the typical anisotropy in soil permeability, in our judgment a similar criterion of 100 feet for vertical transport is generally conservative. These recommended distances will be re-evaluated and, if necessary, adjusted by EPA as additional empirical data are compiled.

3. What should you keep in mind when evaluating this criterion?

It is important to consider whether **significant preferential pathways** could allow vapors to migrate more than 100 feet laterally. For the purposes of this guidance, a "significant" preferential pathway is a naturally occurring or anthropogenic subsurface pathway that is expected to have a high gas permeability and be of sufficient volume and proximity to a building so that it may be reasonably anticipated to influence vapor intrusion into the building. Examples include fractures, macropores, utility conduits, and subsurface drains that intersect vapor sources or vapor migration pathways. Note that naturally occurring fractures and macropores may serve as preferential pathways for either vertical or horizontal vapor migration, whereas anthropogenic features such as utility conduits are relatively shallow features and would likely serve only as a preferential pathway for horizontal migration. In either case, we recommend that buildings with significant preferential pathways be evaluated even if they are further than 100 ft from the contamination.

We also recommend that the potential for mobile "vapor clouds" (gas plumes) emanating from near-surface sources of contamination into the subsurface be considered when evaluating site data. Examples of such mobile "vapor clouds" include: 1) those originating in landfills where methane may serve as a carrier gas; and 2) those originating in commercial/industrial settings (such as dry cleaning facilities) where vapor can be released within an enclosed space and the density of the chemicals' vapor may result in

significant advective transport of the vapors downward through cracks/openings in floors and into the vadose zone. In these cases, diffusive transport of vapors is usually overridden by advective transport, and the vapors may be transported in the vadose zone several hundred feet from the source of contamination.

Finally, this guidance is intended to be applied to existing groundwater plumes as they are currently defined (e.g., MCLs, State Standards, or Risk-Based Concentrations). However, it is very important to recognize that some non-potable aquifers may have plumes that have been defined by threshold concentrations significantly higher than drinking-water concentrations. In these cases, contamination that is not technically considered part of the plume may still pose significant risks via the vapor intrusion pathway and, consequently, the plume definition may need to be expanded. Similarly, we recommend evaluating the technologies used to obtain soil gas and indoor air concentrations to determine if appropriate methods were used to ensure adequate data quality at the time analyses were conducted.

4. ***Identify Inhabited Buildings (or Areas With Potential for Future Residential Development) Within Distances of Possible Concern:***

There are homes above the plumes but ther is clean groundwater in between.

C. Primary Screening Stage— Question #3

Q3: Does evidence suggest immediate action may be warranted to mitigate current risks?

_____ If **YES** – check here and proceed with appropriate actions to verify or eliminate imminent risks. Some examples of actions may include but are not limited to indoor air quality monitoring, engineered containment or ventilation systems, or relocation of people. The action(s) should be appropriate for the site-specific situation.

__✓__ If **NO** – check here and continue with Question 4.

1. What is the goal of this question?

This question is intended to help determine whether immediate action may be warranted for those buildings identified in Question 2 as located within the areas of concern. For the purposes of this guidance, "immediate action" means such action is necessary to verify or abate imminent and substantial threats to human health.

2. What are the qualitative criteria generally considered sufficient to indicate a need for immediate actions?

Odors reported by occupants, particularly if described as "chemical," or "solvent," or "gasoline." The presence of odors does not necessarily correspond to adverse health and/or safety impacts and the odors could be the result of indoor vapor sources; however, we believe it is generally prudent to investigate any reports of odors as the odor threshold for some chemicals exceeds their respective acceptable target breathing zone concentrations.

Physiological effects reported by occupants (dizziness, nausea, vomiting, confusion, etc.) may, or may not be due to subsurface vapor intrusion or even other indoor vapor sources, but, should generally be evaluated.

Wet basements, in areas **where chemicals of sufficient volatility and toxicity** (see Table 1) **are known to be present in groundwater and the water table is shallow enough that the basements are prone to groundwater intrusion or flooding.** This has been proven to be especially important where there is evidence of light, non-aqueous phase liquids (LNAPLs) floating on the water table directly below the building, and/or any direct evidence of contamination (liquid chemical or dissolved in water) inside the building.

