CLOSEOUT REPORT
BROOKHAVEN NATIONAL LABORATORY
OPERABLE UNIT I AREA OF CONCERN (AOC) 10
WASTE CONCENTRATION FACILITY

Text, Figures and Appendices

September 2005

Prepared for:

BROOKHAVEN NATIONAL LABORATORY
Upton, New York 11973-5000

Prepared by:

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VOLUME 1 OF 2

Department of Energy
Washington, DC 20585

SEP 2 8 2005

Mr. James Lister, P.E.
New York State Department of
Environmental Conservation
Division of Hazardous Waste Remediation
625 Broadway -11th Floor
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Mr. Douglas Pocze
Federal Facilities Section
Emergency and Remedial Response Division
U.S. EPA - Region II
290 Broadway - 18th Floor
New York, New York 10007-1866

Dear Mr. Lister and Mr. Pocze:

SUBJECT: BROOKHAVEN NATIONAL LABORATORY (BNL) OPERABLE UNIT I AREA OF CONCERN 10 WASTE CONCENTRATION FACILITY (WCF) CLOSEOUT REPORT VOLUMES 1 & 2

Enclosed are two copies of the subject document. This report incorporates all comments received from the regulatory agencies and includes the Oak Ridge Institute for Science and Education independent verification report and is now considered final.

If you have any questions, please contact me at (631) 344-3429 or Terri Kneitel of my staff at (631) 344-2112.

Sincerely,

Rodrigo V. Rimando, Jr.
Brookhaven Project Director
Office of Environmental Management

Enclosures
As Stated:

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EXECUTIVE SUMMARY

The *Record of Decision – Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6, 8, 10, 16, 17, and 18)* (*ROD),* dated August 1999, was developed by Brookhaven National Laboratory (BNL) for the U.S. Department of Energy (DOE). Specifically, the *ROD* addressed contamination found at OU I and AOCs 6, 8, 10, 16, 17 and 18. All the identified areas contained radiologically contaminated soils; the contamination was resultant from past waste handling operations, spills, or inadvertent use of contaminated soils for landscaping. The soils at Building 811 (AOC 10) had become contaminated with radionuclides as a result of leaks from the storage tanks.

Soil cleanup objectives were established for this site and outlined in the ROD. The soil cleanup objectives for radiological contamination were based on a dose from remaining concentrations of all radionuclides present of 15 millirem per year (mrem/year) above background considering 50 years of institutional control for residential land use, per U.S. DOE RESidual RADioactive (RESRAD) computer code. The ROD also specified the removal of the six 8,000 gallon underground storage tanks (UST'S) and associated piping and appurtances.

Remedial Action construction activities commenced on September 14, 2004 with the removal of contaminated overburden material above the UST's. The following summarizes the actions taken at the Waste Concentration Facility to satisfy the requirements of the ROD:

- Approximately 4100 cubic yards of soil, concrete, asphalt, and piping were removed, transported, and disposed of at Envirocare of Utah
- The six 8,000 gallon underground storage tanks were successfully removed, transported, and disposed of at Envirocare of Utah
- The average Cs-137 and Sr-90 concentrations following remediation are 4.56 pCi/g and 5.35 pCi/g, respectively
- 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 meeting both the EPA cleanup criteria of 15 mrem/yr and the New York State Department of Conservation ALARA cleanup goal of 10 mrem/yr.

This Area of Concern (AOC 10) meets all the completion requirements as specified in OSWER Directive 9320.2-09-A-P, *Closeout Procedures for National Priorities List Sites.* The affected areas were remediated in accordance with the decommissioning criteria of 10 CFR Part 834, Radiation Protection for the public and environment.

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D	Modification Forms
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F	ORISE Independent Field Verification Report

Note 1: Appendix C is on file with the Brookhaven National Laboratory Long Term Response Action Group and can be made available upon request

ATTACHMENTS

ATTACHMENT	TITLE
1	Final Status Survey Plan
2	Final Status Survey Report (including Post-Remedial Dose Assessment and RESRAD)
3	Waste Control Forms
4	Post-Remedial Dose Assessment Analytical Results
5	Correlation Curves of Instrument Response to Measured Soil Activity
6	Final Scan/pCi/g Correlation
7	Lessons Learned Forms

SECTION 1.0
INTRODUCTION

1.1 SITE HISTORY

Established in 1947, BNL is a multi-program national laboratory operated by Brookhaven Science Associates for the U.S. DOE. BNL's role for the DOE is to produce excellent science and advanced technology with the cooperation, support, and appropriate involvement of scientific and local communities.

The BNL facility is comprised of approximately 5,320 acres; approximately 900 acres are developed and 500 of these acres were originally developed for use by the United States Army (Army). The site location is depicted in Figure 1-1. The BNL site, formerly Camp Upton, was occupied by the Army during World Wars I and II. Between the wars, the site was operated by the Civilian Conservation Corps. It was transferred to the Atomic Energy Commission in 1947, then to the Energy Research and Development Administration in 1975. The DOE began operation of the property in 1977.

1.2 WASTE CONCENTRATION FACILITY

A portion of the BNL facility known as the Waste Concentration Facility (WCF) has been used since 1947 as a facility for processing and concentrating liquid radioactive wastes received from the Brookhaven Graphite Research Reactor (BGRR), the Hot Laboratory Complex (Building 801), and the High Flux Beam Reactor (HFBR). Liquid wastes were stored in three 100,000 gallon above-ground storage tanks (known as D Tanks) from 1947 to 1987. Past operations and practices, including three documented leaks from the above-ground tanks, created both surface and deep soil contamination that required remediation.

1.3 REGULATORY FRAMEWORK

In 1980, the BNL site was placed on the New York State Department of Environmental Conservation (NYSDEC) list of Inactive Hazardous Waste Sites. On December 21, 1989, the BNL site was included on the Environmental Protection Agency (EPA) National Priorities List because of soil and groundwater contamination that resulted from past BNL operations. Subsequently, the EPA, NYSDEC, and DOE entered into a Federal Facilities Agreement (herein referred to as the Interagency Agreement; [IAG]) that became effective in May 1992 (Administrative Docket Number: II-CERCLA-FFA-00201) to coordinate the cleanup.

The IAG identified areas of concern that were grouped to be evaluated for response actions. To effectively manage remediation of the BNL site, 29 Areas of Concern (AOCs) were identified and divided into seven discrete groups called Operable Units (OUs). The seven OUs were subsequently reduced to six OUs by combining OU II and OU VII into OU II/VII.

The IAG required a remedial investigation/feasibility study for Operable Unit I, pursuant to 42 United States Code (USC) 9601 et. Seq., to meet Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) requirements. The IAG also requires cleanup actions to address the identified concerns.

This project was completed in compliance with the *Closeout Procedures for National Priorities List Sites* (OSWER Directive 9320.2-09A-P), which outlines closeout requirements for sites within the CERCLA program. The completed scope of work was performed in accordance with the *Workplan* and complies with the requirements set forth in the *ROD*. A pre-final inspection, including post-excavation sampling and evaluation of sample results, determined that the contractors had constructed the remedy in accordance with remedial design plans and specifications, and no further response is anticipated.

All activities conducted at the Waste Concentration Facility were performed in accordance with BNL's Standard Based Management System (SBMS), Environmental Management System (EMS), Operational Procedure Manual – Standard Operating Procedures, Radiological Control Manual, specific documents, procedures and specifications.

1.4 SITE INVESTIGATIVE ACTIVITIES

A Remedial Investigation (RI) for OU I (CDM Federal 1996, IT 1999, and CDM Federal 1996, respectively) was conducted to evaluate the nature and extent of contamination, and the potential risks associated with the Waste Concentration Facility. A *Feasibility Study* (FS) report (CDM Federal 1999) was prepared to evaluate the alternatives for remediating the radiologically contaminated soils and other areas of concern. In addition, supplemental investigations of the soils, UST's, and associated piping and components were conducted to further delineate the extent of contamination.

Soils were characterized in the *Engineering Evaluation/Cost Assessment* (EE/CA) *for the D Tanks Removal Action* (Dames and Moore, 1993). Eight borings were installed to between 7 and 12 feet bgs. Elevated levels of Cs-137 (maximum 1486 pCi/g) and Sr-90 (maximum 454 pCi/g) were detected in several surface soil samples. Subsurface soils were also contaminated in the 5-7 foot interval at two boring locations (maximum Cs-137 at 41 pCi/g and maximum Sr-90 at 148 pCi/g) and in the 10-12 foot interval (maximum Cs-137 of 22 pCi/g and maximum Sr-90 of 45 pCi/g). Contaminated soils were not removed at the same time as the tanks, but were deferred to the OU II/VII RI.

IT performed further characterization of soils associated with the former tanks in the OU II/VII RI Report. Surface soil samples were collected from eight sites at depths up to one foot. Subsurface soil borings samples were also collected from seven sites at a depth of 23 to 25 feet. Samples were analyzed for gross alpha and beta activity, tritium, Sr-89/90, isotopic thorium, isotopic americium, and gamma emitters by gamma spectroscopy. The only radiological parameter or radiochemical species detected in IT's samples above its calculated risk-based cleanup goal for future residential use was Cs-137, which was detected at 43.3 pCi/g at one surface soil location. No radioactive species were found above cleanup goals in any of the subsurface samples. BNL conducted a review of the data sources and compiled the existing data for Cs-137 results. This evaluation identified and documented additional Cs-137 contamination around the perimeter of the D-Tanks pad and adjacent to Building 811. The Building 811 work location is depicted in Figure 1-2. Figure 1-3 provides the UST locations.

The supplemental investigations of the USTs identified several failures of the tanks integrities creating additional contamination pathways not previously identified. A single soil boring through the floor of vault B3 confirmed that contamination had made its way to the soil below the tank vaults.

1.5 PRIOR REMEDIAL ACTIVITIES AT THE WASTE CONCENTRATION FACILITY

Prior to the remedial activities associated with the UST removal and soil excavation, two removal actions were completed. The two Closeout Reports with those removal actions detailed the field activities and final waste disposition.

In 1995, the removal of the three above ground storage tanks was documented in the *Closeout Report for Brookhaven National Laboratory "D" Tanks Removal Action* (IT Corp 1995).

In 2001, the removal of wastes from the six UST's was documented in the *Closeout Report, Removal Treatment, and Disposal of Radioactive and Mixed Waste Sludge from Building 811 Tanks.*

SECTION 2.0
OPERABLE UNIT BACKGROUND

2.1 RECORD OF DECISION REQUIREMENTS

The *Record of Decision – Operable Unit I and Radiologically Contaminated Soils (Including Areas of Concern 6, 8, 10, 16, 17, and 1*8) (*ROD),* dated August 1999, was developed by BNL for the U.S. DOE. Specifically, the *ROD* addressed contamination found at OU I and AOCs 6, 8, 10, 16, 17 and 18. All the identified areas contained radiologically-contaminated soils; the contamination was resultant from past waste handling operations, spills, or inadvertent use of contaminated soils for landscaping. The soils at Building 811 (AOC 10) had become contaminated with radionuclides as a result of leaks from the storage tanks. Contamination was present in the form of Cesium -137 (CS) and Strontium-90 (Sr-90), to a depth of 12 ft. bgs. No chemical contaminants were noted to be present in the Waste Concentration Facility (WCF) area (AOC 10).

Due to the elevated levels of radioactive present at the former WCF, active remediation in the form of excavation and removal was proposed. This included the removal of impacted soils and subsurface fixtures (including concrete pads, vaults and USTs).

2.2 CLEANUP GOAL BASIS

Soil cleanup objectives were established for this site and outlined in the ROD. The soil cleanup objectives for radiological contamination were based on a dose from remaining concentrations of all radionuclides present of 15 millirem per year (mrem/year) above background considering 50 years of institutional control for residential land use, per U.S. DOE RESidual RADioactive (RESRAD) computer code. The radionuclides that were detected are listed in Table 2-1 in addition to their minimum, maximum, and representative site concentration, remediation goals, and ratio of site value to remediation goal.

Table 2-1

Radionuclide	Minimum Value (pCi/g)	Maximum Value (pCi/g)	Rep. Site Value (pCi/g)	Remediation Goal (pCi/g)	Ratio of Site Value to Remediation Goal
Ac-288	0.1	2.5	1	NA	NA
Cs-137	0.1	464	51	23	2.2
H-3	0.05	32	0.5	NA	NA
K-40	1	14	7.6	NA	NA
Ra-226	0.09	21	1	5	NA
Sr-90	5.6	454	77	15	5.1
Th-232	0.3	1.8	0.7	NA	NA

pCi/g – pico Curie per gram

Cs-137 and Sr-90 were present above acceptable risk-based soil concentrations. Therefore, the cleanup goals for the radionuclides at the site were based on Cs-137 and Sr-90. These goals are listed below:

Cs-137 ≤ 23 pCi/g
Sr-90 ≤ 15 pCi/g

Post remediation sampling and dose assessments were performed ensuring the 15 mrem/yr dose limit was met for all radionuclides that remained.

An additional goal for Ra-226 was established prior of start of work and met post-remediation. This goal is listed below:

Ra-226 ≤ 5 pCi/g

The remedial approach for Building 811 focused on the removal and cleanup of the six (6) remaining USTs, vault and pipe trench; former D Tanks Pad and D Waste Vault; and Yard Soils. The tanks were emptied, decontaminated, and triple rinsed in 1998. However, significant dose rates were measured inside the USTs in 2001 by BNL and further remediation of the area was required.

The Building 811 WCF was used to store and distill liquid radioactive waste received from the Brookhaven Graphite Research Reactor (BGRR), Building 801, and the High Flux Beam Reactor (HFBR). At the WCF, liquid radioactive waste received from the BGRR, the Hot Laboratory Complex-Building 801, and the HFBR, was temporarily stored and eventually distilled to remove particulates, and suspended and dissolved solids. The D-waste tanks (Tanks D-1, D-2 and D-3) were three 100,000 gallon aboveground storage tanks that were part of the original Waste Concentration Facility configuration. BNL defined "D" waste as liquid waste with a gross beta concentration greater than 90 picoCuries/milliliter (pCi/ml). Three documented incidents of leaks from the D-tanks had occurred, as discussed in Section 1.4.1. Active cleanup of this site began in 1995. The D-Tanks and related materials were removed in 1995 as part of a Removal Action. The D-Tanks Pad provided subsurface support for the D Tanks. After the D-Tanks were removed, the D-Tank Pad was covered with geotextile fabric and clean fill. However, six (6) out-of-service 8,000-gallon USTs (A-1, A-2, A-3, B-1, B-2, B-3), which were located approximately 50 feet north of Building 11 in a below grade, celled concrete vault approximately 20 feet below grade, remained.

2.2.1 ALARA Analysis

The selected approach for the remediation of radiologically contaminated soils at AOC 10 is large scale excavation and off-site disposal of wastes. In addition to the overall project objective of maintaining future doses below 15 mrem to members of the public, further dose reduction techniques needed to be considered to meet As-Low-As-Reasonably-Achievable (ALARA) goals.

An ALARA analysis was performed during the remedial design to identify cost effective measures for further reducing exposure to residual contamination. This ALARA analysis considered or incorporated the following elements:

- An ALARA objective of reduction of the annual public dose to less than 15 mrem and preferably less than 10 mrem.

- Both radiological and non-radiological factors in analyzing each option for accomplishing this objective were clearly identified. Remediation worker doses and non-radiological safety risks were included in the analysis.

- Options for achieving the stated objectives including use of innovative technologies were generated. While some alternative remedies were initially rejected when compared with large scale excavation, their inclusion as a supplement to the excavation process was still considered. Impractical options were eliminated early in the process but the rationale for their early elimination was included in the ALARA analysis.

- The two future use scenarios of residential and industrial were considered when performing the analysis.

- The advantages and disadvantages of implementing each option were described. Qualitative factors for each option that cannot be included in the quantitative analysis were identified and a brief narrative describing why these factors are non-quantifiable was included.

- Each option was quantitatively analyzed to include costs, dose reduction and impact on long term effectiveness. The quantitative analysis for future dose to members of the public and dose to remediation/site workers utilized current accepted methodologies. Modeling tools such as RESRAD are considered acceptable means for modeling and estimating future doses to members of the public.

- Where a net-monetary benefit comparison is made, the justification and uncertainties associated with converting non-monetary factors to capital values were included in the analysis. This justification also included how future worth/costs are extrapolated to present worth values.

- All modeling and analysis tools were clearly defined including any areas where relevant analytical factors cannot be considered or incorporated into the model.

- The uncertainties associated with each quantitative analysis were identified.

- Non-radiological impacts were included in the analysis of each option.

- A decision summary on the best option for achieving the ALARA objective was presented and this summary included both the quantitative analysis but also the qualitative factors previously identified and a rank ordering of their impact on the selected remedy or combination of remedies.

2.3 REMEDIAL DESIGN AND REMEDIAL ACTION WORKPLAN

An *Operable Unit I Remedial Design Work Plan and Remedial Action Work Plan* dated June 25, 2001 was developed for OU I. The general approach for remediation of the radiologically contaminated soil (and debris), consisting of AOCs 1, 6 and 10, included: pre-design sampling, excavation, soil sorting/volume reduction of radiologically contaminated soil, offsite disposal of radiologically contaminated soil and mixed waste, confirmation sampling, backfilling of excavated areas, and site reconstruction. The components related to the radiologically contaminated debris were identified as: demolition, processing or crushing of debris for size reduction, and offsite disposal.

Remedies for remedial actions at the Building 811 area were selected based on consideration of CERCLA requirements, an analysis of alternatives and public comments.

The selected remedies addressed three distinct components: radiologically contaminated soils; other areas of concern to be remediated; and other areas of concern to be controlled and monitored. The selected remedy for radiologically contaminated soils is Large Scale Excavation and Off-Site Disposal, which involves excavation and off-site disposal of soils above cleanup goals, institutional controls and long-term monitoring. The major components of this remedy (as it relates to AOC 10) are:

- Excavation of radiologically and chemically contaminated soils (above the cleanup goals) from AOC 10. Soils will be disposed of off-site at a permitted facility. Disposal options will be determined during the remedial design and will be in compliance with federal and state requirements. Post- remediation sampling and dose assessments will also be performed to ensure that the cleanup goals are met.

- Removal of radiologically and chemically contaminated structures and debris. This material includes vaults, buildings, asphalt, concrete pads, and out-of-service underground storage tanks and associated piping located at AOC 10.

- Performance of an As-Low-As-Reasonably-Achievable (ALARA) analysis during the remedial design and implementation of the remedy to identify cost effective measures for further reducing exposure to residual contamination below cleanup goals.

- Identification of techniques, which minimize waste volumes or further stabilize wastes to meet disposal facility waste acceptance criteria.

- Development of a Long-term Monitoring and Maintenance Plan for post remediation monitoring and institutional controls of residual contamination, to ensure that land uses remain protective of public health and the environment.

SECTION 3.0
CONSTRUCTION ACTIVITIES

The project objective was, to safely and cost effectively complete characterization, remediation and disposal of the resulting radioactive waste and debris from the Building 811 USTs, vault and pipe trench; former D Tanks Pad and D Waste Vault; and Yard Soils. A depiction of the UST locations is provided as Figure 3-1. The construction activities associated with the previous removal actions were detailed in their associated closeout reports. All pre-construction tasks, including the mobilization of subcontractors and completion of detailed work plans, were completed by 13 September 2004. Prior to all daily remedial action activities, Health and Safety tailgate meeting were held, confronting all possible hazards.

3.1 FIELD SCREENING PRIOR TO EXCAVATION

Prior to the start of excavation of yard soils, a New York licensed land surveyor identified the boundary limits of yard soils to be excavated. This consisted of a topographic survey, visual site inspection and mark-out of excavation area. BNL provided all digging permits and identified all underground utilities and structures prior to start of excavation. Results of the pre-excavation field screening are depicted in Figure 3-2.

3.2 UNDERGROUND STORAGE TANKS AND PIPING

3.2.1 Overburden Soil Removal

Remedial actions for the USTs included the initial removal of overburden soil. Contaminated overburden removal began on 14 September 2004 and was completed on 24 September 2004. Photographs of the soil excavation process are located in Appendix A. The soils were removed with a trackhoe and screened for radiological contamination by Radiological Control Technicians (RCTs). Excavated soil volumes are included in Table 3-1. Clean fill receipts are included as Appendix B.

Excavated soils determined to be radioactively contaminated were sampled or surveyed and transported to the Former Hazardous Waste Management Facility (FHWMF) for loading into railcars for transportation to Envirocare of Utah for disposal. All trucks and/or roll-off containers exiting the soil and debris contamination area were screened for radiological contamination by BNL's RCTs.

During overburden soil removal all appurtenances were removed including man-ways, manholes, corrugated metal entryways, pipes, wood covers, and wood "dog houses" to the vault and/or trench. These materials were also screened for radiological contamination using hand-held ISOCS and or hand-held Beta/Gamma instrumentation. The materials were then size reduced according to waste disposal facility requirements, consolidated, and loaded onto 15 cubic yard roll off containers, sampled and transported to HWMF for loading into railcars for transportation to the disposal facility. Removal of overburden soil exposed the vault cover and corrugated trench cover.

Table 3-1
Excavated Soil Volumes
Building 811 Remediation Project
Brookhaven National Laboratory

Shipments						Dose Rates		Cs-137					Waste Streams				
RWCF #	Box		Inspect		Date	Contact	1 Foot	uCi	Material	est Yards	Other	UST Vault	811 Yards Soils			D-Tank	Waste
			Here	There							Material	Concrete	A/B	D-Pad	Yard	Pad Debris	Verification
										3609.9	38.3	50.6	3017.3			503.7	0
48411	1				15-Sep	0.2	0.1	1430	soil	15			15				
48404	2				15-Sep	0.05	0.02	381	soil	15			15				
48405	3				16-Sep	0.015	0.005	209	soil	15			15				
48406	4				16-Sep	0.02	0.01	1430	debris/rub	13.7	3.4	6.9	3.4				
48403	5				16-Sep	0.008	0.005	1430	soil	15.9			15.9				
48407	6				17-Sep	0.05	0.02	1430	soil	13.7			13.7				
48408	7				17-Sep	0.02	0.01	1430	soil/con	13.7		2.7	11.0				
48410	8				17-Sep	0.05	0.02	1430	soil	14.8	0.1	1.3	13.3				
48417	9				17-Sep	0.02	0.01	1560	soil	13.7		0.1	13.6				
48418	10				20-Sep	0.03	0.02	1560	soil	13.7	0.1	0.1	13.6				
48416	11				21-Sep	0.01	0.005	1560	soil	13.7			13.7				
48421	14				21-Sep	0.02	0.01	1560	soil	13.7			13.7				
48420	13				21-Sep	0.05	0.03	1560	soil	13.7			13.7				
48419	12				21-Sep	0.05	0.03	1560	soil	13.7			13.7				
48422	15				22-Sep	0.04	0.01	1560	soil	13.7			13.7				
48423	16				22-Sep	0.2	0.01	1560	soil	13.7		0.7	13.0				
48424	17				22-Sep	0.3	0.2	1560	soil	13.7	1.0		12.7				
48425	18				22-Sep	0.01	0.005	1560	soil/con	13.7		1.4	12.3				
48426	19				23-Sep	Pu 239		1820	soil	6.2		0.6	5.6				
48427	20				23-Sep	0.01	0.005	1820	soil	6.2	0.2		6.0				
48428	21				23-Sep	0.01	0.005	455	soil	6.2	0.2		6.0				
48429	22				23-Sep	0.008	0.005	14100	soil	6.2	0.1		6.1				
48430	23				23-Sep	0.008	0.005	860	soil	6.2			6.2				
48431	24				24-Sep	0.02	0.005	860	soil	6.2			6.2				
48432	25				24-Sep	0.01	0.005		soil	13.7			13.7				
48433	26				30-Sep	0.1	0.08		soil	13.7			13.7				
48435	28				7-Oct	0.005	0.005	1560	soil	13.7			13.7				
48434	27				7-Oct	0.008	0.005	1560	soil	13.7			13.7				
48436	29				7-Oct	0.008	0.005	616	soil	13.7	0.1		13.6				
48437	30				7-Oct	0.01	0.005	616	soil	6.2			6.2				
48460	31				11-Oct	0.005	0.005		concrete (1608 lbs.)	0.4		0.4	0.0				
48461	32				12-Oct	0.005	0.005		concrete (1608 lbs.)	0.4		0.4	0.0				
47914	33				12-Oct	0.01	0.005	320	soil/con	0.5		0.2	0.3				
47915	34				13-Oct	0.01	0.005	0.7	soil/con	8		1.6	6.4				
48438	35				26-Oct	0.008	0.005	0.04	concrete	8		8					
47916	36				27-Oct	0.01	0.005	665	soil	15				14.85		0.15	
47909	37				28-Oct	0.02	0.01	163	soil	15				15			
47910	38				2-Dec	0.05	0.03		PPE (2400 lbs.)	15						15	
47911	39				28-Oct	0.01	0.005	163	soil	15				15			
47912	40				28-Oct	0.01	0.005	163	soil	15				15			

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Excavated Soil Volumes
Building 811 Remediation Project
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Shipments						Dose Rates		Cs-137				Waste Streams					
RWCF #	Box		Inspect		Date	Contact	1 Foot	uCi	Material	est Yards	Other	UST Vault	811 Yards Soils			D-Tank	Waste
			Here	There							Material	Concrete	A/B	D-Pad	Yard	Pad Debris	Verification
47913	41				28-Oct	0.005	0.005	163	soil	15				15			
48409	42				29-Oct	0.009	0.005	161	soil	15				15			
47937	43				29-Oct	0.01	0.005	161	soil	15				15			
47938	44				29-Oct	0.4	0.2	163	soil/asphalt	15				13.5		1.5	
47939	45				13-Dec	1	0.5	163	soil	15				15			
47940	46				1-Nov	0.01	0.005	163	soil	15				15			
47941	47				1-Nov	0.01	0.005	163	soil	15				15			
47943	48				2-Nov	0.01	0.008	163	soil	15				15			
47944	49				2-Nov	0.008	0.005	163	soil	15				15			
47945	50				2-Nov	0.02	0.01	163	soil	15				15			
47946	51				2-Nov	0.02	0.01	163	soil/asphalt	15				9		6	
47947	52				4-Nov	0.2	0.08	163	soil	15				15			
47948	53				4-Nov	0.3	0.1	163	soil	15				15			
47949	54				4-Nov	0.03	0.01	163	soil	15				15			
47950	55				4-Nov	0.06	0.04	163	soil	15				15			
47951	56				4-Nov	0.08	0.05	163	soil	15				15			
47952	57				4-Nov	0.5	0.3	163	soil	15				15			
47953	58				4-Nov	0.2	0.01	163	soil	15				15			
47954	59				8-Nov	0.2	0.01	163	soil	15				15			
47955	60				8-Nov	0.01	0.005	163	soil/asphalt	15				9		6	
47956	61				8-Nov	0.02	0.008		soil/concrete	15				0.75		14.25	
47957	62				8-Nov	0.03	0.015		soil/concrete	15				0.75		14.25	
47958	63				8-Nov	0.2	0.01	597	soil/concrete	15				1.5		13.5	
47959	64				8-Nov	0.3	0.2	597	soil/concrete	15				1.5		13.5	
47960	65				9-Nov	0.015	0.01	597	soil/concrete	15				1.5		13.5	
47961	66				9-Nov	0.5	0.3	597	soil/concrete	15				1.5		13.5	
47962	67				9-Nov	0.01	0.005	597	soil	15				15			
47963	68				9-Nov	0.005	0.005	597	soil	15				15			
47964	69				10-Nov	0.1	0.05	754	soil/concrete	15				4.5		10.5	
47965	70				10-Nov	0.05	0.03	597	soil	15				15			
47966	71				10-Nov	0.05	0.05	597	soil	15				15			
47967	72				10-Nov	0.01	0.005	597	soil	15				15			
48462	73				10-Nov	0.08	0.05	597	Soil	15				15			
48561	74				10-Nov	0.015	0.01	691	Soil/Concrete	15				1.5		13.5	
48562	75				10-Nov	0.03	0.005	691	Soil/Concrete	15				1.5		13.5	
48563	76				10-Nov	0.005	0.005	691	Soil/Concrete	15				1.5		13.5	
48564	77				10-Nov	0.05	0.03	660	Soil/Concrete	15				4.5		10.5	
48565	78				11-Nov	0.5	0.3	597	Soil/Concrete	15				6		9	
48566	79				11-Nov	4	0.2	25000	Soil/Concrete	15				13.5		1.5	

Table 3-1
Excavated Soil Volumes
Building 811 Remediation Project
Brookhaven National Laboratory

Shipments						Dose Rates		Cs-137				Waste Streams					
RWCF #	Box		Inspect		Date	Contact	1 Foot	uCi	Material	est Yards	Other	UST Vault	811 Yards Soils			D-Tank	Waste
			Here	There							Material	Concrete	A/B	D-Pad	Yard	Pad Debris	Verification
48567	80				11-Nov	0.005	0.005	723	Asphalt	15						15	
48568	81				11-Nov	0.4	0.2	597	Soil	15				15			
48569	82				12-Nov	0.2	0.1	597	Soil	15				15			
48570	83				12-Nov	1	0.02	597	Soil	15				15			
48571	84				11-Nov	0.05	0.01	597	Soil	15				15			
48572	85				12-Nov	0.2	0.05	660	Soil/Concrete	15				7.5		7.5	
48573	86				12-Nov	1	0.5	660	Soil/Concrete	15				9		6	
48574	87				12-Nov	0.2	0.07	660	Soil/Concrete	15				9		6	
48575	88				12-Nov	15	4	103000	Soil/Concrete	15				7.5		7.5	
48576	89				15-Nov	5	1.2		Soil/Concrete	15				13.5		1.5	
48577	90				15-Nov	2	0.1		Soil/Concrete	15				13.5		1.5	
48579	91				15-Nov	0.1	0.005	26300	Soil/Concrete	15				10.5		4.5	
48580	92				16-Nov	0.5	0.2	26300	Soil/Concrete	15				9		6	
48581	93				16-Nov	0.06	0.03	597	Soil/Concrete	15				12		3	
48582	94				16-Nov	0.3	0.1	597	Soil/Concrete	15		3		12			
48583	95				16-Nov	0.02	0.01		Asphalt	15						15	
48584	96				16-Nov	1	0.5		Soil	15				13.5		1.5	
48585	97				17-Nov	0.5	0.2	691	Soil/Concrete	15				4.5		10.5	
48586	98				17-Nov	0.5	0.1	691	Soil/Concrete	15				4.5		10.5	
48587	[redacted]				18-Nov	0.3	0.08	644	Soil/Concrete	15				10.5		4.5	
48588	100				18-Nov	0.3	0.1	691	Soil/Concrete	15				4.5		10.5	
48589	101				18-Nov	0.04	0.02		Soil	15				15			
48590	102				18-Nov	0.4	0.07		Soil	15				15			
48591	103				18-Nov	0.2	0.08		Soil	15				15			
48592	104				19-Nov	0.02	0.01	597	Soil/Asphalt	15				4.5		10.5	
48593	105				19-Nov	0.01	0.008	597	Soil	15				15			
48594	106				19-Nov	0.2	0.1	597	Soil/Concrete	15				13.5		1.5	
48595	107				19-Nov	0.5	0.1	597	Soil/Concrete	15				4.5		10.5	
48596	108				23-Nov	0.5	0.1	691	Soil/Concrete	15				7.5		7.5	
48597	109				23-Nov	0.5	0.12	691	Soil/Concrete	15				13.5		1.5	
48598	110				22-Nov	6	0.8		Soil	15				15			
48599	111				22-Nov	0.8	0.2	691	Soil/Concrete	15				15			
48600	112				22-Nov	1.2	0.2	691	Soil/Concrete	15				10.5		4.5	
48601	113				22-Nov	0.6	0.2	691	Soil/Concrete	15				10.5		4.5	
48691									HIC Liner								
48693	114				30-Nov	0.005	0.005	503	Concrete	15						15	
48694	115				30-Nov	0.01	0.008	597	Soil/Concrete	15				7.5		7.5	
48695	116				30-Nov	0.008	0.005	597	Soil	15				15			
48696	117				9-Dec	0.005	0.005	628	Soil/Asphalt	15				4.5		10.5	
48697	118				3-Dec	0.1	0.05	597	Soil	15				15			
48698	119				3-Dec	0.15	0.1	597	Soil	15				15			

Table 3-1
Excavated Soil Volumes
Building 811 Remediation Project
Brookhaven National Laboratory

	Shipments					Dose Rates		Cs-137				Waste Streams					
RWCF #	Box		Inspect		Date	Contact	1 Foot	uCi	Material	est Yards	Other	UST Vault	811 Yards Soils			D-Tank	Waste
			Here	There							Material	Concrete	A/B	D-Pad	Yard	Pad Debris	Verification
48699	120				3-Dec	0.2	0.1	597	Soil	15				15			
48700	121				8-Dec	0.05	0.01	597	Soil	15				15			
48701	122				8-Dec	0.1	0.02	597	Soil	15				15			
48702	123				9-Dec	0.07	0.02	597	Soil	15				15			
48703	124				9-Dec	0.01	0.008		Soil/Concrete	15				1.5		13.5	
48704	162				8-Dec	0.02	0.01		Soil	15				15			
48705	125				9-Dec	0.05	0.01		Soil/Concrete	15				1.5		13.5	
48706	126				9-Dec	0.06	0.01		Soil/Asphalt	15				9		6	
48707	127				9-Dec	0.05	0.01		Soil	15				15			
48709	[redacted]	1	X	X	28-Apr	0.2	0.1	1902	PPE	30	30						
48710	129				13-Dec	3	1	597	Soil	15				15			
48711	130				14-Dec	0.03	0.01	597	Soil/Asphalt	15				10.5		4.5	
48712	131				14-Dec	2	0.5	660	Soil	15				15			
48713	132				14-Dec	0.05	0.02		Soil	15				15			
48714	133				14-Dec	0.08	0.05		Soil	15				15			
48715	134				14-Dec	1.5	1		Soil	15				15			
48716	135				15-Dec	0.1	0.05		Metal/Pipes	15						15	
48717	136				15-Dec	0.1	0.005		Soil	15				15			
48718	138				15-Dec	0.05	0.03		Soil	15				15			
48719	137				15-Dec	0.5	0.3		Soil	15				15			
48720	139				16-Dec	0.2	0.1	597	Soil/Asphalt	15				1.5		13.5	
48721	140				16-Dec	0.5	0.3		Soil/Concrete	15				13.5		1.5	
48722	141				16-Dec	0.01	0.008	597	Soil/Concrete	15				13.5		1.5	
48723	142				17-Dec	0.1	0.08	597	Soil/Concrete	15				13.5		1.5	
48724	143				16-Dec	0.05	0.03	597	Soil/Concrete	15				13.5		1.5	
48725	144				17-Dec	0.1	0.08	597	Soil	15				15			
48726	145				17-Dec	0.1	0.08	597	Soil	15				15			
48727	146				17-Dec	0.1	0.08	660	Soil/Concrete	15				7.5		7.5	
48728	147				17-Dec	0.01	0.008	597	Concrete	15						15	
48729	148				17-Dec	0.3	0.4	597	Soil	15				15			
48730	149				22-Dec	0.1	0.008		Soil	15				15			
48731	150				22-Dec	0.1	0.008		Soil	15				15			
48732	151				22-Dec	0.1	0.008		Soil	15				15			
48733	152				22-Dec	0.1	0.008		Soil	15				15			
48734	153				22-Dec	0.1	0.008		Soil	15				15			
48735	154				3-Jan	0.05	0.02	597	Soil/Concrete	15				15			
48736	155				3-Jan	0.08	0.02	597	Soil/Concrete	15				15			
48737	156				22-Dec	0.1	0.08		Soil/Concrete	15				15			
48738	157				3-Jan	0.1	0.08		Soil/Concrete	15				13.5		1.5	
48739	158				3-Jan	0.05	0.02		Soil/Concrete	15				13.5		1.5	
48740	[redacted]				12-Jan	0.3	0.2		Soil/Concrete	15		1.5		13.5			

Table 3-1
Excavated Soil Volumes
Building 811 Remediation Project
Brookhaven National Laboratory

		Shipments				Dose Rates		Cs-137				Waste Streams					
RWCF #	Box		Inspect		Date	Contact	1 Foot	uCi	Material	est Yards	Other	UST Vault	811 Yards Soils			D-Tank	Waste
			Here	There							Material	Concrete	A/B	D-Pad	Yard	Pad Debris	Verification
48741	164				4-Jan	4	2		Soil	15				15			
48742	165				4-Jan	0.05	0.03		Soil	15				15			
48743	166				4-Jan	0.03	0.02		Soil	15				15			
48744	167				4-Jan	0.08	0.05		Soil	15				15			
48745	168				4-Jan	0.05	0.02		Soil	15				15			
48746	169				12-Jan	0.2	0.1	597	Soil	15				15			
48747	172				12-Jan	0.2	0.08	707	Soil/Concrete	15		13.5		1.5			
48748	170				12-Jan	0.18	0.08	597	Soil	15				15			
48749	171				12-Jan	0.2	0.1	597	Soil	15				15			
48750	173				12-Jan	0.01	0.008		Soil/Concrete	15				13.5		1.5	
48805	174				26-Jan	0.1	0.008	597	Sand/Concrete	15				13.5		1.5	
48844	175				4-Feb	0.2	0.1	597	Wood/Concrete	15				13.5		1.5	
48845	176				4-Feb	0.2	0.05	597	Wood/Concrete	15				13.5		1.5	
48846	177				20-Jan	0.2	0.1	597	Soil	15				15			
	[redacted]																
48848	179				4-Feb	0.2	0.5	500	Soil/Concrete	15				7.5		7.5	
48849	180				26-Jan	0.2	0.1		Soil/Wood	7.4				0.7		6.7	
48850	181	4			Hold	0.2	0.1		Plastic/Wood/Asbestos	4						4	
48851	182				16-Feb	0.08	0.04	754	Soil/Concrete	15				7.5		7.5	
48852	183				14-Feb	0.06	0.03	597	Soil	15				15			
48853	184				14-Feb	0.5	0.1	50.5	Soil/Concrete	15				14.3		0.8	
48854	185				14-Feb	0.05	0.03	597	Soil	15				15			
48855	186				15-Feb	1	0.5	597	Misc. Yard Debris	15			15				
48856	A-1								UST								
48857	B-3								UST								
48858	B-1								UST								
48859	A-3								UST								
48860	A-2								UST								
48861	B-2								UST								
48864	163	-			15-Feb	2	0.8		Vault Concrete Sacks	15		7.5	7.5				
48862	187				16-Feb	0.04	0.02	597	Soil	15				15			
48975	161				17-Feb	0.5	0.1		Soil/Sample/Misc	5.6	2.2			3.3			
48863	188				17-Feb	0.05	0.02	1000	Soil/Debris	15		0.75		14.25			
48977	189				17-Feb	0.04	0.01	1000	Soil	15				15			
48978	190				17-Feb	0.05	0.02	1000	Soil/Debris	15				14.4		0.6	
48979	191				17-Feb	0.15	0.04	1000	Soil/Debris	15				14.7		0.3	
48980	192				18-Feb	0.06	0.01	1000	Soil/Debris	15				14.7		0.3	
48981	193				18-Feb	0.03	0.02	1000	Soil/Debris	15				14.85		0.15	
48982	194				18-Feb	0.08	0.03	1000	Soil/Debris	15				14.85		0.15	
48983	195				18-Feb	0.1	0.03	1000	Soil	15				15			
48984	196				18-Feb	0.08	0.03	1000	Soil	15				15			
48985	197				19-Feb	0.05	0.03	1000	Soil	15				15			
48986	198				22-Feb	0.5	0.1	1000	Soil/Debris	15				14.55		0.45	
48987	199				22-Feb	0.8	0.3	1000	Soil/Debris	15				14.55		0.45	

Table 3-1
Excavated Soil Volumes
Building 811 Remediation Project
Brookhaven National Laboratory

Shipments						Dose Rates		Cs-137					Waste Streams				
RWCF #	Box		Inspect		Date	Contact	1 Foot	uCi	Material	est Yards	Other	UST Vault	811 Yards Soils			D-Tank	Waste
			Here	There							Material	Concrete	A/B	D-Pad	Yard	Pad Debris	Verification
48988	200				22-Feb	0.5	0.1	1000	Soil/Debris	15				14.25		0.75	
48989	201				22-Feb	0.5	0.1	1000	Soil/Debris	15				14.7		0.3	
48990	202				22-Feb	0.06	0.03	1000	Soil	15				15			
48991	203				22-Feb	0.05	0.01	1000	Soil	15				15			
48992	204				23-Feb	0.02	0.01	1000	Soil	15				15			
48994	160				23-Feb	0.02	0.01	1000	Soil	15				15			
48993	205				23-Feb	0.03	0.01	1000	Soil	15				15			
48995	206				23-Feb	0.05	0.02	500	Soil	15				15			
48996	207				23-Feb	0.03	0.02	500	Soil	15				15			
48997	208	9			24-Feb	0.03	0.02	500	Soil	15				15			
49010	209	7			24-Feb	0.03	0.02	500	Soil	15				15			
49011	210	2			24-Feb	0.05	0.02	500	Soil	15				15			
49012	211	3			24-Feb	0.03	0.02	500	Soil/Radsorb	15	0.45			14.55			
49013	212	4			24-Feb	0.02	0.01	1000	Soil/Radsorb	15	0.45			14.55			
49014	213	3			26-Feb	0.03	0.01	500	Soil	15				15			
49015	214	8			26-Feb	0.02	0.01	500	Soil	15				15			
49016	215	7			26-Feb	0.02	0.01	500	Soil	15				15			
49017	216	2			26-Feb	0.03	0.02	500	Soil	15				15			
49018	217	10			26-Feb	0.02	0.01	500	Soil	15				15			
49019	218	6			26-Feb	0.02	0.01	500	Soil	15				15			
49020	219	2			28-Feb	0.03	0.02	500	Soil	15				15			
49021	220	7			28-Feb	0.02	0.01	278	Soil	15				15			
49022	221	2			4-Mar	0.01	0.008	278	Soil	15				15			
49023	222	9			4-Mar	0.03	0.01	278	Soil	15				15			
49024	223				4-Mar	0.02	0.01	278	Soil/Metal	15				15			
49025	224	7			4-Mar	0.02	0.01	278	Soil	15				15			
49026	225	2			7-Mar	0.02	0.01	278	Soil	15				15			
49027	226				7-Mar	0.2	0.08	1647	Soil	15				15			
49028	227	8			7-Mar	0.02	0.01	278	Soil	15				15			
49029	228	9			7-Mar	0.04	0.01	305	Soil	15				15			
49030	229	6			14-Mar	0.3	0.1	2243	Soil/Asphalt	15				13.5		1.5	
49031	230	7			11-Mar	0.02	0.01	278	Soil	15				15			
49032	231	2			11-Mar	0.2	0.01	754	Soil	15				15			
49033	232	8			14-Mar	0.02	0.01	278	Soil	15				15			
49034	233	9			11-Mar	0.03	0.01	278	Soil	15				15			
49035	234	7			15-Mar	0.03	0.01	278	Soil	15				15			
49036	235	2			15-Mar	0.02	0.01	278	Soil	15				15			
49037	236	9			15-Mar	0.02	0.01	278	Soil	15				15			
49038	237	8			15-Mar	0.02	0.01	278	Soil	15				15			
49039	238	6			15-Mar	0.02	0.01	278	Soil/Concrete	15				15			
49082	239	10			16-Mar	0.02	0.01	278	Soil	15				15			

Table 3-1
Excavated Soil Volumes
Building 811 Remediation Project
Brookhaven National Laboratory