Short-term safety concerns are known, or are reasonably suspected to exist, including: a) measured or likely explosive or acutely toxic concentrations of vapors in the building or connected utility conduits, sumps, or other subsurface drains directly connected to the

building and b) measured or likely vapor concentrations that may be flammable/combustible, corrosive, or chemically reactive.

3. ***Rationale and Reference(s):***

None.

VII. VAPOR INTRUSION PATHWAY SUMMARY PAGE

Facility Name: Off-site Plumes

Facility Address: BNL

Primary Screening Summary

☐ *Q1: Constituents of concern Identified?*

_____ *Yes*

__✓__ *No* (If NO, skip to the conclusion section below and check NO to indicate the pathway is *incomplete.)*

☐ *Q2: Currently inhabited buildings near subsurface contamination?*

_____ *Yes*

__✓__ *No*

Areas of future concern near subsurface contamination?

_____ *Yes*

__✓__ *No* (If NO, skip to the conclusion section below and check NO to indicate the pathway is *incomplete.)*

☐ *Q3: Immediate Actions Warranted?*

_____ *Yes*

__✓__ *No*

Secondary Screening Summary

☐ *Vapor source identified:*

_____ *Groundwater*

_____ *Soil*

_____ *Insufficient data*

☐ *Indoor air data available?*

_____ *Yes*

_____ *No*

☐ *Indoor air concentrations exceed target levels?*

_____ *Yes*

_____ *No*

☐ *Subsurface data evaluation: (Circle appropriate answers below)*

Medium	Q4 Levels Exceeded?	Q5 Levels Exceeded?	Data Indicates Pathway is Complete?
Groundwater	YES / NO / NA / INS	YES / NO / NA / INS	YES / NO / INS
Soil Gas	YES / NO / NA / INS	YES / NO / NA / INS	YES / NO / INS

NA = not applicable
INS = insufficient data available to make a determination

Site-Specific Summary

☐ *Have the nature and extent of subsurface contamination, potential preferential pathways and overlying building characteristics been adequately characterized to identify the most-likely-to-be-impacted buildings?*

_____ *Yes*

_____ *No*

_____ *N/A*

EPA recommends that if a model was used, it be an appropriate and applicable model that represents the conceptual site model. If other means were used, document how you determined the potentially most impacted areas to sample. EPA recommends that predictive modeling can be used to support Current Human Exposures Under Control EI determinations without confirmatory sampling to support this determination. Current Human Exposures Under Control EI determinations are intended to reflect a reasonable conclusion by EPA or the State that current human exposures are under control with regard to the vapor intrusion pathway and current land use conditions. Therefore, if conducting evaluation for an EI determination, document that the **Pathway is Incomplete** and/or does not pose an unacceptable risk to human health for EI determinations.

☐ *Are you making an EI determination based on modeling and does the model prediction indicate that determination is expected to be adequately protective to support Current Human Exposures Under Control EI determinations?*

_____ *Yes*

_____ *No*

_____ *N/A*

☐ *Do subslab vapor concentrations exceed target levels?*

_____ *Yes*

_____ *No*

_____ *N/A*

☐ *Do indoor air concentrations exceed target levels?*

_____ *Yes*

_____ *No*

Conclusion

Is there a Complete Pathway for subsurface vapor intrusion to indoor air?

Below, check the appropriate conclusion for the Subsurface Vapor to Indoor Air Pathway evaluation and attach supporting documentation as well as a map of the facility.

__✓__ NO - the "Subsurface Vapor Intrusion to Indoor Air Pathway" has been verified to be incomplete for the off-site plumes facility, EPA ID #_____, located at BNL.
This determination is based on a review of site information, as suggested in this guidance, check as appropriate:

__✓__ for current and reasonably expected conditions, or

_____ based on performance monitoring evaluations for engineered exposure controls. This determination may be re-evaluated, where appropriate, when the Agency/State becomes aware of any significant changes at the facility.

_____ YES –The "Subsurface Vapor to Indoor Air Pathway" is Complete. Engineered controls, avoidance actions, or removal actions taken include: _____

_____

_____

_____ UNKNOWN - More information is needed to make a determination.

Locations where References may be found:

_____

_____

_____

_____

_____

Contact telephone and e-mail numbers:

(name) R Howe 3/13/06

(phone #) _____

(e-mail) _____