RWCF #	Box	Shipments	Inspect Here	Inspect There	Date	Dose Rates Contact	Dose Rates 1 Foot	Cs-137 uCi	Material	est Yards	Other Material	UST Vault Concrete	Waste Streams 811 Yards Soils A/B	811 Yards Soils D-Pad	811 Yards Soils Yard	D-Tank Pad Debris	Waste Verification
49083	240	2			16-Mar	0.03	0.01	278	Soil	15				15			
49084	241	7			16-Mar	0.02	0.01	278	Soil	15				15			
49085	242	9			16-Mar	0.02	0.01	278	Soil	15				15			
49086	243	8			16-Mar	0.02	0.01	278	Soil	15				15			
49087	244	6			16-Mar	0.02	0.01	278	Soil	15				15			
49088	245	10			16-Mar	0.03	0.01	278	Soil	15				15			
49089	246	[redacted]	X	X	24-Mar	0.02	0.01	278	Soil/Metal	15				14.25		0.75	
49090	247	7		X	24-Mar	0.02	0.01	278	Soil	15				15			
49091	248		X	X	24-Mar	0.02	0.01	278	Soil	15				15			
49003	249	8	X	X	24-Mar	0.03	0.01	278	Soil/Concrete	15				14.7		0.3	
49096	250	10		X	24-Mar	0.04	0.01	278	Soil	15				15			
49097	251	6	X	X	24-Mar	0.02	0.01	278	Soil/Concrete	15				14.85		0.15	
49098	252	3			28-Mar	0.02	0.01	278	Soil	15				15			
49099	253	7		X	30-Mar	0.2	0.1	278	Soil	15				15			
49100	254	10		X	30-Mar	0.02	0.01	278	Soil	15				15			
49101	255	8	X	X	20-Apr	0.01	0.008	278	Soil/Concrete/Wood	15				12		3	
49132	256	10	X		5-Apr	0.02	0.001	278	Soil	15			15				
49124	257	6	X		1-Apr	0.05	0.02	405	Soil	15			7.5	7.5			
49125	258	5	X		1-Apr	0.3	0.1	2243	Soil	15			11.25	3.75			
49126	259	10			1-Apr	0.08	0.05	880	Soil	15			15				
49127	260	3	X		4-Apr	0.4	0.15	1209	Soil	15			15				
49128	261	7	X		4-Apr	0.02	0.01	278	Soil	15			15				
49129	262	6	X	X	5-Apr	0.04	0.01	228	Soil	15			15				
49130	263	7	X		1-Jun	0.07	0.03	565	Concrete/Rebar	10	8	2					
49131	264	5		X	5-Apr	0.05	0.02	405	Soil	15			15				
49133	265	3			7-Apr	0.04	0.02	355	Soil	15			15				
49136	266	5	X	X	7-Apr	0.02	0.01	278	Soil	15				15			
49137	267	6	X	X	7-Apr	0.02	0.01	278	Soil	15				15			
49138	268	10	X		7-Apr	0.04	0.02	355	Soil	15				15			
49139	269	10	X	X	21-Apr	0.01	0.008	50	Asphalt	15						15	
49141	270	3	X	X	14-Apr	0.5	0.3	5476	Soil	15			7.5	7.5			
49142	271	5	X	X	14-Apr	0.05	0.03	533	Soil	15			15				
49143	272	6	X	X	18-Apr	0.01	0.008	50	Soil	15				15			
49144	273	3	X	X	18-Apr	0.2	0.1	1902	Soil	15				15			
49145	274	3	X	X	28-Apr	0.02	0.01	278	PPE/3/4	10	10						
49146	275	9	X	X	21-Apr	0.04	0.02	355	Soil	15			10	5			
49147	276	8	X	X	3-May	0.05	0.03	533	Soil/concrete	15		5	10				
49148	277	6	X	X	3-May	0.7	0.3	2233	Soil/Radsorb	15	5		10				
49149	278	6		X	4-May	0.5	0.1	2926	Soil	15			15				
49150	279	8			4-May	0.08	0.06	982	Soil	15			15				

Table 3-1
Excavated Soil Volumes
Building 811 Remediation Project
Brookhaven National Laboratory

Shipments						Dose Rates		Cs-137				Waste Streams					
RWCF #	Box		Inspect		Date	Contact	1 Foot	uCi	Material	est Yards	Other	UST Vault	811 Yards Soils			D-Tank	Waste
			Here	There							Material	Concrete	A/B	D-Pad	Yard	Pad Debris	Verification
49151	280	3	X	X	5-May	0.02	0.01	278	Soil	15			15				
49152	281	6	X	X	9-May	0.05	0.01	278	Soil/Concrete	15		5	5		5		
49153	282	3	X	X	16-May	0.01	0.008	278	Misc. Yard Debris	15	15						
49154	283	8	X		1-Jun	0.07	0.015	83	Concrete Blocks	8		8					
49155	284	3			20-May	0.05	0.02	533	Soil/Misc. Yard Debris	15		4.5	10.5				
49381	285	6			20-May	0.03	0.01	278	Soil/Concrete	15		3	12				
49282	286	6	X		23-May	0.02	0.01	278	Soil	15			15				
49383	287	3			23-May	0.02	0.01	278	Soil/Debris	15	2.25	0.75	12				
49385	289	6	X	X	23-May	0.04	0.02	355	Soil/Debris	15	4.5		10.5				
49386	288	3		X	23-May	0.04	0.02	355	Soil/Debris	15	1.5	0.75	12.75				
49387	290		X		24-May	0.04	0.02	355	Soil/Debris	15	6		9				
49388	291	6	X	X	24-May	0.02	0.01	278	Soil/Debris	15	3.75		11.25				
49389	292		X	X	24-May	0.02	0.01	278	Soil/Debris	15	4.5		10.5				
49390	293		X	X	24-May	0.02	0.01	278	Soil/PPE	15	2		13				
49406	294	6	X	X	26-May	0.02	0.01	278	Soil	15			15				
49407	295	3	X	X	26-May	0.02	0.01	278	Soil/Debris	15	2		13				
49408	296	3	X	X	26-May	0.02	0.01	278	Soil	15			15				
49409	297	6	X	X	26-May	0.03	0.01	278	Soil/Debris	15	3		12				
49410	298	3	X	X	27-May	0.03	0.01	278	Soil/Debris	15	3		12				
49411	299	6	X	X	27-May	0.03	0.01	278	Soil/Debris	9	3		6				
49439	300	3	X		27-May	0.03	0.01	278	Asphalt	15						15	
49428	301	6	X		27-May	0.03	0.01	278	Asphalt	15						15	
49429	302	3	X	X	31-May	0.03	0.01	278	Asphalt	15						15	
49430	303	6	X	X	31-May	0.03	0.01	278	Asphalt	15						15	
49431	304							278	Debris	5	5						

3.2.2 Valves and Piping Removal

A & B vault trench piping removal was completed on 5 October 2004. Inspections were performed on all the piping between the existing A & B Transfer Line pipecuts and their entrance to the vault. All remaining valves were opened to drain. All additional liquids were captured in glovebags, ensuring clean operations.

Liquid disposal information is included in Section 3.6.4. Drained pipes were resealed after liquid removal. Contamination control measures were implemented, the pipes were cut, and then placed into a separate container.

Two asbestos-containing material (ACM) pipes were uncovered during this process. These pipes were demolished by appropriately qualified and licensed asbestos professionals. Engineering controls such as glove bagging, misting and the use of surfactants were used to mitigate fugitive emissions.

3.2.3 UST Vault and Concrete Cover Removal

After removal of overburden soil and all appurtenances (as discussed in Section 3.2.1), the vault and trench covers were exposed. The visible concrete tank covers were removed using a combination of concrete saw cutting and concrete demolition. Heavy equipment was used to remove the concrete pieces above the tank. The debris were then loaded into transport vehicles and transported to the FHWMF. Concrete disposal is further discussed in Section 3.6.3.

3.2.4 UST Removal

Rigging and hoisting work was required for the removal of the six (6) stainless steel USTs. The crane used was staged in the area creating the shortest radius to pick and set the tanks. All work was performed by the BNL Rigging Department and utilized the BNL Grove 150 ton truck mounted crane. Tanks were removed from east to west in order (811-T-32 (B1), 811-T-31 (A1), 811-T33 (B2), 811-T30 (A2), 811-T34 (B3) and 811-T29 (A3)). An approved fixative or plastic enclosure (bag) was used to achieve the DOT excepted package requirements for radioactive waste shipments. All rigging work was performed in compliance with OSHA 1926, Subpart N, "Cranes, Derricks, Hoists, Elevators, and Conveyors", DOE Standard Hoisting and Rigging (DOE-STD-1090-2004), and BNL SBMS Lifting Safety.

Each UST had a diameter of approximately ten (10) feet. The total height of each UST was approximately 14 feet-10 7/8 inches. The walls of the USTs were approximately 1/8-inch thick stainless steel with supporting horizontal bands and vertical stiffeners. Each stainless steel USTs weighed approximately 5,500 pounds.

After successful removal of the six (6) existing, out-of-service 8,000-gallon USTs, the tanks were either placed directly on the ground and re-rigged for a basket pick on the trailer bed, or placed directly on the trailer bed from their vertical position.

The tanks were transported whole as Surface Contaminated Objects (SCO) or Low Specific Activity (LSA) waste in accordance with DOT requirements. TAG Transport, Inc. performed the transportation of the USTs to the Envirocare disposal facility under BNL's contract.

3.3 VAULTS AND TRENCHES

3.3.1 Former D Waste Vault

The D-Waste vault was demolished beginning on 18 January 2005. Prior to demolition, BNL removed the active D-Waste Lines from service. Lines were supported and approximately eight feet of the D Waste Lines were removed from service. Disposal of vault contents is discussed in Section 3.6.5. A cross section drawing depicting the D Tank Vault excavation is provided in Figure 3-1. The D-Waste lines and other surface utilities were supported prior to the commencement of demolition activities through the use of shoring posts on the northern and southern ends of the exposed piping.

3.4 FORMER D TANK PAD

Surveys and saw-cutting of the existing asphalt pavement in the Former D Tank Pad area began on 25 October 2004. Utilizing hydraulic equipment, the Former D Tank Concrete Pad was removed. Any contaminated materials were sampled and directly loaded into 15 cubic yard roll off containers and transported to the FHWMF for loading into railcars for transportation to the disposal facility. Clean materials were used for subsequent restoration of D Tank Pad area.

3.4.1 Former D Tank Pad Soil Removal

Prior to the start of excavation of yard soils, a New York Registered Licensed Surveyor conducted the field layout of the limits of yard soils to excavate. The soils were excavated beginning 26 October 2004. Radiological surveys were taken over the exposed soil prior to the removal of each six inch lift. Work proceeded from the west to the east in the Former D Tank Pad area. The excavations remained open for sampling, characterization and screening.

Twenty-foot deep excavations within the D Tank Pad area utilized trench boxes to support the walls and facilitate soil removal. In one portion of the D Tank Pad area, the excavation was continued to 30 feet below ground surface in order to remove additional contaminated materials. Volumes of excavated soils for the Former D Tank pad operation are included in Table 3-1. Dust suppression methods were utilized during all concrete demolition and cutting activities.

3.5 POST EXCAVATION FINAL STATUS REPORT

3.5.1 Final Radiological Status Survey Design

The Final Radiological Status Survey Design is include as Attachment 1. Results of the pre-excavation walkover survey results are included as Figure 3-2.

3.5.2 Final Status Survey Results

The Final Status Survey Results are included as Attachment 2. Results of the post-excavation walkover survey results are included as Figure 3-3. In addition, ORISE performed an independent verification survey and their final report is in Appendix F.

3.5.3 Final Status Survey Conclusions

The Final Status Survey Report and results concluded that the Building 811 remediation area passed all the release criteria. The RESRAD run shows that the dose to a future resident in 50 years would be 3.75 mrem/yr. The dose to a resident at time zero would be 12.79 mrem/yr thus satisfying the dose goal of 15 mrem/yr. It is, therefore, recommended that the area be released for unrestricted use.

Two areas of known contamination were left behind but were still factored into the final dose assessment. They included a small pocket of contaminated soil below 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. These areas are discussed in detail in the attached Final Status Survey Report.

3.6 WASTE MANAGEMENT

The objective of waste management was to characterize the expected resulting waste from Building 811 prior to start of work. After characterization, the resulting waste was properly handled, stored, transported and disposed of. The August 2004 Waste Management Plan (WMP) was prepared in accordance with the project specifications of the Environmental Directorate's WMP (28 January 2002), and the Standards Based Management System (SBMS). Plan requirements were based on BNL procedures, applicable regulations, and off-site disposal facility WAC.

3.6.1 Waste Generation

The waste streams generated during this project are presented in Table 3-2. Waste streams were organized and presented based on the preferred disposal pathway. The waste streams were sorted by their destination, further broken down into categories of waste, and descriptions.

Table 3-2
Consolidated Waste Streams and Disposal Paths

Destination	Category	Description
Reuse onsite (Suspect clean material)	Backfill materials	4 – 6 ½ feet overburden over tanks
		Asphalt, stone blend, sand over D-tanks
Material staged at the Former HWMF and loaded into railcars for disposal at EOU	Concrete and other debris	Concrete Tank vault cover
		Concrete Manholes from tank area and D-tank area
		Concrete D-tank pad and vault
		Wooden appurtenances over tank vault and in D-tank area
		Geotextile over former D-tank pad
		Compactable secondary waste including PPE, enclosures, HEPA filters, heavy equipment air filters, sampling debris, etc.
	Piping and other metal Debris	Piping – Tank piping to be drained
		Asbestos and transite piping
		Piping – D-tank area piping
		Metal Debris – Corrugated metal trench cover
		Metal Debris – Manhole covers
		Metal Debris – Other metal appurtenances
	D-tank soils	Soils known to be contaminated and remediated per contract drawings
Liquid materials for onsite treatment	Suspect clean liquids, destined for sanitary liquid waste treatment facility	Decon water
		Storm water/runoff
	Rad liquids, destined for D-waste facility	Liquids from pipe draining
		Liquids encountered in vault
		Liquids (storm water) that entered contaminated trenches, etc.
		Decon water
Disposed of at EOU	USTs	To be disposed under BNL contract

3.6.2 Suspect Clean Materials

Two primary sources make up the suspected clean materials waste stream, including 1) the soil overburden over the A and B Tanks and 2) the asphalt – stone blend and sand covering the D-tank pad. These areas were excavated and characterized. The majority of suspected clean materials were determined to be radiologically contaminated and segregated for disposal.

3.6.3 Material Staged at the Former HWMF Prior to Disposal at Envirocare of Utah (EOU)

All contaminated soil and debris generated at the Waste Concentration Facility were transported to BNL's Former HWMF. Transportation of the waste from the Building 811 area to the railcar loading area (FHWMF) was achieved via roll-off containers and dump trucks. The soil and debris were then loaded for railcar transportation to the radiological disposal facility. All of the soil, debris, and UST waste from this remedial action were disposed of at Envirocare of Utah.

Concrete and Other Non-Metal Debris

Materials of this nature were size reduced to less than 10 inches in order to meet the Envirocare of Utah definition of "soil like" material. Materials were loaded into 15 cubic yard roll-off containers. Characterization, storage, and transfer of these materials were discussed in subsequent sections of this closeout report. Approximately 574 cubic yards of this material was generated.

- A&B tank vault cover;
- Manholes and other concrete features;
- D-tank pad and vault; and
- Wooden appurtenances over A&B tank vault and in D-tank area.

Piping and Metal Debris

Piping and other metal debris were generated during this project. The corrugated metal trench cover associated with the A&B Tanks was removed. Special care was taken to ensure there was no free standing liquid within the pipes. Transport container void space requirements were met through material re-sizing as necessary. Approximately 15 cubic yards of this material was generated.

- A&B Tank piping;
- Asbestos and transite piping;
- D-tank area piping;
- Corrugated metal trench cover;
- Metal appurtenances; and
- Wooden appurtenances over A&B tank vault and in D-tank area

- Approximately 16' of out of service sanitary piping

Special packaging requirements apply to asbestos waste and are outlined in subsequent sections of this *Closeout Report.*

A- and B-Tank Soils

Approximately 5.5 feet of soils were removed from atop the A and B tanks. A total of 452 cubic yards of soils were excavated in six-inch lifts. Monitoring of the soils was performed before they were placed into lined 20-cubic yard roll-off containers. Liners were of sufficient strength to ensure they remained intact during off-loading at the former HWMF ramp area.

D-Tank Soils

Soils associated with the former D-Tank pad were excavated to depths of 30 feet. Soils were removed in six-inch lifts and monitored for radioactivity. This material was loaded into lined, 20-cubic yard roll-off containers. Liners were of sufficient strength to ensure they remained intact during off-loading at the former HWMF ramp area. Approximately 1,613 cubic yards of soils were excavated.

Compactable Debris/DAW

The main component of this waste stream was secondary waste such as Personnel Protective Equipment (PPE), sampling debris, plastics, etc. Also included in this waste stream was the geotextile over the D-Tank pad that was removed. Approximately 30 cubic yards of this waste stream was generated.

3.6.4 Liquid Materials for Onsite Treatment

There were several sources/potential sources for the generation of liquid waste that required management. There were two on-site options for this waste stream, including liquids that met the standards specified for the Sewage Treatment Plant (STP) at BNL and liquids that required consolidation and transfer to the D-Waste Facility (Rad Liquid Waste).

Suspect Clean Liquids Destined for Sanitary Liquid Waste Treatment Facility

Approximately 1800 gallons of decontamination water and storm water/runoff were generated during the course of the Building 811 project. These liquids were packaged and transported to the STP for treatment.

Rad Liquids, Destined for D-Waste Facility

Some liquids generated by draining pipes or encountered at the bottom of vault or trenches exceeded the limits set forth for acceptance at the STP. This waste was collected, characterized, and managed under SBMS *Radioactive Waste Management Plan,* Processing Radioactive Liquid Waste and WMD-SOP-210 WMD Water Processing Operations. Approximately 4,215 gallons of liquid waste, including liquids from pipe draining and in the vaults, respirator wash, dust control, water found in the vaults and pipe pits, and some rain water that entered the vaults was removed.

3.6.5 Materials Destined for Direct Disposal at Envirocare of Utah

The A&B USTs were loaded and transported for direct disposal at Envirocare of Utah. The six existing, out-of-service 8,000-gallon USTs, known as the A & B Tanks, were removed. Videotaped, camera inspections of the tanks performed in 2001 indicated that there was a small amount of standing liquid in the bottom of several of the tanks and absorbent material was added; during the videotaped inspections, it was determined that approximately 30 gallons of absorbed liquid were in the bottom of each tank. The tanks were surveyed in 2001 and beta-gamma dose rates were measured inside the tanks prior to their removal in 2004.

3.6.6 Pollution Prevention and Waste Minimization

Listed below are methods utilized during the Building 811 remediation project to minimize the primary and secondary wastes generated:

- controlling storm water runoff;
- collecting additional characterization data;
- employing decontamination techniques to the vault;
- reuse of the soil and debris (asphalt, etc.) as backfill material where applicable and allowed;
- excavating the least amount of soil/debris required to meet the design drawings;
- judicious use of consumable materials; and
- ensuring that the required radiological surveys are performed to prevent accidental spread of contamination.

3.6.7 Segregation

All wastes generated were segregated and stored in a manner that facilitated effective waste management and disposal. To the extent possible, non-hazardous/non-radioactive, hazardous and radioactive wastes were segregated and containerized/staged based upon waste classification.

3.6.8 Treatment On-Site

Treatment operations were performed to meet the waste acceptance criteria of the anticipated disposal facility, as discussed in the BNL Low Level Radioactive Waste Basis Document. Specifically, this included absorbing free liquids in sludge streams; size reduction of pipeline, concrete vaults, and the D-Tank Pad; fogging the inside of tanks;

coating the outside of tanks; and solidifying absorbed liquids inside the tanks. These tasks were performed to minimize dose rates.

3.6.9 Release of Waste and Property Contaminated with Residual Radioactivity

No waste streams were volumetrically released.

3.6.10 Waste Characterization

Methods used to characterize the Building 811 UST Removal and Soil Remediation Project wastes included process knowledge, and direct sampling and analysis. The majority of the wastes generated from this effort were characterized (preliminarily) as either low-level radioactive or meeting cleanup goals. A Bulk Waste Determination Profile was prepared for the anticipated waste streams that were generated as part of the Building 811 UST Removal and Soil Remediation Project. Process knowledge was used, in part, to characterize the USTs and piping.

Soils considered clean were first screened for radiological contamination on site using the ISOCS unit to detect Cs-137. Using the ISOCS results, on-site ratios were applied to estimate the Sr-90 values. Alternatively, these values were determined using BNL's BetaScint equipment.

Confirmatory characterization/waste verification sampling was performed on all waste packages/streams acceptable to the BNL EWMS Division and the disposal facility.

3.6.11 Waste Stream Sampling Frequency

Waste stream sampling was conducted in accordance with Table 3-3.

Table 3-3
Characterization Sampling

Media	Number of Samples / Analyses
UST vault concrete	1 sample every 10 cubic yards (minimum of 3 samples): Complete TCLP Gamma spectroscopy Strontium-90 Alpha spectroscopy
USTs/Piping absorbed liquids, liquids, sludge	1 sample every 55-gallons: Complete TCLP PCBs Gamma spectroscopy Strontium-90 Alpha spectroscopy
USTs and piping	As required by disposal facility waste acceptance criteria
811 yard soils	1 sample every 350 cubic yards (minimum of 3 samples): Complete TCLP Gamma spectroscopy Strontium-90 Alpha spectroscopy
Former D-tanks Pad debris	1 sample every 140 cubic yards (minimum of 3 samples): Complete TCLP Gamma spectroscopy Strontium-90 Alpha spectroscopy

3.6.12 UST and Piping Characterization Strategy

The tanks were emptied, decontaminated, and triple rinsed in 1998. However, significant dose rates remained, as measured in 2001. Previously obtained characterization data was provided for total dose, gamma dose, and beta dose. The dose rate measurements implied that remnant fixed contamination was present on tank surfaces, especially the tank bottoms. Radionuclide data from the removed sludges indicated that the primary gamma emitting radionuclide was Cs-137 with small contributions from uranium and americium. The primary beta sources were Sr-90 and Cs-137, also with small contributions from uranium. These radionuclides were present as fixed contamination and as expected, alpha emitting radionuclides (transuranics) were also present as fixed contamination. Significant quantities of plutonium were present in removed sludges, and present as fixed contamination. Pipes exhibited a gamma dose rate as expected. The approach presented below combines directly measured quantities with process knowledge.

Quantification of Gamma Emitting Radionuclides

ISOCS was used to quantify gamma-emitting radionuclides, mainly, Cs-137. U-238 was also quantified due to the low yield gamma emission of Pa-234m. Am-241 was also quantified due to a low yield gamma emission. ISOCS instrumentation was designed to quantify gamma-emitting radionuclides by "looking" at large areas with specified geometries and known shielding. In this case, the shielding was the absorbed liquids in the tank bottoms and the known geometry was the tank or the pipe sections.

Quantification of Beta and Alpha Emitting Radionuclides

The largest contribution to the beta dose was due to Sr-90 and Cs-137. Uranium also contributed to the beta dose rate due to the strong beta emitted by Pa-234m, a daughter product of Th-234, which is a daughter of U-238 and is present in equilibrium with both parents. Quantities of beta and alpha emitters were determined by creating ratios of the quantities of gamma emitting radionuclides and the sludge data for beta and alpha emitting radionuclides.

Uranium values were further evaluated by determining if the calculated isotopic abundances were equal to the isotopic abundances present in the sludge.

Plutonium quantification was accomplished using ratios based on the gamma quantification achieved with ISOCS and radionuclide data of removed sludges. Further, some additional quantifications were possible based on quantities of Am-241 dependent upon the level of detail available on the original isotopic abundance of the plutonium and the approximate age.

ISOCS values were compared with fixed lab values to ensure a reasonable correlation existed between quantities of gamma emitters and beta and alpha emitters.

Upon removal of the tanks and piping, external dose rate values were employed. MicroShield calculations were performed to independently determine gamma emitting radionuclide quantities. Calculations accounted for the possibility of Bremsstrahlung radiation resulting from the interaction of strong beta emission from Strontium/Yttrium 90 interacting with the relatively high Z steel tank material.

Waste Certification

All Low-Level Radioactive Waste (LLRW) generated was managed in accordance with the Low Level Waste Certification Program Plan, to ensure that the requirements of the disposal facility's WAC were met. Waste verification sampling for all of the waste streams generated was performed at a frequency approved by BNL's EWMS Division, as outlined in Table 3-4.

Table 3-4
Waste Verification Sampling

Media	**Number of Samples / Analyses**
Soil and Debris	1 sample every 100 cubic yards (1 sample every 5 roll-offs, roll-off contains approximately 15 cubic yards): Complete TCLP Gamma spectroscopy Strontium-90 Alpha spectroscopy Gross Beta PCBs/Pesticides Physical Parameters (pH, Reactivity, flashpoint)

3.6.13 Packaging Requirements

All waste packages met the requirements of the Low Level Waste Procedure, which included: inspections of new packages by BNL's Environmental and Waste Management Services (EWMS) Division prior to use, inspection of containers during and after filling, and final packaging configuration. The intent of properly containing the waste was to prevent the spread of contamination during handling and transport.

All free liquids were removed from dry material volumes and collected in liquid waste containers. The only exception to this rule was asbestos containing waste, which was shipped wet; however, there was no more than 1% free liquid by volume. Additionally, asbestos waste handling required specific licenses and airtight packaging to fully contain the waste.

When filling containers, the introduction of void space was avoided in the waste containers. Void spaces in non-compactable did not exceed two inches or 10% of the total volume. Containers were only opened during filling or material transfer or for sampling. No container was left open.

Transportation/shipping packages for the Building 811 UST Removal and Soil Remediation Project included roll-off containers and pre-blocked and braced transport trailers for the tanks. Transportation of the waste from the Building 811 area to the railcar loading area (former HWMF) was performed by roll-off containers, dump trucks or like vehicle.

MHF, Incorporated and ECDC Logistics, LLC provided railcars for transportation of the waste soil and debris to Envirocare. After the railcars arrived on site, they were inspected and released for loading. The bottom of the inside of each railcar was covered with a geotextile liner and a "burrito bag" liner was placed within each railcar prior to loading. Approximately 80-100 tons of waste was placed into each rail car. The weights of the soil and debris were determined utilizing a bucket scale on the front-end loader. After the waste was loaded into the railcar, the liner was closed/secured using tie wraps and bungee hooks for transport and secured into position. In addition, either a hard or soft tarp cover was secured over each railcar for shipment.

All packages were approved by BNL prior to ordering, inspected by BNL's EWMS Division once on-site, visually inspected by the Waste Manager and surveyed by BNL's Facility Support prior to filling. Surveys of transport vehicles transferring radioactive waste were taken prior to leaving the Building 811 area. Clean overburden transports were accomplished without radiological surveys. All waste containers/transport vehicles were driven through the BNL vehicle monitor (for survey) prior to leaving the site empty.

The Waste Manager was responsible for maintaining control over all waste containers from their arrival on-site to their departure off-site. All waste that was shipped off-site for disposal was immediately packaged into sealed containers. Packaged waste was inspected in accordance with applicable SBMS requirements. In addition, the weight of the waste packages was determined and recorded. BNL's Waste Management Division verified that all of the soils and debris were packaged in accordance with the approved Technical Work Document for loading railcars.

3.6.14 Documentation and Record Keeping

The waste generator completed a Waste Control Form (WCF) (i.e. Radioactive, Non-Hazardous, etc.) for each container of waste generated. These were reviewed by the EWMS Division for waste acceptance and compliance with the approved waste profile and the WAC of the disposal facility. In addition, these forms accompanied the waste during all transport on-site. A waste manifest also accompanied all off-site waste shipments. Other documents that were maintained by the waste generator included the inspection records, characterization documents, and container inventory sheets. Documentation was in accordance with BNL's SBMS. Copies of waste control forms are included as Attachment 3.

3.6.15 Waste Transportation Requirements

Transportation of materials and wastes were conducted in accordance with the following BNL Standard Based Management System (SBMS) procedures:

- Transfer of Hazardous Materials On-site;
- Transport of Hazardous Materials Off-site;
- Transfer of Radioactive Materials On-site;
- Transport of Radioactive Materials Off-site; and
- Hazardous Material Transportation Manual.

Additionally, all transportation was conducted in accordance with U.S. Department of Transportation (USDOT) regulations.

TAG Transport, Inc., a BNL approved hauler, performed the transportation of the USTs to the Envirocare of Utah disposal facility under BNL's contract. Dose values for open transport were measured at the edge of each trailer. In cases where an open transport could not be completed because of dose rate exceedences (greater than 200mR/hr), tanks were loaded in an end-to-end configuration. Shielding and a mesh cover were added to the transport vehicle so that the DOT definition of "closed transport" vehicle was met.

3.7 POST-REMEDIAL DOSE ASSESSMENT

Modeling was performed based on analytical data to determine upon completion to signal the start of the Final Status Survey. Excavation was considered completed when the remaining soils were evaluated and determined to meet the cleanup criteria. A copy of analytical data used to support this is included as Attachment 4. The pathway dose is based on the results of the Final Status Surveys and RESRAD Modeling. Calculations for the post-remedial dose for the work area are included in Section 7 of the *Final Status Survey Report (FSSP)*, included as Attachment 2.

The same input parameters as the *ROD* RESRAD runs was utilized for the selected site remedy. For the Final Status Survey, the activity input parameters input into RESRAD represented the actual average nuclide concentrations present in the Final Status Survey samples. All field and analytical data for modeling inputs was first subject to data validation and data assessment protocols.

The final RESRAD results were compared to the NYSDEC guidance of 10 mrem/yr, which is also contained in the ROD, utilizing the OU I residential scenario, alternative 4 (large scale excavation) RESRAD input parameters for the Building 811 project. The FSSR has been prepared, which includes the final dose assessment and RESRAD calculations. This deliverable has undergone a documented peer review cycle before submission.

3.7.1 Remnant Contamination

Residual soil contamination adjacent to Buildings 810 and 811 that was located within two feet of the building foundations was excluded from the final RESRAD calculations. Removal of these soils would have compromised the structural integrity of the buildings. Sufficient analytical and screening data was collected to quantify the remaining soil contamination, which will be remediated when the operating facilities are decommissioned.

SECTION 4.0
CHRONOLOGY OF EVENTS

- August 25, 1999: Record of Decision Operable Unit I and Radiologically Contaminated Soils
- May 9, 2000: OU I Contaminated Soils Final Remedial Design Work Plan
- June 25, 2001: OU I AOC 10 Bldg. 811 Waste Concentration Facility Final Remedial Action Field Sampling Plan & Final Remedial Action Work Plan
- October 2001: Closeout Report for Removal, Treatment, and Disposal of Radioactive and Mixed Waste Sludge from Building 811 Tanks
- September 13, 2004: Remedial Action mobilization completed
- September 14, 2004: Remedy construction activities commenced
- December 17, 2004: All UST's removed from the underground vaults
- May 19, 2005: Soil remediation completed
- May 23, 2005: ORISE verification sampling completed
- July 11, 2005: Restoration completed

SECTION 5.0
PERFORMANCE STANDARDS AND CONSTRUCTION QUALITY CONTROL

5.1 TECHNOLOGY PERFORMANCE

General construction techniques were used to excavate soil, demolish concrete, lift the UST's, and decontaminate the concrete. Removal of soil exceeding the cleanup guidelines and decontaminating concrete to release criteria was performed to meet the 15mrem goal.

5.2 QA/QC PROTOCOL

All activities associated with remediation of Building 811 were performed in conformance with Weston's Quality Assurance Project Plan (QAPP), which is provided in Appendix F of the *Work Plan for Brookhaven National Laboratory Operable Unit I Building 811 Underground Storage Tank Removal and Remediation*, August 2004. The QAPP was developed in accordance with 10 CFR Part 830, Nuclear Safety Management, Subpart A, Quality Assurance Requirements; DOE Order 414.1B; and the BNL SBMS Requirements. Per the QAPP, all site activities were recorded daily by personnel in field logbooks. All measurements or calculations were checked by at least one additional competent person.

Any significant deviations from the work plan, scope, or schedule were discussed with, and approved by, BNL in the form of Modifications. Each Modification was submitted to Brookhaven in the format of an ER Modification Form. Copies of modification forms are included as Appendix D.

5.3 SAMPLING AND ANALYSIS PROTOCOL

All sampling was performed in accordance with the *Field Sampling Plan*, included as Appendix B of the *Workplan*.

SECTION 6.0
FINAL INSPECTIONS

6.1 ON-SITE INSPECTION RESULTS

Comprehensive on-site audits were performed by subcontractor management and Corporate Environmental Health and Safety personnel throughout the course of the remediation project. Audit findings were reported to Weston management, and any minor deficiencies found during the inspections were immediately corrected. No deficiencies affecting worker health and safety or remediation progress were noted.

BNL provided daily field engineers, ES&H, and radiological supervision to ensure that all work plans, regulations, and polices and plans were adhered. In addition, DOE provided project management and field supervision.

The project was completed with no major safety violations, personnel contaminations, or incidents requiring ORPS reporting.

6.2 INSTITUTIONAL CONTROLS AND MONITORING

Site closure activities are documented in the ROD, and include institutional controls and monitoring for all AOCs following completion of remedial activities. As a result, site closure of the AOCs will be considered after the post-closure period has passed. The institutional controls will include ensuring that land uses remain protective of human health, limit access to the site, to ensure that the cover is not disturbed, and to prevent the installation of drinking water wells in contaminated groundwater.

To ensure the effectiveness of the remedies, post remediation activities will be conducted. These activities will be consisted of groundwater monitoring. Long-term groundwater monitoring will be performed in accordance with BNL's site wide groundwater monitoring plan.

6.3 PROTECTIVENESS

This AOC meets all the completion requirements as specified in OSWER Directive 9320.2-09-A-P, *Closeout Procedures for National Priorities List Sites*. Specifically, confirmatory sampling verifies that the site has achieved the ROD cleanup objective, the unity rule was applied and the final dose assessment demonstrated the cleanup achieved the objective of 15 mrem/yr to a future resident.

Confirmatory soil screening and sampling, backfilling the site with clean soil, and the implementation of institutional controls provide further assurance that the site no longer poses any threats to human health or the environment. All activities outlined under the *ROD* for this area have been completed. A bibliography of all reports relevant to the completion of this project under the Superfund program is included in Appendix E of this report.

The affected areas were remediated in accordance with the decommissioning criteria of 10 CFR Part 834, Radiation Protection for the public and environment. Specifically, Subpart E, 10 CFR 20.1402, Radiological Criteria for Unrestricted Use, allows release of a site for unrestricted use if the residual radioactivity distinguishable from background results in a Total Effective Dose Equivalent (TEDE) to an average member of the critical group that does not exceed 15 mrem/yr and the residual radioactivity has been reduced to levels that are as-low-as-reasonably-achievable (ALARA).

SECTION 7.0
LESSONS LEARNED

During project activities or as part of self-assessments, personnel have identified various occurrences, issues, problems or positive outcomes/experiences that warranted a lessons learned discussion. Project personnel reported such lessons learned opportunities to the Project Manager (PM), who then evaluated and documented the lessons learned using the Weston Lessons Learned Form. Copies of the Lessons Learned Forms developed during the course of the Building 811 remediation are provided as Attachment 8 of Volume 2. The PM and/or project Quality Assurance Manager ensured that project participants were promptly informed of the lessons learned results. The lessons learned were reviewed and discussed during each meeting conducted throughout the duration of the project.

Lessons Learned forms were filled out upon identification of any job practice or site condition that warranted attention, or to provide recognition for a good work practice noted at the job site. Lessons Learned forms generated during the course of the Building 811 Remediation project documented potential hazardous conditions and corrective procedures, or safe methodologies employed to prevent a hazardous condition from arising.

The lessons learned during the performance of the project included the following:

- Clarifying the purpose of the vault covers with the crew
- Timely reporting of elevated air samples
- Heavy equipment delivered without the proper lift chart
- HEP filter clogging with scabbled concrete
- Metal cutting started two small grass fires
- Man-lift delivered with suspect bolts
- A buried phone cable was severed during excavator operations
- Slick working surfaces
- Difficulty in bagging the UST's while on ground level
- Inadequate shielding during welding operations

SECTION 8.0
PROJECT COST SUMMARY

The projected cost for removal of the UST's and approximately 1,100 cubic yards of soils was $3,276,000. The actual cost to complete the project was approximately $6,457,000. The major reason for cost growth was for the cost to excavate and dispose of an additional 3,000 cubic yards of soil and debris. The soil contamination was deeper and more widely spread than the Remedial Investigation or Supplemental Investigation results indicated.

LEGEND:

TITLE:

SITE LOCATION MAP

PROJECT:

Building 811
Close-Out Report

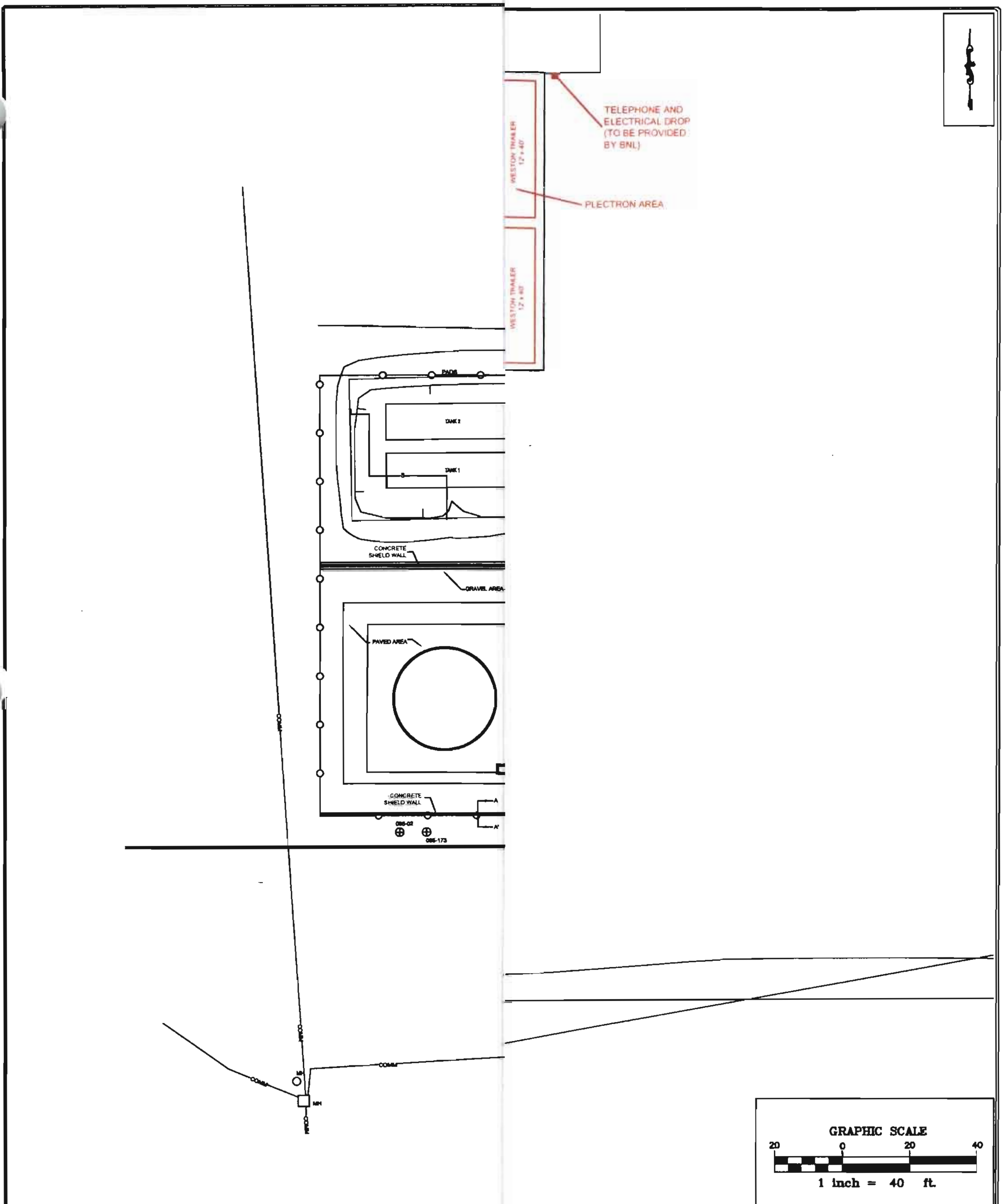
CLIENT NAME: Brookhaven National Labs

WESTON

DATE: Jun 16 2005

FIGURE #: 1-1

P:\BNL ... khaven)\Close-Out Report\01813siteloc.dwg



...NT SERVICE MANAGER: M. JAWORSKI

...CKED BY: M. JAWORSKI

...TRACT NO. ...0

...VERY ORDER NO. ...0

...WN/MODIFIED BY: ...POULTNEY

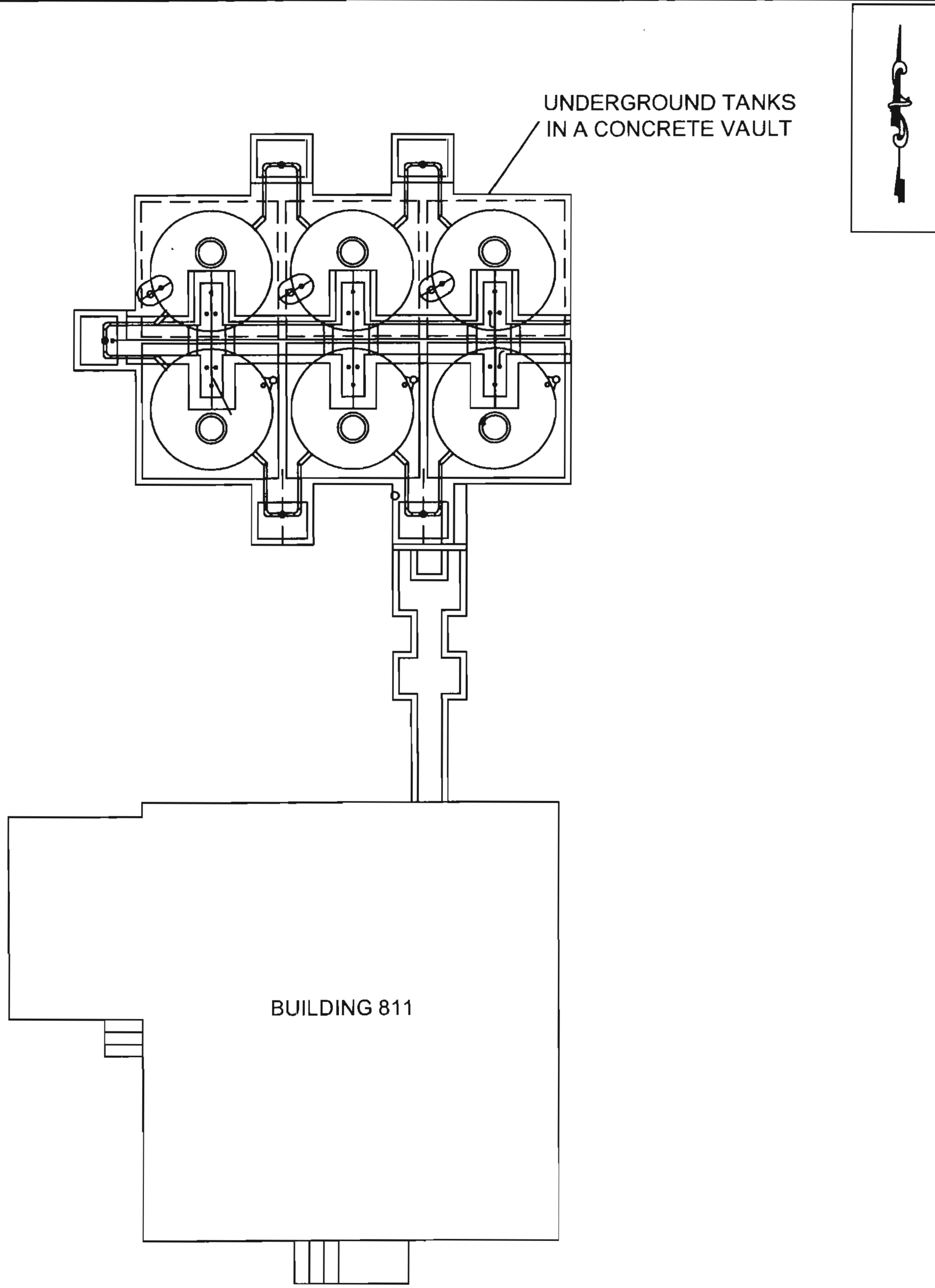
...: ...17 2005

Weston Solutions SM

Weston Solutions, Inc.
205 Campus Drive
Edison, New Jersey 08837-3939
http://www.westonsolutions.com
TEL: (732) 417-5800
FAX: (732) 417-5801

1-2

1" = 40ft



LEGEND:

GRAPHIC SCALE

1/2 0 1/2 1

1 inch = 1 ft.

TITLE:

UST LOCATIONS

PROJECT: Building 811 Close-Out Report

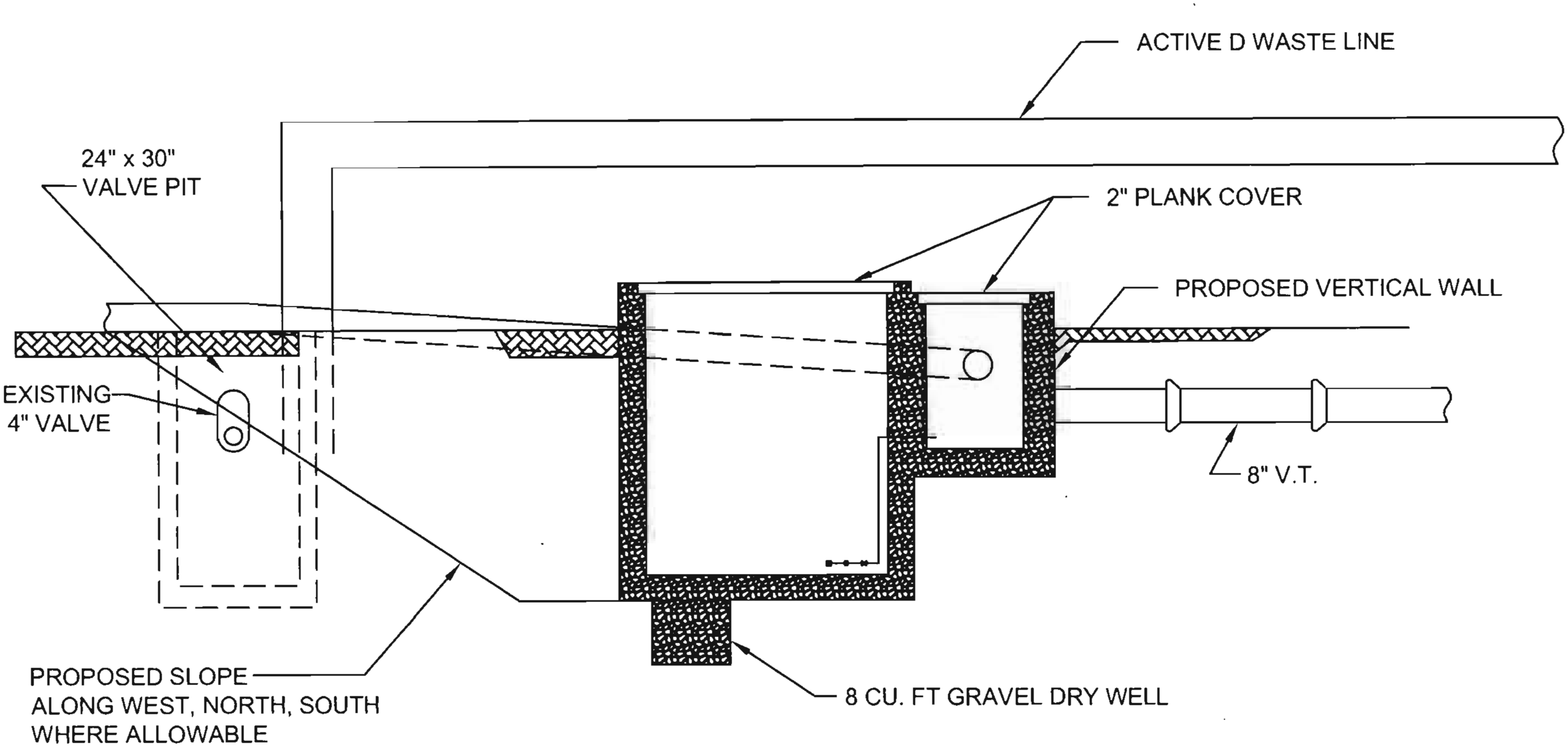
CLIENT NAME: Brookhaven National Labs

WESTON

DATE: Jun 17 2005

FIGURE #: 1-3

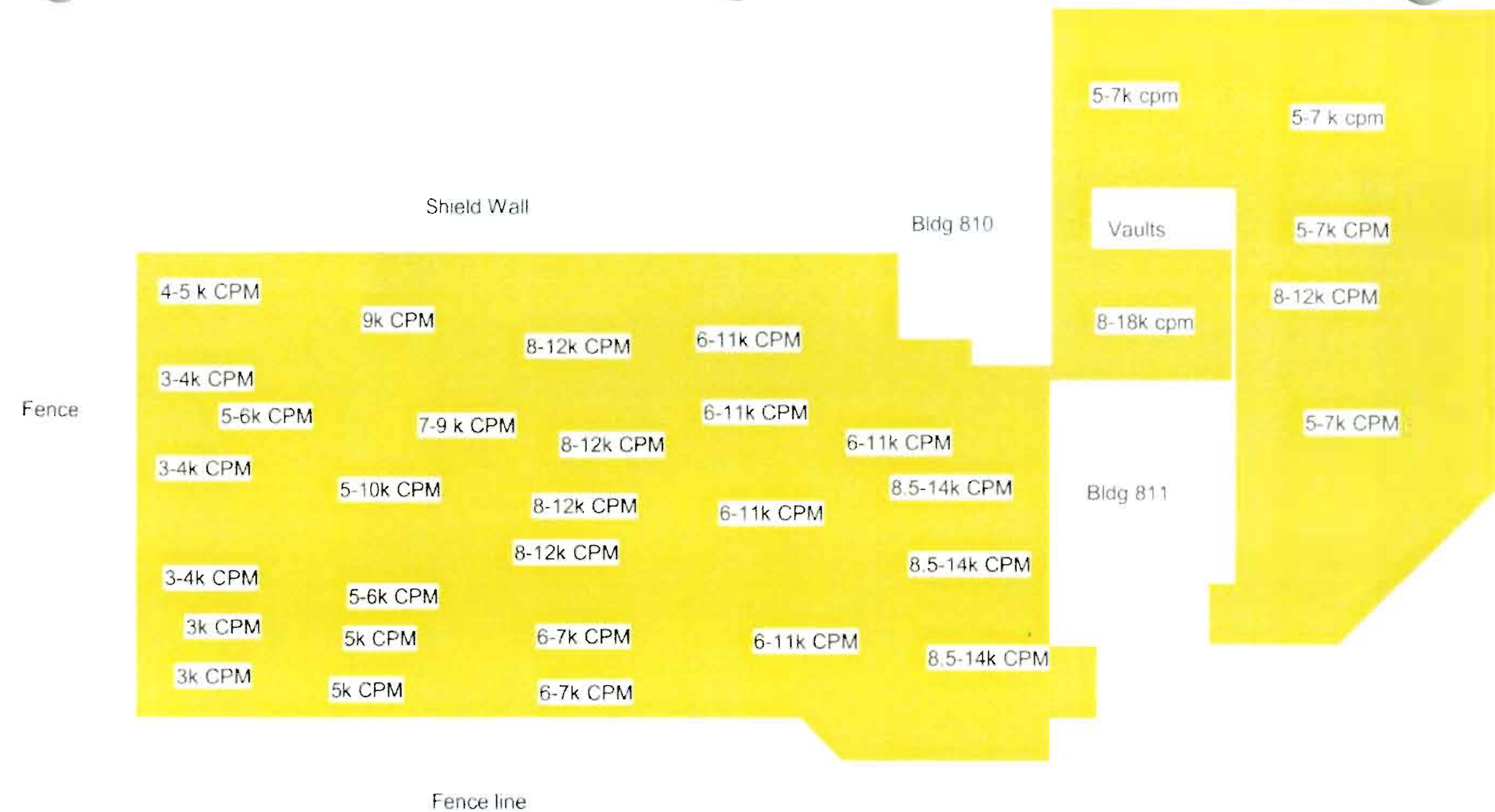
P:\BNL (Brookhaven)\Close-Out Report\02115tanks.dwg



DRAWING NOT TO SCALE

WESTON	PROJECT: Building 811 Close-Out Report	TITLE: D-WASTE VAULT EXCAVATION CROSS SECTION
DATE: 4-18-05	CLIENT NAME: Brookhaven National Labs	
FIGURE #: 3-1		

P:\BNL (Brookhaven)\Close-Out Report\01815wastevault.dwg



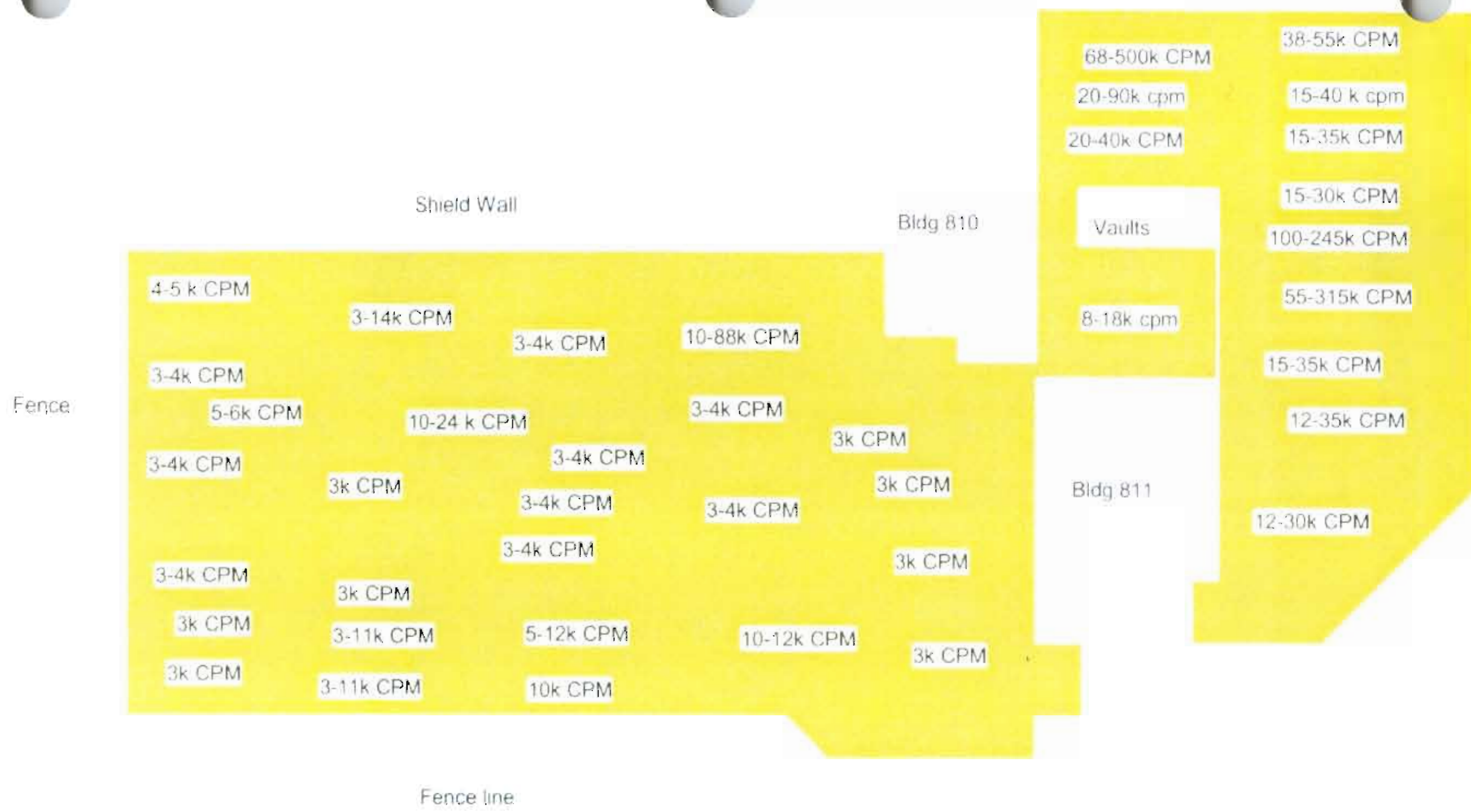
Summary of Final Survey results for 811 area after remediation activities were complete

All measurements performed using Ludlum model 2221(2"x2" NaI)

All measurements recorded approximately 1-2" above soil

WESTON SOLUTIONS	PROJECT: BUILDING 811 REMEDIATION	TITLE: POST-EXCAVATION WALKOVER SURVEY RESULTS
DATE: June 20, 2005	CLIENT NAME: BROOKHAVEN NATIONAL LAB	
FIGURE #: 3-3		

L:\Brookhaven\GIS\MXD\020129_Figure3-3



Summary of initial Survey results for 811 area prior to remediation activities.
All measurements performed using Ludlum model 2221 (2"x2" NaI)
All measurements recorded approximately 1-2" above soil
Some areas contain overburden material

WESTON SOLUTIONS	PROJECT: BUILDING 811 REMEDIATION	TITLE: PRE-EXCAVATION WALKOVER SURVEY RESULTS
DATE: June 20, 2005	CLIENT NAME: BROOKHAVEN NATIONAL LAB	
FIGURE #: 3-2		

L:\Brookhaven\GIS\MXD\020128_Figure3-2

Appendix A
Remediation Photographs

Photo 1: View of the Building 811 remediation project area during initial stages of field activities (A/B yard)

Photo 2: View of the Building 811 remediation project area during initial stages of remediation (D yard)

Photo 3: Uncovering the vaults and valve pits in A/B yard

Photo 4: Access to the work area was allowed only through a gate. The fence line served as the exclusion zone boundary.

Photo 5: Removal of the USTs was performed via crane. Load capacities were carefully calculated prior to lift initiation.

Photo 6: Tanks were placed in bags to prevent contaminant migration during transport.

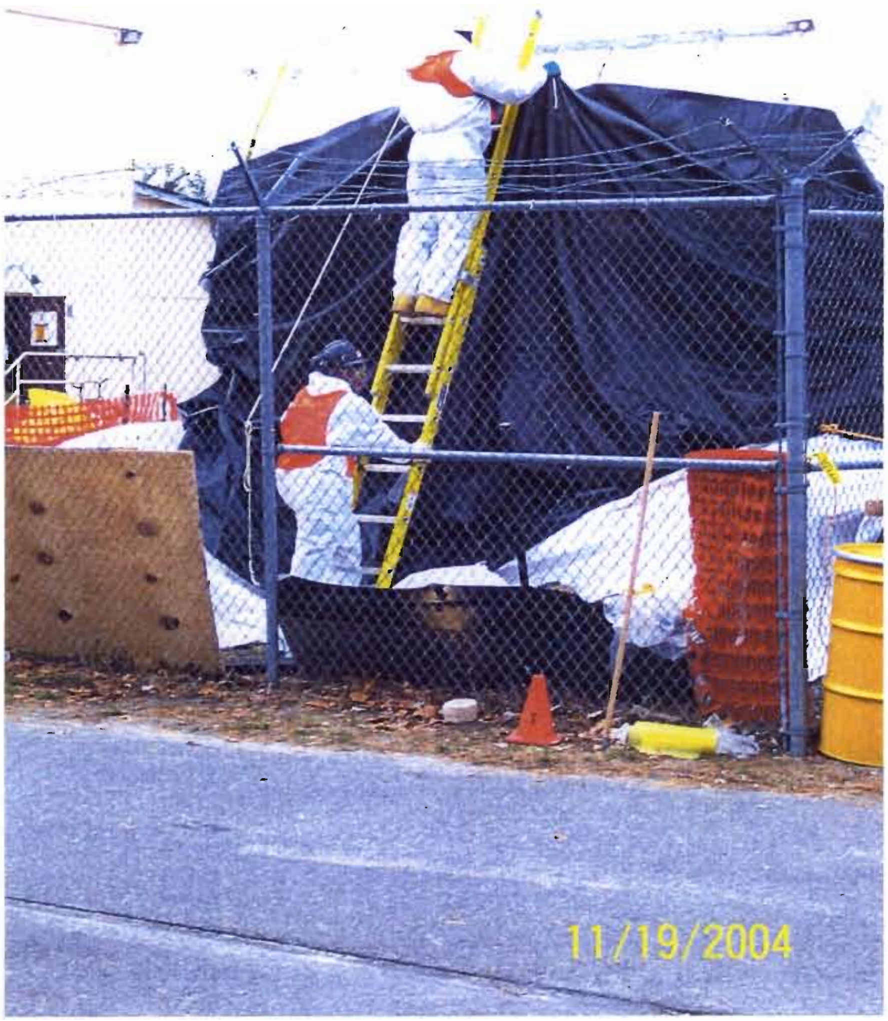


Photo 7: Man lifts were utilized to allow for safe bagging and preparation of USTs prior to transport.

Photo 8: The USTs are loaded and crated for transport to Envirocare

Photo 9: Excavation of Phase 1 soils in the D Yard

Photo 10: Soils from the D Yard were loaded directly into lined roll-off containers

Photo 11: D Yard excavation was completed through use of both shoring systems and trench boxes

Photo 12: Remediation was performed throughout the winter months and included working in adverse conditions.

Photo 13: Decontamination of the vault interiors included scabbling of the inner concrete surfaces to remove contamination

Photo 14: Use of a HEPA vacuum was required during scabbling activities to reduce potential hazard of airborne contaminants

Photo 15: Valve pits were exposed in preparation for remediation

Photo 16: Valve pit covers were removed prior to cleanout

Photo 17: Vault walls are surveyed for radioactive contamination after clean-out

Appendix B
Clean Fill Receipts

Ranco Sand & Stone Corp.
151 SOUTH STREET
MANORVILLE, NEW YORK 11949
OFFICE PHONE: 874-3939 • 874-3993
Ranco 42

№ 6732
DATE

BUYER Weston Solutions
Dlv: Brookhaven Lab Bldg 811
08:27 05/31/05

117060 LB GROSS
34540 LB (K) TARE
82520 LB NET
41.26

WEIGHED BY ____________ SIGNED BY ____________
Processed F.O

Ranco Sand & Stone Corp.
151 SOUTH STREET
MANORVILLE, NEW YORK 11949
OFFICE PHONE: 874-3939 • 874-3993
Ranco 42

№ 6733
DATE

BUYER Western Solutions
Dlv. Brookhaven Lab Bldg 811
09:27 05/31/05

122040 LB GROSS
34540 LB (K) TARE
87500 LB NET
43.75

WEIGHED BY JTD SIGNED BY ____________
Processed Fill

№ 6734
DATE

Ranco Sand & Stone Corp.
151 SOUTH STREET
MANORVILLE, NEW YORK 11949
OFFICE PHONE: 874-3939 • 874-3993

Ranco 42

BUYER Western Solutions
Delv: Brookhaven Lab Bldg 811
10:31 05/31/05

121800 LB GROSS

34540 LB (K) TARE

87260 LB NET

43.63

WEIGHED BY SH SIGNED BY

Processed Fill

№ 6737
DATE

Ranco Sand & Stone Corp.
151 SOUTH STREET
MANORVILLE, NEW YORK 11949
OFFICE PHONE: 874-3939 • 874-3993

Ranco 42

BUYER Western Solutions
Delv: Brookhaven Lab Bldg 811
11:28 05/31/05

119980 LB GROSS

34540 LB (K) TARE

85440 LB NET

42.72

WEIGHED BY SIGNED BY

Processed Fill

Ranco Sand & Stone Corp.
151 SOUTH STREET
MANORVILLE, NEW YORK 11949
OFFICE PHONE: 874-3939 • 874-3993

Ranco 42

№ 6738

DATE

BUYER Western Solutions
Delv: Brookhaven Lab Bldg 811
13:01 05/31/05

117120 LB GROSS

34540 LB (K) TARE

82580 LB NET

41.29

total - 212.65

WEIGHED BY [signature]

SIGNED BY [signature]

Processed Fill

Appendix C
Radiological Survey Forms

Included under separate cover due to size constraints

Appendix D
Modification Forms

Project: EM SURFACE Number: ~~4578~~ 811-01

Initiator: KEVIN KOSKO 9/13/04
Name/Title

Affected Document: BLDG 811 UST REMOVAL & SOIL REMEDIATION Work Plan
Document Revision Required: ☑ Yes ☐ No

Document Section: 3.2.1.7

Description (Attach documents as necessary) REMOVE LEGACY CONCRETE ^installed by EM^ PAD IN ORDER TO ACCESS OVERBURDEN SOILS.

Required Date of Approval: 9/14/04 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ________ YES ✓ NO

2. Prepare Estimate ________ YES ✓ NO

3. Notification Made: (i.e., verbal/e-mail) Teresa M Baker 9/13/04 ER Management
Date/ /Individual's Name

NA DOE
Date/ /Individual's Name

NA EPA/DEC
Date/ /Individual's Name

Resolution/Follow up items: ADD SECTION TO DOCUMENT REMOVAL ACTIONS.

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ____✓____ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☑	☐	Project Manager:	[signature] 9/15/04 Name/Date/Title
☑	☐	Group Manager:	[signature] 9/15/04 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☑	☐	ES&H/.Q Manager/Designee:	[signature] 9/15/04 Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☑	☐ FE	Other	[signature] 9/15/04 Name/Date/Title

Project: EM SURFACE - 157 Number: ~~157~~ P11-02 (initialed)

Initiator: KEVIN KOSKO ES&H OFFICER
Name/Title

Affected Document: BUILDING 811 HASPP			
Document Revision Required:	☑ Yes	☐ No	
Document Section:	JSHA		
Description (Attach documents as necessary)	NEED TO ANALYZE HAZARDS ASSOCIATED WITH FENCE REMOVAL. LIST MITIGATING ACTIONS & CORRECT PPE		
Required Date of Approval:	9/15/04	N/A (i.e., for information only) ☐	

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO

2. Prepare Estimate ______ YES ✓ NO

3. Notification Made: (i.e., verbal/e-mail)

   TERESA BAKER 9/15/04 ER Management
   Date/ /Individual's Name

   NA DOE
   Date/ /Individual's Name

   NA EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items: ADD ADDENDUM TO THE HASPP

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ___✓___ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☑	☐	Project Manager:	Teresa M Dahn 9/15/04 Name/Date/Title
☑	☐	Group Manager:	[signature] 9/15/04 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☑	☐	ES&H/.Q Manager/Designee:	[signature] 9/15/04 Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☑	☐	Other Field Engineer	Thomas [signature] 9/15/04 Name/Date/Title

Project: EM SURFACE - 157 Number: 811-03

Initiator: KEVIN KOSKO EH&S MANAGER
Name/Title

Affected Document: BUILDING 811 WORK PLAN

Document Revision Required: ☑ Yes ☐ No

Document Section: 3.2.3.2

Description (Attach documents as necessary) 9/23/04 DELETE ~~REPLACE~~ THE USE OF A 15'x25' TENT. REPLACE WITH TENTS THAT MEASURES 6'x6'x8' HEPA NEGATIVE AIR MACHINE WILL SERVICE THE TENT *

Required Date of Approval: 9/24/04 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO

2. Prepare Estimate ______ YES ✓ NO

3. Notification Made: (i.e., verbal/e-mail)
   [signature] 9/24/04 — ER Management
   Date/ /Individual's Name
   NA — DOE
   Date/ /Individual's Name
   NA — EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items: Accept as is [signature]

* NEGATIVE AIR MACHINE WILL BE SET @ 1000 CFM. ALL OTHER EXHAUST INFORMATION WILL REMAIN THE SAME.

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ___✓___ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ___0___ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☒	☐	Project Manager:	Teresa M B[illegible] 9/24/04 Name/Date/Title
☒	☐	Group Manager:	[illegible signature] 9/24/04 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☒	☐	ES&H/.Q Manager/Designee:	[illegible signature] 9/27/04 Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☒	☐	~~EPA~~ RCD FS Rep	Cheryl Burns 9/24/04 Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☒	☐	~~Other~~ FE	Thomas D[illegible] 9/24/04 Name/Date/Title

Attachment 1

ER Modification Form

Project: BLDG 811 UST REMOVAL Number: 911-04

Initiator: Rick Eggleston /Project Mgr
Name/Title

Affected Document:	Building ~~[illegible]~~ 811 USTs and Soil Remediation Work Plan		
Document Revision Required:	☒ Yes	☐ No	
Document Section:	3.2.3.1		
Description (Attach documents as necessary)	SEE ATTACHED SHEETS		
Required Date of Approval:	10/4/04	N/A (i.e., for information only) ☐	

Impact of Modification

1. HOLD UP WORK X YES ____ NO
2. Prepare Estimate ____ YES ____ NO
3. Notification Made: (i.e., verbal/e-mail)
   - Teresa M Baker 10/4/04 — ER Management
     Date/ /Individual's Name
   - NA — DOE
     Date/ /Individual's Name
   - NA — EPA/DEC
     Date/ /Individual's Name

Resolution/Follow up items: Change plan via this modification. [initials]

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ✓ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☑	☐	Project Manager:	Teresa M Baker 10/4/04 Name/Date/Title
☑	☐	Group Manager:	[signature] for TD 10/4/04 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☑	☐	ES&H/.Q Manager/Designee:	[signature] 10/4/04 Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☑	☐	~~EPA~~ BNL HES Officer	Name/Date/Title
☑	☐	~~DEC~~ FS Representative	Cheryl Burns 10/4/04 Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☑	☒	Other FG	[signature] 10/4/04 Name/Date/Title

Attachment 1

ER Modification Form

Project: BLDG 811 UST REMOVAL Number: 811-05

Initiator: Rick Eggleston/Project Manager
Name/Title

Affected Document:	EXCAVATION Plan		
Document Revision Required:	☐ Yes	☒ No	
Document Section:	6.3		
Description (Attach documents as necessary)	SEE ATTACHED SHEET		
Required Date of Approval:	10/4/04	N/A (i.e., for information only) ☐	

Impact of Modification

1. HOLD UP WORK ____ YES ✓ NO

2. Prepare Estimate ____ YES ✓ NO

3. Notification Made: (i.e., verbal/e-mail)
   - Teresa M Baker 10/4/04 — Date/ /Individual's Name — ER Management
   - NA — Date/ /Individual's Name — DOE
   - NA — Date/ /Individual's Name — EPA/DEC

Resolution/Follow up items:

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ____✓____ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☒	☐	Project Manager:	Terese M Ash 10/4/04 Name/Date/Title
☐	☐	Group Manager:	Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☐	☐	ES&H/.Q Manager/Designee:	Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☒	☐	T. Doyle ~~SCDHS~~ FE	Thomas Doyle 10/4/04 Name/Date/Title
☒	☒	A. Raphael ~~Other~~ PE	Al Raphael 10/4/04 Name/Date/Title

Attachment 1
ER Modification Form

Project: BUILDING 811 UST Number: 811-06

Initiator: KEVIN KOSKO ES&H MANAGER
Name/Title

Affected Document: BLDG 811 WORK PLAN

Document Revision Required: ☑ Yes ☐ No

Document Section: 3.2.3.1 (PAGE 14)

Description (Attach documents as necessary) WESTON PLANS TO USE FOAM AGENT TO CONTROL/MITIGATE CONTAMINATION LEVELS TO ACCEPTABLE LEVELS. THE (6) 6" VAULT VENTS*

Required Date of Approval: ________ N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ____ YES ✓ NO
2. Prepare Estimate ____ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail) [signature] 10/07/04 ER Management
   Date/ /Individual's Name

   ________ DOE
   Date/ /Individual's Name

   ________ EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items: Pipes must be foamed that correspond to smears A2 & A6

ARE EITHER BELOW UNCONDITIONAL RELEASE LEVELS OR MINIMALLY CONTAMINATED AS DETERMINED BY SURVEYS OF THE ENTIRE LINE. THE WORK AREA IS POSTED AND CONTROLLED AS A CONTAMINATION AREA. THIS CHANGE...

liquid waste shall be conducted in accordance with the approved Field Sampling Plan, the project Waste Management Plan, and the disposal facility's waste acceptance criteria (WAC). All analysis will be performed within a 3-day turnaround time (TAT) unless longer TATs can be utilized without affecting the project schedule. WESTON will utilize the analytical data to prepare the waste profiles in accordance with disposal facility requirements. After the pipes have been drained, pipe ends will be resealed in place.

WESTON will attach a passive aerosol generator to the selected pipe cut locations and passively apply non-hazardous fixative to the piping and tank internals. A Material Safety Data Sheet (MSDS) for the fixative fog and all PPE requirements will be provided to BNL five days before its application. Encapsulation Technologies, Inc. proprietary fixative "fog" and delivery system will be used to achieve this task. This fixative is applied remotely therefore personnel exposure is maintained ALARA. Due to the fact the fixative "fog" is applied passively, hazards associated with re-suspension of particulate airborne contamination during application are completely mitigated. The fog will not only coat the piping internals, but it can also penetrate the associated tank internals if desired, given there are no complete blockages. The fixative will serve as primary containment to mitigate release of contamination.

Once the fogging is complete, a foaming agent will be applied to the pipe where cuts will be made. This will act to seal the ends of the pipe and provide additional contamination control. Sections of piping will be removed, sized, reduced and placed in appropriate and approved containers including B-25 boxes or intermodal boxes. WESTON will "cold" cut all pipes on this project per the sizing requirements of BNL's waste disposal contract with Envirocare of Utah. WESTON will utilize 4-wheel hinged cutters which do not produce sparks, therefore producing a safer environment and thus eliminating the requirement of "hot work" permits for this work. The cutters only require six inches of clearance around the pipe and can be utilized in minimum clearance areas. Prior to cutting, all pipes will be cleaned in the area to be cut. A small diameter hole will be drilled into the pipe and an expandable foam sealant will be injected. After the foam is cured, the pipe will be cut. WESTON will use direct ventilation HEPA equipment positioned adjacent to the cutting area. The HEPA exhaust will be monitored for radiological contamination.

WESTON will place the piping inside a separate container which may include an intermodal box, a B-25 box, or other appropriate container approved by BNL for transportation and disposal. They will not be placed inside of the USTs unless directed by BNL or added as debris to project soils unless directed by BNL.

The ten-inch transite pipe and the 7" asbestos insulated pipe will be demolished by appropriately qualified and licensed professionals which are part of the WESTON Team. Engineering controls such as glove bagging, misting and/or the use of surfactants will be used to mitigate fugitive emissions. During removal of asbestos insulated piping, a glovebag will be installed and sections of asbestos removed. The newly exposed piping will be wiped down and a surfactant applied. The pipe will then be cut (using mechanical methods) and sleeved with plastic. The piping will

Attachment 1

ER Modification Form

07 ⓓ

Project: BLDG 811 UST REMOVAL Number: 811-08

Initiator: Rick Eggleston / Project Manager
Name/Title

Affected Document:

Document Revision Required: ☒ Yes ☐ No

Document Section: BLDG 811 Health and Safety Plan

Description (Attach documents as necessary) Incorporate JSHA into Health & Safety Plan. SEE ATTACHED JSHA + DOE LESSONS LEARNED DOCUMENT.

Required Date of Approval: 10/11/04 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ✓ YES ______ NO
2. Prepare Estimate ______ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail) [signature] 10/11/04 ER Management
   Date/ /Individual's Name

   ______ DOE
   Date/ /Individual's Name

   ______ EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items: Flame Retardent should include the shoe cover area. Refer to lessons learned that are attached.

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ________ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		Name/Date/Title
☒	☐	Project Manager:	[signature] 10/11/04
☒	☐	Group Manager:	[signature] 10/11/04
☐	☐	DOE:	
☒	☐	ES&H/.Q Manager/Designee:	[signature] 10/11/04
☐	☐	Quality Representative:	
☒	☐	~~EPA~~ FS Rep	Cheryl Burns 10/11/04
☐	☒	~~DEC~~ Brian Heneveld	NA [initials]
☐	☐	SCDHS	
☒	☐	Other Field Engineer	[signature] 10/11/04

Attachment 1

ER Modification Form

Project: BLDG 811 UST REMOVAL Number: 811-08

Initiator: Rick Eggleston / Project Manager
Name/Title

Affected Document:	Work Plan			
Document Revision Required:	☐	Yes	☑	No
Document Section:	3.2.2.1			
Description (Attach documents as necessary)	SEE ATTACHED Procedure for Concrete vault Removal			
Required Date of Approval:	10/13/04	N/A (i.e., for information only) ☐		

Impact of Modification

1. HOLD UP WORK ✓ YES ____ NO
2. Prepare Estimate ____ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail)
   - Teresa McOakey 10/13/04 — Date/ /Individual's Name — ER Management
   - NA — Date/ /Individual's Name — DOE
   - NA — Date/ /Individual's Name — EPA/DEC

Resolution/Follow up items: approve procedure for 1st UST (A3), incorporate lessons learned after 1st UST and revise procedure, as necessary. [initials]

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ______ YES ✓ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ______ Schedule Impact: ______ (days/weeks/months)

2. Required Change Information detailed and forwarded, ______ Initials

(Check if required)

Final Approvals	Information Only		Name/Date/Title
☒	☐	Project Manager:	Teresa M Baker 10/13/04
☒	☐	Group Manager:	[signature] 10/13/04
☐	☐	DOE:	
☒	☐	ES&H/.Q Manager/Designee:	[signature] 10/13/04
☐	☒	~~Quality Representative:~~ Brian Heneveld	NA
☒	☐	~~EPA~~ FS Representative	Cheryl Burns 10/13/04
☐	☐	DEC	
☐	☐	SCDHS	
☒	☐	Other Field Engineer	Thomas Doyle 10/13/04

Attachment 1

ER Modification Form

Project: BLDG 811 UST REMOVAL Number: 811-09

Initiator: Rick Eggleston / Proj MGR
Name/Title

Affected Document:	WORK PLAN / HEALTH & SAFETY Plan		
Document Revision Required:	☐ Yes	☒ No	
Document Section:	WORK PLAN 3.2.2.1 Concrete Vault Cover DEMO HEALTH & SAFETY Plan - TABLE 15-1 JSA'S		
Description (Attach documents as necessary)	See attached.		
Required Date of Approval:	10/15/04	N/A (i.e., for information only) ☐	

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO

2. Prepare Estimate ______ YES ✓ NO

3. Notification Made: (i.e., verbal/e-mail)

Teresa M Baker 10/15/04 — ER Management
Date/ /Individual's Name

NA — DOE
Date/ /Individual's Name

NA — EPA/DEC
Date/ /Individual's Name

Resolution/Follow up items: Modification is acceptable during demo of concrete cover. A new modification should be submitted for fall protection during rebar cutting in annular space and over-flow piping cutting and removal.

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ______ YES ✓ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ______ Schedule Impact: ______ (days/weeks/months)

2. Required Change Information detailed and forwarded, ______ Initials

(Check if required)

Final Approvals	Information Only		
☒	☐	Project Manager:	[signature] 10/15/04 Name/Date/Title
☒	☐	Group Manager:	[signature] 10/12/04 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☒	☐	ES&H/.Q Manager/Designee:	[signature] 10/18/04 Name/Date/Title
☒	☐	~~Quality Representative:~~ FS Representative	Cheryl Burns 10/21/04 Name/Date/Title
☒	☐	~~EPA~~ HESO – Brian Heneveld	NA Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☒	☐	~~Other~~ Field Engineer	[signature] Name/Date/Title

Attachment 1

ER Modification Form

Project: EM SURFACE - 157 Number: 811 - 10

Initiator: KEVIN KOSKO (PROJECT MANAGER)
Name/Title

Affected Document: BLDG 811 WORK PLAN

Document Revision Required: ☑ Yes ☐ No

Document Section: 3.2.3.2

Description (Attach documents as necessary) SEE ATTACHED DOCUMENT

Required Date of Approval: 10/19/04 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ✓ YES ____ NO
2. Prepare Estimate ____ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail) TERESA BAKER 10/18/04 ER Management
   Date/ /Individual's Name
   NA DOE
   Date/ /Individual's Name
   NA EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items: Hole covers require evaluation after installation for adequacy. [initials]

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ✓ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☒	☐	Project Manager:	Teresa M Bell 10/21/04 Name/Date/Title
☒	☐	Group Manager:	[signature] 10/21/04 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☒	☐	ES&H/.Q Manager/Designee:	[signature] 10/22/04 Name/Date/Title
☒	☒	~~Quality Representative:~~ HESO Brian Heneveld	NA Name/Date/Title
☒	☐	~~EPA~~ FS Rep.	Cheryl Burns 10/21/04 Name/Date/Title
~~☒~~	~~☐~~	~~DEC~~ PE [initials]	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☒	☐	~~Other~~ Field Engineer	[signature] 10/21/04 Name/Date/Title

Attachment 1

ER Modification Form

Project: EM SURFACE-157 Number: 811-11

Initiator: KEVIN KOSKO (PROJECT MANAGER)
Name/Title

Affected Document:	BLDG 811 WORK PLAN			
Document Revision Required:	☑	Yes	☐	No
Document Section:	FIGURE 4 of 9			
Description (Attach documents as necessary)	SHIELD wall Lifting Procedure (see attached)			
Required Date of Approval:	10/21/04	N/A (i.e., for information only) ☐		

Impact of Modification

1. HOLD UP WORK ✓ YES ____ NO
2. Prepare Estimate ____ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail)
   - TERESA BAKER 10/20/04 — ER Management
     Date/ /Individual's Name
   - NA — DOE
     Date/ /Individual's Name
   - NA — EPA/DEC
     Date/ /Individual's Name

Resolution/Follow up items: Approve for 1st section, review implementation and determine appropriate revision, as necessary. Implementation was observed on 10/21 and was found to be acceptable.

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ______ YES ✓ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ______ Schedule Impact: ______ (days/weeks/months)

2. Required Change Information detailed and forwarded, ______ Initials

(Check if required)

Final Approvals	Information Only		
☒	☐	Project Manager:	[signature] 10/20/04 Name/Date/Title
☒	☐	Group Manager:	[signature] 10/21/04 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☒	☐	ES&H/.Q Manager/Designee:	[signature] 10/22/04 Name/Date/Title
☒ OG	☒	~~Quality Representative~~: Brian Horeveld HES Officer	NA Name/Date/Title
☒	☐	EPA FS Rep.	Cheryl Burns 10/21/04 Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☒	☐	Other FE	Thomas [signature] Name/Date/Title

Attachment 1

ER Modification Form

Project: EM SURFACE-157 Number: 811-12

Initiator: KEVIN KOSKO PROJECT MANAGER
Name/Title

Affected Document: BUILDING 811 UST REMOVAL WORK PACKAGE

Document Revision Required: ☑ Yes ☐ No

Document Section: 3.2.3.2

Description (Attach documents as necessary) DELETE REQUIREMENT TO ATTACH VENTILATION (HEPA NAM) TO THE UST'S. REPLACE WITH REQUIREMENT FOR LOCALIZED VENTILATION

Required Date of Approval: 10/21/04 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ✓ YES ____ NO

2. Prepare Estimate ____ YES ✓ NO

3. Notification Made: (i.e., verbal/e-mail)

10/21/04 TERESA BAKER — ER Management
Date/ /Individual's Name

NA — DOE
Date/ /Individual's Name

NA — EPA/DEC
Date/ /Individual's Name

Resolution/Follow up items: Delete, section conflicts with previous section on 3-14. Provide HEPA Negative air at location of cut after water/liquids in line have been purged. TJB

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ___✓___ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☒	☐	Project Manager:	[signature] 10/21/04 Name/Date/Title
☒	☐	Group Manager:	[signature] 10/21/04 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☒	☐	ES&H/.Q Manager/Designee:	[signature] 10/21/04 Name/Date/Title
☒	☒	~~Quality Representative:~~ He's Officer Brian Henerald	NA Name/Date/Title
☒	☐	~~EPA~~ FS Rep	Cheryl Burns 10/21/04 Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☑	☐	Other Field Engineer	Thomas [signature] [date] Name/Date/Title

Attachment 1
ER Modification Form

Project: EM SURFACE-157   Number: 811-13

Initiator: KEVIN KOSKO
Name/Title

Affected Document: BUILDING 811 UST REMOVAL WORK PLAN

Document Revision Required: ☑ Yes ☐ No

Document Section: 3.2.3.2

Description (Attach documents as necessary) * THE WESTON TEAM HAS OPENED AND EVALUATED CONDITIONS IN ~~ALL (6) USTs~~ UST A3 on. DUE TO THE ~~ABSENCE OF AIRBORNE CONTAMINATION~~ and uneven work surfaces KK, ~~TENTS WILL NO LONGER BE REQUIRED TO OPEN TANKS~~ KK 10/21/04

Required Date of Approval: 10/21/04   N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ✓ YES ____ NO
2. Prepare Estimate ____ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail)

10/21/04 TERESA BAKER — ER Management
Date/ /Individual's Name

NA — DOE
Date/ /Individual's Name

NA — EPA/DEC
Date/ /Individual's Name

Resolution/Follow up items: LOCALIZED VENTILATION WILL BE UTILIZED IN THE IMMEDIATE AREA OF OPEN MANWAY. MANWAYS KK WILL BE OPENED FOR MEASUREMENTS AND VISUAL INSPECTION ONLY.

* This modification is for a one time use to measure the amount of rad sorb in tank A3. Measuring stick will be wiped down as it comes out of the tank.
...ork cannot be performed in winds greater than 15 mph.

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ✓ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________
Initials

(Check if required)

Final Approvals	Information Only		
☒	☐	Project Manager:	Terese M Bush 10/21/04 Name/Date/Title
☒	☐	Group Manager:	[signature] 10/20/04 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☒	☐	ES&H/.Q Manager/Designee:	[signature] 10/22/04 Name/Date/Title
☒	☐	~~Quality Representative:~~ FS Representative	Cheryl Burns 10/21/04 Name/Date/Title
☐	☒	~~EPA~~ H&S Officer Brian Heneveld	NA Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☒	☐	~~Other~~ Field Engineer	Thomas Daly [date illegible] Name/Date/Title

Attachment 1

ER Modification Form

Project: EM-SURFACE-157 Number: 811-14

Initiator: KEVIN KOSKO ES&H MANAGER
Name/Title

Affected Document: BUILDING 811 UST REMOVAL HASPP

Document Revision Required: ☑ Yes ☐ No

Document Section: TABLE 15-1

Description (Attach documents as necessary) ADD DETAIL TO THE SHIELD WALL TRANSPORTATION JSHA.

Required Date of Approval: 10/25/04 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO

2. Prepare Estimate ______ YES ✓ NO

3. Notification Made: (i.e., verbal/e-mail)
   10/25/04 TERESA BAKER ER Management
   Date/ /Individual's Name
   NA DOE
   Date/ /Individual's Name
   NA EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items: approve as is. [initials]

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ✓ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☒	☐	Project Manager:	[signature] 10/25/04 Name/Date/Title
☒	☐	Group Manager:	[signature] 10/21/04 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☒	☐	ES&H/.Q Manager/Designee:	[signature] 10/26/04 Name/Date/Title
☒	☒	~~Quality Representative:~~ H&S Officer - Brian Henerveld	NA Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☒	☐	~~SODHS~~ FE	Thomas [signature] Name/Date/Title
☐	☒	Other FS REP	Cheryl Burns 10/25/04 FS Rep Name/Date/Title

Attachment 1

ER Modification Form

Project: EM-SURFACE-157 Number: 811 - 15

Initiator: KEVIN KOSKO ES&H MANAGER
Name/Title

Affected Document: BLDG 811 HASPP

Document Revision Required: ☑ Yes ☐ No

Document Section: TABLE 15-1

Description (Attach documents as necessary) ADD ADDITIONAL DETAIL TO THE UST PREPARATIONS PORTION OF THE JSHA.

Required Date of Approval: 10/25/04 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO

2. Prepare Estimate ______ YES ✓ NO

3. Notification Made: (i.e., verbal/e-mail)
10/25/04 TERESA BAKER — ER Management
Date/ /Individual's Name
NA — DOE
Date/ /Individual's Name
NA — EPA/DEC
Date/ /Individual's Name

Resolution/Follow up items: Approve as is.

Attachment 1

ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ✓ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		Name/Date/Title
☒	☐	Project Manager:	[signature] 10/25/04
☒	☐	Group Manager:	[signature] 10/25/04
☐	☐	DOE:	
☒	☐	ES&H/.Q Manager/Designee:	[signature] 10/28/04
☐	☒	~~Quality Representative:~~	NA
☒	☐	~~FS Representative~~ HES Officer Brian Hengeld ~~EPA~~ Field Engineer	Thomas Doyle 10/25/04
☐	☐	DEC	
☐	☐	SCDHS	
☒	☐	Other FS REP	Cheryl Burns 10/25/04 FS Rep

Attachment 1

ER Modification Form

Project: BLDG 811 UST Removal Number: 811-16

Initiator: Dennis Pasatieri / Interim Project Manager
Name/Title

Affected Document: Work Plan and HASPP

Document Revision Required: ☐ Yes ☑ No

Document Section: 3.2.3.1

Description (Attach documents as necessary) Add the use of a band saw in addition to 4-wheel hinged pipe cutter to cold cut piping to/from tanks.

Required Date of Approval: 10/25/04 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ✓ YES ____ NO

2. Prepare Estimate ____ YES ✓ NO

3. Notification Made: (i.e., verbal/e-mail)

Teresa M Baker — ER Management
Date/ /Individual's Name

NA — DOE
Date/ /Individual's Name

NA — EPA/DEC
Date/ /Individual's Name

Resolution/Follow up items: 4-wheel hinged pipe cutter should be used whenever logistically possible. ceo

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ______ YES ✓ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ______ Schedule Impact: ______ (days/weeks/months)

2. Required Change Information detailed and forwarded, ______ Initials

(Check if required)

Final Approvals	Information Only		
☒	☐	Project Manager:	[signature] 10/26/04 Name/Date/Title
☒	☐	Group Manager:	[signature] 10/26/04 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☒	☐	ES&H/.Q Manager/Designee:	[signature] 10/26/04 Name/Date/Title
☒	☐	~~Quality Representative:~~ FS Representative	Cheryl Burns 10/26/04 Name/Date/Title
☐	☒	~~EPA~~ H&S Officer Brian Heneveld	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☒	☐	~~Other~~ Field Engineer	Thomas Doyle 10/26/04 Name/Date/Title

Attachment 1

ER Modification Form

Project: EM SURFACE-157 Number: 811-1B ~~02~~

Initiator: KEVIN KOSKO ES&H MANAGER
Name/Title

Affected Document: BLDG 811 WORK PLAN

Document Revision Required: ☑ Yes ☐ No

Document Section: 3.2.3.2

Description (Attach documents as necessary) THROUGH SAMPLING & ANALYSIS, BNL AND WESTON HAVE AGREED THAT CONTAINMENT TENTS ARE NO LONGER REQUIRED TO OPEN UST MANWAYS.

Required Date of Approval: 11/1/04 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ✓ YES ____ NO

2. Prepare Estimate ____ YES ✓ NO

3. Notification Made: (i.e., verbal/e-mail) TERESA BAKER 11/1/04 — ER Management
   Date/ /Individual's Name

   N A — DOE
   Date/ /Individual's Name

   N A — EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items: B vaults air sample = 174% of DAC 10/6/04
Work I/s fenced area = 101% of DAC 10/13/04
High vol I/s tent B3 tank = 34% 10/13/04
High vol I/s tent A2 tank = 234% 10/13/04

Tent not required for A1 & A3, B3

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ✓ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☒	☐	Project Manager:	[signature] 11/1/04 Name/Date/Title
☒	☐	Group Manager:	[signature] 11/1/04 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☒	☐	ES&H/.Q Manager/Designee:	[signature] 11/1/04 Name/Date/Title
☒	☐	~~Quality Representative:~~ FS Rep.	Cheryl Burns 11/1/04 Name/Date/Title
☐	☒	~~EPA~~ H&S Officer Brian Heneveld	NA Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☒	☐	~~Other~~ Field Engineer	[signature] 11/1/04 Name/Date/Title

Attachment 1

ER Modification Form

Project: EM SURFACE-157 Number: 811-19

Initiator: KEVIN KOSKO ES&H MANAGER
Name/Title

Affected Document: BUILDING 811 WORK PLAN				
Document Revision Required:	☑	Yes	☐	No
Document Section:	3.2.6			
Description (Attach documents as necessary)	PLEASE SEE ATTACHED MODIFICATION			
Required Date of Approval: 11/2/04		N/A (i.e., for information only) ☐		

Impact of Modification

1. HOLD UP WORK ✓ YES ____ NO
2. Prepare Estimate ____ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail)
   - 11/2/04 TERESA BAKER — ER Management
     Date/ /Individual's Name
   - NA — DOE
     Date/ /Individual's Name
   - NA — EPA/DEC
     Date/ /Individual's Name

Resolution/Follow up items:

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ___✓___ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☒	☐	Project Manager:	[signature] 11/3/04 — Name/Date/Title
☒	☐	Group Manager:	[signature] for T.D. 11/3/04 — Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☒	☐	ES&H/.Q Manager/Designee:	[signature] 11/3/04 — Name/Date/Title
☒	☒	~~Quality Representative:~~ ~~FS Representative~~ or HES Officer Brian Heneveld	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☒	☐	~~SCDHS~~ Field Engineer	Thomas [signature] 11/3/04 — Name/Date/Title
☒	☑	~~Other~~ FS Representative	Cheryl Burns 11/2/04 FS Rep — Name/Date/Title

Attachment 1

ER Modification Form

Project: EM SURFACE - 157 Number: 811-~~17~~ 20

Initiator: KEVIN KOSKO ES&H MANAGER
Name/Title

Affected Document: BUILDING 811 WORK PLAN				
Document Revision Required:	☑	Yes	☐	No
Document Section:	3.2.3.1			
Description (Attach documents as necessary)	PLEASE SEE ATTACHED DOCUMENT DESCRIBING MANWAY DOWN-SIZING OPERATIONS			
Required Date of Approval: 11/01/04		N/A (i.e., for information only) ☐		

Impact of Modification

1. HOLD UP WORK ✓ YES ____ NO
2. Prepare Estimate ____ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail)
   11/01/04 TERESA BAKER — ER Management
   Date/ /Individual's Name
   NA — DOE
   Date/ /Individual's Name
   NA — EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items: Size reduce man-way to meet Envirocare of Utah debris standard, per specification. Pipe cap for man-way shall meet transportation requirements. have excavator flatten manway cut piece in lieu of cutting for size reduction.

Attachment 1

ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ **YES** ✓ **NO**

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☒	☐	Project Manager:	~~Teresa M Baker 11/1/04~~ Teresa M Baker 11/3/04 Name/Date/Title
☐	☒	Group Manager:	~~11/1/04~~ for TD 11/3/04 Name/Date/Title
☐	☒	DOE: Waste Management Mike Clancy	NA Name/Date/Title
☒	☐	ES&H/.Q Manager/Designee:	11/1/04 Name/Date/Title
☒	☐	~~Quality Representative:~~ FS Rep.	Cheryl Burns 11/3/04 ~~Cheryl Burns 11/1/04~~ Name/Date/Title
☐	☒	~~EPA~~ H&S officer Brian Heneveld	NA Name/Date/Title
☒	☐	~~DEC~~ ~~WE~~ Field Engineer	Thomas Dyke 11/1/04 Thomas Dyke 11/3/04 Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☐	☐	Other	Name/Date/Title

Attachment 1

ER Modification Form

Project: EM SURFACE-157 Number: 811-21

Initiator: KEVIN KOSKO ES&H MANAGER
Name/Title

Affected Document: BLDG 811 HASPP / WORK PLAN				
Document Revision Required:	☑	Yes	☐	No
Document Section:	15-1			
Description (Attach documents as necessary)	THE WESTON TEAM WILL UTILIZE A PUMP TO REMOVE WATER FROM UST VAULTS/SUMPS AND TRANSFER TO DOUBLE-WALLED WM TANK			
Required Date of Approval: 11/3/04	N/A (i.e., for information only) ☐			

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO

2. Prepare Estimate ______ YES ✓ NO

3. Notification Made: (i.e., verbal/e-mail)

11/3/04 TERESA BAKER Date/ /Individual's Name	ER Management
NA Date/ /Individual's Name	DOE
NA Date/ /Individual's Name	EPA/DEC

Resolution/Follow up items: Use RWP ERD04-11, approve with #7. [initials]

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ✓ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		Name/Date/Title
☒	☐	Project Manager:	Teresa M Baker 11/3/04
☒	☐	Group Manager:	[signature] TO 11/3/04
☐	☐	DOE:	
☒	☐	ES&H/.Q Manager/Designee:	
☒	☒	~~Quality Representative:~~ H&S Officer Brian Heneveld	
☒	☐	~~EPA~~ Field Engineer	[signature] 11/3/04
☐	☐	DEC	
☐	☐	SCDHS	
☒	☐	~~Other~~ FS Rep.	Cheryl Burns 11/4/04

Attachment 1

ER Modification Form

Project: EM SURFACE - 157 Number: 811-22

Initiator: Rick Eggleston / PROJECT MANAGER
Name/Title

Affected Document: Work Plan				
Document Revision Required:	☐	Yes	☑	No
Document Section:				
Description (Attach documents as necessary)	SEE ATTACHED SHEET			
RADSORB pulled UNDERNEATH MANWAY				
Required Date of Approval: 11/8/04	N/A (i.e., for information only) ☐			

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO
2. Prepare Estimate ______ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail)
   - Teresa M Baker 11/8/04 — Date/ /Individual's Name — ER Management
   - NA — Date/ /Individual's Name — DOE
   - NA — Date/ /Individual's Name — EPA/DEC

Resolution/Follow up items: LEAVE RAKES IN TANKS FOR VACUUM operations.

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ______ YES ✓ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ______ Schedule Impact: ______ (days/weeks/months)

2. Required Change Information detailed and forwarded, ______ Initials

(Check if required)

Final Approvals	Information Only		
☒	☐	Project Manager:	Teresa Baker 11/08/04 Name/Date/Title
☒	☐	Group Manager:	[signature] 11/8/04 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☒	☐	ES&H/.Q Manager/Designee:	[signature] 11/9/04 Name/Date/Title
☐	☐	~~Quality Representative:~~ FS Rep	Cheryl Burns 11/9/04 Name/Date/Title
☐	☒	~~EPA~~ H&S Officer - Brian Heneveld	NA Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☒	☐	~~Other~~ Field Engineer	[signature] 11/8/04 Name/Date/Title

Attachment 1

ER Modification Form

Project: EM SURFACE - 157 Number: R11 - 23

Initiator: RICK EGGLESTON
Name/Title

Affected Document:

Document Revision Required: ☑ Yes ☐ No

Document Section: WORK PLAN SECTION 3.2.3.2 UST CHARACTERIZATION AND REMOVAL

Description (Attach documents as necessary) VACUUM OUT RADSORB FROM BOTTOM OF TANKS (SEE ATTACHED FORM)

Required Date of Approval: 11/12/04 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ✓ YES ____ NO

2. Prepare Estimate ____ YES ✓ NO

3. Notification Made: (i.e., verbal/e-mail)

____________________ ER Management
Date/ /Individual's Name

____________________ DOE
Date/ /Individual's Name

____________________ EPA/DEC
Date/ /Individual's Name

Resolution/Follow up items:

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ____✓____ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☐	☐	Project Manager:	Name/Date/Title
☒	☐	Group Manager:	[signature] 11/15/04 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☑	☐	ES&H/.Q Manager/Designee:	Charles Schaefer 11/12/04 Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☐	☑	~~EPA~~ Brian Jenneveld	Name/Date/Title
☑	☐	~~DEC~~ FS Rep	Cheryl Burns 11/12/04 Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☐	☑	Other FE	Thomas [signature] 11/12/04 Name/Date/Title

Attachment 1
ER Modification Form

Project: EM SURFACE-157 Number: MOD # 811-024

Initiator: KEVIN KOSKO ES&H MANAGER
Name/Title

Affected Document: BUILDING 811 HASPP

Document Revision Required: ☑ Yes ☐ No

Document Section: TABLE 15-1

Description (Attach documents as necessary) JSHA FOR MAN-LIFT OPERATIONS

Required Date of Approval: 11/23/04 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ✓ YES ____ NO
2. Prepare Estimate ____ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail)
   11/23/04 TERESA BAKER ER Management
   Date/ /Individual's Name
   NA DOE
   Date/ /Individual's Name
   NA EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items: Approve as is [initials]

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ___✓___ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☒	☐	Project Manager:	Teresa M Baker 11/23/04 Name/Date/Title
☒	☐	Group Manager:	[signature] 11/23/04 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☒	☐	ES&H/.Q Manager/Designee:	[signature] 11/29/04 Name/Date/Title
☐	☒	~~Quality Representative:~~ H&SO Brian Heneveld	NA Name/Date/Title
☒	☐	~~EPA~~ FS Rep.	Cheryl Burns 11/23/04 Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☒	☐	Other Field Engineer	[signature] 11/23/04 Name/Date/Title

Attachment 1

ER Modification Form

Project: BUILDING 811 Number: 811-25

Initiator: KEVIN KOSKO
Name/Title

Affected Document: BLDG 811 HASPP

Document Revision Required: ☑ Yes ☐ No

Document Section: TABLE 15-1

Description (Attach documents as necessary) JSHA ADDENDUM TO ADDRESS HAZARDS ASSOCIATED WITH TRENCH BOX ASSEMBLY.

Required Date of Approval: 12/7/04 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ____ YES ✓ NO
2. Prepare Estimate ____ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail)
   12/7/04 TOM DANIELS — ER Management
   Date/ /Individual's Name
   ____ — DOE
   Date/ /Individual's Name
   ____ — EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items:

Attachment 1

ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ✓ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☐	☑	Project Manager:	Doyle Name/Date/Title
☑	☐	Group Manager:	[signature] 12/7/07 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☐	☑	ES&H/.Q Manager/Designee:	Lykins Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☐	☐	Other	Name/Date/Title

Attachment 1
ER Modification Form

Project: EM SURFACE - 157 Number: 8H-26

Initiator: Rick Eggleston / Rick Eggleston
Name/Title

Affected Document:

Document Revision Required: ☐ Yes ☑ No

Document Section:

Description (Attach documents as necessary) SEE ATTACHED DOCUMENT
ENTRY INTO TANK VAULTS for water and Concrete Removal / Radiological Contamination survey

Required Date of Approval: 12/15/04 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO

2. Prepare Estimate ______ YES ✓ NO

3. Notification Made: (i.e., verbal/e-mail) P. DANIELS 12/15/04 1330 ER Management
Date/ /Individual's Name

N/A DOE
Date/ /Individual's Name

N/A EPA/DEC
Date/ /Individual's Name

Resolution/Follow up items: NONE

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ______ YES ✓ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ______ Schedule Impact: ______ (days/weeks/months)

2. Required Change Information detailed and forwarded, ______ Initials

(Check if required)

Final Approvals	Information Only		
☐	☐	Project Manager:	Name/Date/Title
☑	☐	Group Manager:	[signature] 12/15/04 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☐	☑	ES&H/.Q Manager/Designee:	C. Burns Rad Safety Check Burns Name/Date/Title B. Henneveld 12/15/04
☐	☐	Quality Representative:	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☐	☐	Other	Name/Date/Title

Attachment 1

ER Modification Form

Project: EM-SURFACE-157 Number: 811-27

Initiator: Rick Eggleston/Project Manager
Name/Title

Affected Document: BLDG 811 HASP

Document Revision Required: ☑ Yes ☐ No

Document Section: TABLE 15-1

Description (Attach documents as necessary) JHSA ADDENDUM TO ADDRESS HAZARDS ASSOCIATED with USE OF Torpedo Propane Heater

Required Date of Approval: 12/16/04 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ______ YES ___✓___ NO

2. Prepare Estimate ______ YES ___✓___ NO

3. Notification Made: (i.e., verbal/e-mail) T. Daniels ER Management
Date/ /Individual's Name

______ DOE
Date/ /Individual's Name

______ EPA/DEC
Date/ /Individual's Name

Resolution/Follow up items: Assistant ~~Bt~~ Fire Chief Bill Emmanuel said a welding/burning permit was not required for this use as propane heater is being used outdoors on stoneblend - 0915 12/16/04 [signature]

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ✓ ________ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☐	☐	Project Manager:	Name/Date/Title
☑	☐	Group Manager:	[signature] 12/16/04 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☐	☑	ES&H/.Q Manager/Designee:	Heneveld Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☐	☐	Other	Name/Date/Title

Attachment 1

ER Modification Form

Project: EM SURFACE-157 Number: 811-28

Initiator: ______________________
Name/Title

Affected Document:				
Document Revision Required:	☐	Yes	☑	No
Document Section:				
Description (Attach documents as necessary)	MOD FOR PUMPING WATER FROM TANK VAULTS and CONSOLIDATING			
Required Date of Approval:	12/16/04	N/A (i.e., for information only) ☐		

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO
2. Prepare Estimate ______ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail)
   T. DANIELS 12/16/04 ER Management
   Date/ /Individual's Name

   ______________________ DOE
   Date/ /Individual's Name

   ______________________ EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items: ______________________

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ✓ ________ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ___—___ Schedule Impact: ___—___ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________
Initials

(Check if required)

Final Approvals	Information Only		
☐	☐	Project Manager:	Name/Date/Title
☑	☐	Group Manager:	[signature] 12/16/04 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☐	☐	ES&H/.Q Manager/Designee:	Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☐	☐	Other	Name/Date/Title

Attachment 1
ER Modification Form

Project: BLDG 811 UST Number: 811-29

Initiator: Rick Eggleston - Weston
Name/Title

Affected Document: Field Sampling Plan for Building 811

Document Revision Required: ☐ Yes ☑ No

Document Section: 5.2.3 Vault, Trench, and Underlying Soils Characterization.

Description (Attach documents as necessary) Additional detail on coring and sampling the concrete trench, concrete vault floor & soils.

Required Date of Approval: Jan 7, 2005 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO
2. Prepare Estimate ______ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail) T. Daniels 1/6/05 ER Management
   Date/ /Individual's Name
   ______ DOE
   Date/ /Individual's Name
   ______ EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items:

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ____________ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ _________ Schedule Impact: _________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________
Initials

(Check if required)

Final Approvals	Information Only		
☐	☐	Project Manager:	Name/Date/Title
☑	☐	Group Manager:	1/6/05 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☐	☐	ES&H/.Q Manager/Designee:	Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☐	☐	Other	Name/Date/Title

Attachment 1
ER Modification Form

Project: EM SURFACE - 157 Number: 811-31

Initiator: Rick Eggleston/Project Manager
Name/Title

Affected Document:

Document Revision Required: ☐ Yes ☑ No

Document Section: ____________________

Description (Attach documents as necessary) EXCAVATION to 30 Ft. SEE ATTACHED DOCUMENTS

Required Date of Approval: ____________ N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ______ YES ___✓___ NO
2. Prepare Estimate ______ YES ______ NO → included in Phase 2 rates
3. Notification Made: (i.e., verbal/e-mail) [signature] 1/20/05 ER Management
   Date/ /Individual's Name
   ____________________ DOE
   Date/ /Individual's Name
   ____________________ EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items: - Screening of all buckets will be performed to determine when cleanup goals have been met
- HP tech + BNL field engineer shall be on-site to coordinate the excavation with Weston.
- the BNL/Weston team shall use all engineering techniques and radiological data available to minimize the extent of excavation

Attachment 1

ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ____✓____ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:

Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☐	☐	Project Manager:	Name/Date/Title
☑	☐	Group Manager:	1/20/05 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☐	☐	ES&H/.Q Manager/Designee:	Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☐	☐	Other	Name/Date/Title

Attachment 1
ER Modification Form

Project: EM Surface -157 Number: 811-33

Initiator: Dennis Pasatieri, Project Manager
Name/Title

Affected Document:	work Plan		
Document Revision Required:	☐ Yes	☑ No	
Document Section:	3.2.4		
Description (Attach documents as necessary)	Concrete vault floor demolition		
Required Date of Approval:	2-2-05	N/A (i.e., for information only) ☐	

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO
2. Prepare Estimate ______ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail)
   T Daniels 2/5/05 ER Management
   Date/ /Individual's Name
   ______ DOE
   Date/ /Individual's Name
   ______ EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items:

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ✓ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☒	☐	Project Manager:	[signature] 2/15/05 Name/Date/Title
☐	☐	Group Manager:	Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☐	☐	ES&H/.Q Manager/Designee:	Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☐	☐	Other	Name/Date/Title

Attachment 1

ER Modification Form

Project: BUILDING 811 Number: 811-35

Initiator: KEVIN KOSKO ESH
Name/Title

Affected Document: BUILDING 811 WORK PLAN

Document Revision Required: ☑ Yes ☐ No

Document Section: 3.2.7

Description (Attach documents as necessary) WESTON TEAM WILL ADD RADSORB (REMOVED FROM TANKS) TO SOIL WASTE STREAM

Required Date of Approval: 2/4/04 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO

2. Prepare Estimate ______ YES ✓ NO

3. Notification Made: (i.e., verbal/e-mail)

2/1/04 TOM DANIELS — ER Management
Date/ /Individual's Name

______ DOE
Date/ /Individual's Name

______ EPA/DEC
Date/ /Individual's Name

Resolution/Follow up items: ES&H Needs to sign off [illegible]

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ✓ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☐	☐	Project Manager:	Name/Date/Title
☑	☐	Group Manager:	[signature] 2/17/05 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☑	☐	ES&H/.Q Manager/Designee:	Brian Arnold 2/17/05 Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☐	☐	Other FS Rep	Cheryl Burns 2/17/05 Name/Date/Title

Attachment 1

ER Modification Form

Project: EM SURFACE -157 Number: 811-36

Initiator: Chris Russo / project engineer
Name/Title

Affected Document: Mod 811-31

Document Revision Required: ☐ Yes ☑ No

Document Section: ______

Description (Attach documents as necessary) modifying manufacturer's representative requirements

Required Date of Approval: ______ N/A (i.e., for information only) ☑

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO

2. Prepare Estimate ______ YES ✓ NO

3. Notification Made: (i.e., verbal/e-mail) [signature] 2/2/05 ER Management
Date/ /Individual's Name

______ DOE
Date/ /Individual's Name

______ EPA/DEC
Date/ /Individual's Name

Resolution/Follow up items: ______

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ✓________ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☐	☐	Project Manager:	________ Name/Date/Title
☒	☐	Group Manager:	[signature] 2/2/05 Name/Date/Title
☐	☐	DOE:	________ Name/Date/Title
☐	☐	ES&H/.Q Manager/Designee:	________ Name/Date/Title
☐	☐	Quality Representative:	________ Name/Date/Title
☐	☐	EPA	________ Name/Date/Title
☐	☐	DEC	________ Name/Date/Title
☐	☐	SCDHS	________ Name/Date/Title
☐	☐	Other	________ Name/Date/Title

Attachment 1
ER Modification Form

Project: EM SURFACE-157 Number: 811-37

Initiator: Chris Russin / Project Engineer
Name/Title

Affected Document:		
Document Revision Required:	☐ Yes	☑ No
Document Section:		
Description (Attach documents as necessary)	Vault well sampling method	
Required Date of Approval:	2-9-05	N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO
2. Prepare Estimate ______ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail)
   T. Daniels 2/8/05 — ER Management
   Date/ /Individual's Name
   ______ DOE
   Date/ /Individual's Name
   ______ EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items: RWP Supplement written. ALARA coordinator signature required & received. Urine bioassays & respirators required.

Attachment 1

ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ **YES** ✓ ________ **NO**

1. **If yes/ Attach Estimate and/or Schedule Impact Information:**
Cost Impact: **$** ________ **Schedule Impact:** ________ **(days/weeks/months)**

2. **Required Change Information detailed and forwarded,** ________ **Initials**

(Check if required)

Final Approvals	Information Only		
☐	☐	Project Manager:	________ Name/Date/Title
☑	☐	Group Manager:	[signature] 2/8/05 Name/Date/Title
☐	☐	DOE:	________ Name/Date/Title
☐	☐	ES&H/.Q Manager/Designee:	________ Name/Date/Title
☐	☐	Quality Representative:	________ Name/Date/Title
☐	☐	EPA	________ Name/Date/Title
☐	☐	DEC	________ Name/Date/Title
☐	☐	SCDHS	________ Name/Date/Title
☐	☐	FS Rep Other	Cheryl Burns 2/11/05 Name/Date/Title

Attachment 1

ER Modification Form

Project: EM SURFACE - 157 Number: 811-39

Initiator: Rick Eggleston
Name/Title

Affected Document: WORK PLAN

Document Revision Required: ☐ Yes ☑ No

Document Section: ____________________

Description (Attach documents as necessary) REMOVAL OF ASBESTOS MASTIC

Required Date of Approval: 2/18/05 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO

2. Prepare Estimate ______ YES ✓ NO

3. Notification Made: (i.e., verbal/e-mail) T. Daniels 2/18/05 ER Management
   Date/ /Individual's Name

   ____________________ DOE
   Date/ /Individual's Name

   ____________________ EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items: ____________________

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ________ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________
Initials

(Check if required)

Final Approvals	Information Only		
☐	☐	Project Manager:	Name/Date/Title
☒	☐	Group Manager:	[signature] 2/18/05 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☐	☐	ES&H/.Q Manager/Designee:	[signature] 2/18/05 Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☐	☐	Other	Cheryl Burns 2/18/05 Name/Date/Title

Attachment 1
ER Modification Form

Project: EM Surface 157 Number: 811-40

Initiator: Rick Eggleston
Name/Title

Affected Document: Specification 02217

Document Revision Required: ☐ Yes ☑ No

Document Section: 1.01 E

Description (Attach documents as necessary) Vault Decontamination Techniques are attached and submitted for approval.

Required Date of Approval: 2-23-05 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO
2. Prepare Estimate ______ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail) T. Daniels 2/20/05 ER Management
   Date/ /Individual's Name

   ______ DOE
   Date/ /Individual's Name

   ______ EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items: ______

Attachment 1

ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ✓ ________ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☐	☐	Project Manager:	________ Name/Date/Title
☒	☐	Group Manager:	[illegible] 2/22/05 Name/Date/Title
☐	☐	DOE:	________ Name/Date/Title
☒	☐	ES&H/.Q Manager/Designee:	[illegible] 2/23/05 Name/Date/Title
☐	☐	Quality Representative:	________ Name/Date/Title
☐	☐	EPA	________ Name/Date/Title
☐	☐	DEC	________ Name/Date/Title
☐	☐	SCDHS	________ Name/Date/Title
☐	☐	Other	Cheryl Burns FS Rep 2/22/05 Name/Date/Title

Attachment 1
ER Modification Form

Project: EM SURFACE - 157 Number: 811-41

Initiator: Rick Eggleston
Name/Title

Affected Document:	WORK PLAN / HEALTH & SAFETY Plan			
Document Revision Required:	☐	Yes	☑	No
Document Section:				
Description (Attach documents as necessary)	Please SEE ATTACHED DOCUMENT AND JSHA / MOD FOR Changing OUT HEPA Filter			
Required Date of Approval:	3/4/05	N/A (i.e., for information only) ☐		

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO
2. Prepare Estimate ______ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail)
   [signature] 3/7/05 — ER Management
   Date/ /Individual's Name
   ______ — DOE
   Date/ /Individual's Name
   ______ — EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items:

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required __________ YES __________ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ __________ Schedule Impact: __________ (days/weeks/months)

2. Required Change Information detailed and forwarded. __________ Initials

(Check if required)

Final Approvals	Information Only		
☐	☐	Project Manager:	__________ Name/Date/Title
☒	☐	Group Manager:	[signature] 3/7/05 Name/Date/Title
☐	☐	DOE:	__________ Name/Date/Title
☐	☐	ES&H/.Q Manager/Designee:	__________ Name/Date/Title
☐	☐	Quality Representative:	__________ Name/Date/Title
☐	☐	EPA	__________ Name/Date/Title
☐	☐	DEC	__________ Name/Date/Title
☐	☐	SCDHS	__________ Name/Date/Title
☐	☐	Other	Cheryl Burns 3/7/05 Name/Date/Title FS Rep

Attachment 1
ER Modification Form

Project: EM Surface 157 Number: 811-42

Initiator: Dennis Pasatieri (Proj. Man.)
Name/Title

Affected Document: Workplan & H&S plan

Document Revision Required: ☐ Yes ☑ No

Document Section: workplan Addition, HASP table 15-1

Description (Attach documents as necessary)

conc. vault prep, slab removal & shoring below slabs.

Required Date of Approval: Mar 8, 2005 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO
2. Prepare Estimate ______ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail) T. Daniels 3/9/05 ER Management
   Date/ /Individual's Name
   ______ DOE
   Date/ /Individual's Name
   ______ EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items:

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ___✓___ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☐	☐	Project Manager:	Name/Date/Title
☒	☐	Group Manager:	3/9/05 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☒	☐	ES&H/.Q Manager/Designee:	Name/Date/Title
☒	☐	~~Quality Representative~~ PE:	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☐	☐	Other	Cheryl Burns FS Rep 3/10/05 Name/Date/Title (Radiation Safety only)

Attachment 1

ER Modification Form

Project: BUILDING 811 Number: 811-43

Initiator: RICK Eggleston / Proj. Mgr
Name/Title

Affected Document: BUILDING 811 WORK PLAN

Document Revision Required: ☑ Yes ☐ No

Document Section: 3.2.7

Description (Attach documents as necessary) WESTON TEAM WILL ADD CONCRETE DUST DRUMS FROM Scabbling to Rolloffs and dump AT FHWMF (SEE ATTACHED)

Required Date of Approval: 4/27/05 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ✓ YES ✓ NO
2. Prepare Estimate YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail) [signature] 4/27/05 ER Management
Date/ /Individual's Name

_______________ DOE
Date/ /Individual's Name

_______________ EPA/DEC
Date/ /Individual's Name

Resolution/Follow up items:

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ________ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: Ø (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☐	☐	Project Manager:	Name/Date/Title
☒	☐	Group Manager:	4/27/05 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☒	☐	ES&H/.~~Q Manager~~/Designee:	Brian 4/27/05 Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☐	☐	Other	Cheryl Burns 4/27/05 Name/Date/Title FACILITY SUPPORT REPRESENTATIVE

Attachment 1
ER Modification Form

Project: EM Surface 157 Number: 811 - 45

Initiator: Rick Eggleston, Proget Manager
Name/Title

Affected Document:	Work Plan		
Document Revision Required:	☐ Yes	☑ No	
Document Section:	Work Plan - Phase 2		
Description (Attach documents as necessary)	Concrete Vault Floor - Cutting		
Required Date of Approval:	May 4, 2005	N/A (i.e., for information only) ☐	

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO
2. Prepare Estimate ______ YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail) [signature] 5/5/05 ER Management
   Date/ /Individual's Name
   ______ DOE
   Date/ /Individual's Name
   ______ EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items: Approved with the marked up changes

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ✓________ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________
Initials

(Check if required)

Final Approvals	Information Only		
☐	☐	Project Manager:	Name/Date/Title
☒	☐	Group Manager:	[signature] 5/31/01 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☐	☐	ES&H/.Q Manager/Designee:	Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☐	☐	Other	Name/Date/Title

Attachment 1
ER Modification Form

Project: EM Surface 157 Number: 811-46

Initiator: Rick Eggleston, Proj Man.
Name/Title

Affected Document: Work Plan

Document Revision Required: ☐ Yes ☑ No

Document Section: workplan phase 2

Description (Attach documents as necessary): Mod to leave shoring panels in place.

Required Date of Approval: May 13, 2005 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ____ YES ✓ NO
2. Prepare Estimate – YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail) [signature] 5/13/05 ER Management
   Date/ /Individual's Name
   ______ DOE
   Date/ /Individual's Name
   ______ EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items:

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ✓________ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________
Initials

(Check if required)

Final Approvals	Information Only		
☐	☐	Project Manager:	Name/Date/Title
☒	☐	Group Manager:	[signature] 5/13/05 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☐	☐	ES&H/.Q Manager/Designee:	Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☐	☐	Other	Name/Date/Title

Attachment 1

ER Modification Form

Project: EM Surface 157 Number: 811-47

Initiator: Rick Eggleston, Project Manager
Name/Title

Affected Document:	work plan			
Document Revision Required:	☐	Yes	☐	No
Document Section:	Work Plan · Phase 2			
Description (Attach documents as necessary)	Revision to Removal and Disposal of Conc. Floor Pieces.			
Required Date of Approval:	May 16, 2005	N/A (i.e., for information only) ☐		

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO

2. Prepare Estimate ______ YES ✓ NO

3. Notification Made: (i.e., verbal/e-mail)
   [signature] 5/16/05 ER Management
   Date/ /Individual's Name

   ______ DOE
   Date/ /Individual's Name

   ______ EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items: ______

Attachment 1

ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ________ YES ✓ ________ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:

Cost Impact: $ ________ Schedule Impact: ________ (days/weeks/months)

2. Required Change Information detailed and forwarded, ________ Initials

(Check if required)

Final Approvals	Information Only		
☐	☐	Project Manager:	Name/Date/Title
☒	☐	Group Manager:	[signature] 5/16/05 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☐	☐	ES&H/.Q Manager/Designee:	Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☐	☐	Other	Name/Date/Title

Attachment 1

ER Modification Form

Project: EM SURFACE 157 Number: 811-44

Initiator: RICK EGGLESTON, Proj. Manager
Name/Title

Affected Document: Work Plan

Document Revision Required: ☐ Yes ☑ No

Document Section: Work Plan Phase 2

Description (Attach documents as necessary) Revised conc slab removal & shoring

Required Date of Approval: May 5, 2005 N/A (i.e., for information only) ☐

Impact of Modification

1. HOLD UP WORK ______ YES ✓ NO
2. Prepare Estimate – YES ✓ NO
3. Notification Made: (i.e., verbal/e-mail) [signature] 5/6/05 ER Management
   Date/ /Individual's Name
   ______ DOE
   Date/ /Individual's Name
   ______ EPA/DEC
   Date/ /Individual's Name

Resolution/Follow up items:

Attachment 1
ER Modification Form (Continued)

BNL Contracts and Procurement Division:

Contract Modification Required ______ YES ✓ NO

1. If yes/ Attach Estimate and/or Schedule Impact Information:
Cost Impact: $ ______ Schedule Impact: ______ (days/weeks/months)

2. Required Change Information detailed and forwarded, ______ Initials

(Check if required)

Final Approvals	Information Only		
☐	☐	Project Manager:	Name/Date/Title
☒	☐	Group Manager:	[signature] 5/6/05 Name/Date/Title
☐	☐	DOE:	Name/Date/Title
☒	☐	ES&H/.Q Manager/Designee:	[signature] 5/6/05 Name/Date/Title
☐	☐	Quality Representative:	Name/Date/Title
☐	☐	EPA	Name/Date/Title
☐	☐	DEC	Name/Date/Title
☐	☐	SCDHS	Name/Date/Title
☐	☐	Other	Name/Date/Title

Appendix E
References

Brookhaven National Laboratory "Request for Proposal JS-04-Building 811 UST and Soil Remediation."

Brookhaven National Laboratory SBMS – "Radiological Control Manual."

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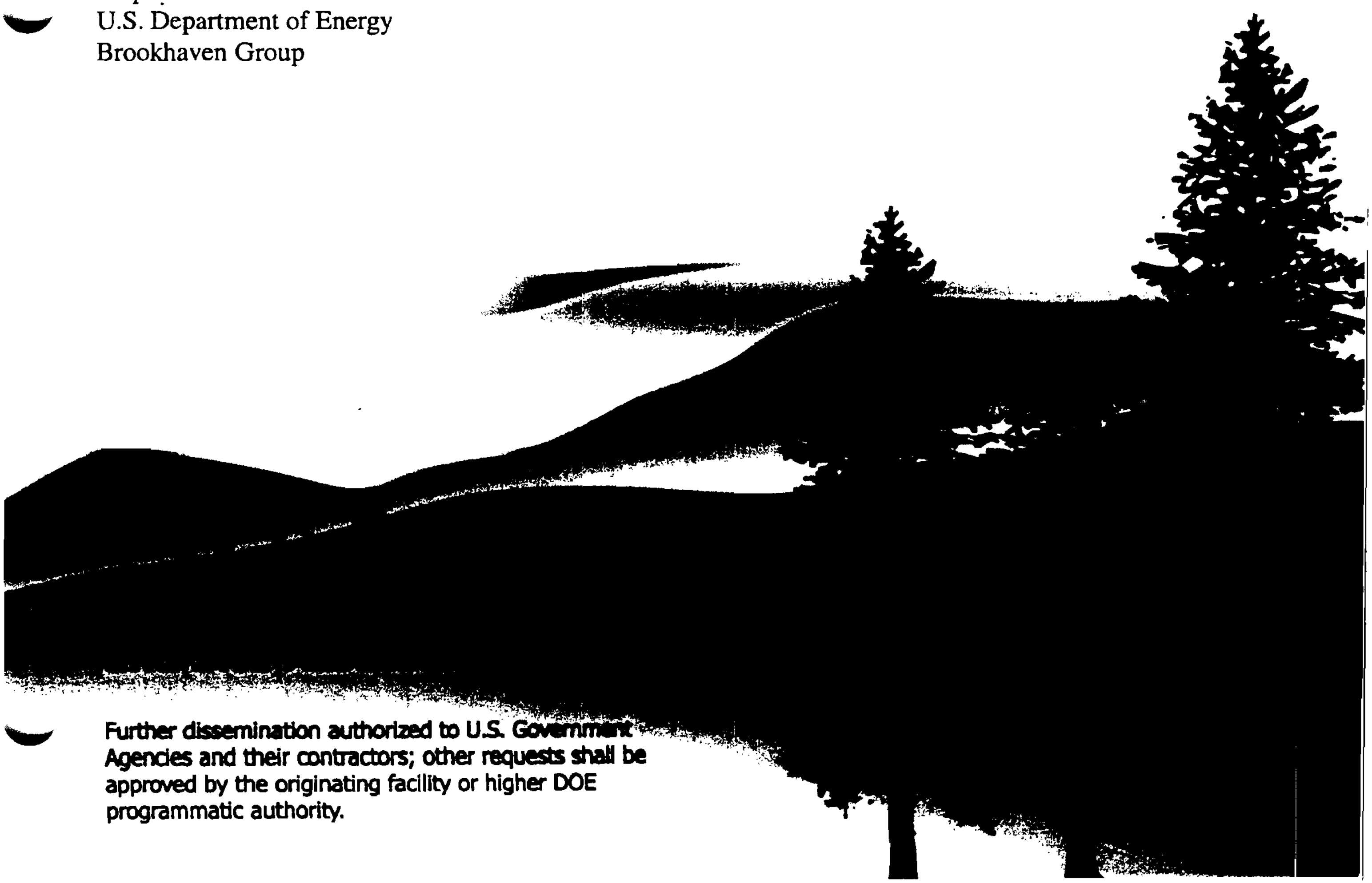
IN-PROCESS VERIFICATION SURVEY FOR THE 811 WASTE CONCENTRATION FACILITY BROOKHAVEN NATIONAL LABORATORY UPTON, NEW YORK

P. C. WEAVER

Prepared for the
U.S. Department of Energy
Brookhaven Group



The Oak Ridge Institute for Science and Education (ORISE) is a U.S. Department of Energy facility focusing on scientific initiatives to research health risks from occupational hazards, assess environmental cleanup, respond to radiation medical emergencies, support national security and emergency preparedness, and educate the next generation of scientists. ORISE is managed by Oak Ridge Associated Universities. Established in 1946, ORAU is a consortium of 91colleges and universities.

IN-PROCESS VERIFICATION SURVEY
FOR THE
811 WASTE CONCENTRATION FACILITY
BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK

Prepared by

P. C. Weaver

Environmental Survey and Site Assessment Program
Oak Ridge Institute for Science and Education
Oak Ridge, Tennessee 37831-0117

Prepared for the

U.S. Department of Energy
Brookhaven Group

FINAL REPORT

SEPTEMBER 2005

Oak Ridge Institute for Science and Education performs complementary work under contract number DE-AC05-00OR22750 with the U.S. Department of Energy.

**IN-PROCESS VERIFICATION SURVEY
FOR THE
811 WASTE CONCENTRATION FACILITY
BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK**

Prepared by: ______________________ Date: 9/1/05

Phyllis C. Weaver, Project Leader
Environmental Survey and Site Assessment Program

Reviewed by: ______________________ Date: 9/1/05

Alex J. Boerner, Acting Survey Projects Manager
Environmental Survey and Site Assessment Program

Reviewed by: ______________________ Date: 9/2/05

R. D. Condra, Laboratory Manager
Environmental Survey and Site Assessment Program

Reviewed by: ______________________ Date: 9/6/05

A. T. Payne, Quality Manager
Environmental Survey and Site Assessment Program

Reviewed by: ______________________ Date: 9/5/05

E. W. Abelquist, Program Director
Environmental Survey and Site Assessment Program

ACKNOWLEDGMENTS

The author would like to acknowledge the significant contributions of the following staff members:

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CLERICAL STAFF

D. K. Herrera
K. L. Pond
A. Ramsey

ILLUSTRATORS

T. L. Brown
T. D. Herrera

TABLE OF CONTENTS

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ABBREVIATIONS AND ACRONYMS

ε_i	instrument efficiency
ε_s	surface efficiency
ε_{total}	total efficiency
AEC	Atomic Energy Commission
AOC	Area of Concern
b_i	number of background counts in the interval
BKG	background
BNL	Brookhaven National Laboratory
cm	centimeter
cm^2	square centimeter
cpm	counts per minute
d′	index of sensitivity
DCGL	derived concentration guideline level
DOE	U.S. Department of Energy
dpm	disintegrations per minute
dpm/100 cm^2	disintegrations per minute per 100 square centimeters
ERDA	Energy Research and Development Administration
ESSAP	Environmental Survey and Site Assessment Program
FSS	final status surveys
ISOCS	In Situ Object Counting System
ITP	Intercomparison Testing Program
IVO	independent verification organization
ISM	integrated safety management
JHA	job hazard analysis
keV	kiloelectron volt
km	kilometer
MAPEP	Mixed Analyte Performance Evaluation Program
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	minimum detectable concentration
MDCR	minimum detectable count rate
MeV	million electron volts
m	meter
m^2	square meter
min	minute
mg	milligram
mg/cm^2	milligrams per square centimeter
mm	millimeter
mrem/y	millirem per year
NaI	sodium iodide
NIST	National Institute of Standards and Technology
NRIP	NIST Radiochemistry Intercomparison Program
ORISE	Oak Ridge Institute for Science and Education
pCi/g	picocuries per gram

ABBREVIATIONS AND ACRONYMS (Continued)

s	second
SOF	sum-of-fractions
TAP	total absorption peak
USTs	underground storage tanks
WCF	Waste Concentration Facility

**IN-PROCESS VERIFICATION SURVEY
FOR THE
811 WASTE CONCENTRATION FACILITY
BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK**

INTRODUCTION

Established in 1947, Brookhaven National Laboratory (BNL) has designed, built, and operated many research facilities for the scientific community. Formerly operated by the U.S. Army as Camp Upton during and between World Wars I and II by the Civilian Conservation Corps, the site was transferred to the Atomic Energy Commission (AEC) in 1947, to the Energy Research and Development Administration (ERDA) in 1975, and to the U.S. Department of Energy (DOE) in 1977. While the site continues to carry out its DOE mission, legacy environmental restoration activities are also being conducted.

BNL has performed remediation of contaminated soils and structures at the 811 Waste Concentration Facility (WCF), in the Area of Concern 10 (AOC 10). The WCF was built to receive liquid radioactive waste (from the Brookhaven Graphite Research Reactor, the Hot Laboratory Complex-Building 801, and the High Flux Beam Reactor) for temporary storage and eventual distillation to remove particulates and suspended and dissolved solids (BNL 2001a). The WCF primarily consisted of three large above ground storage tanks and six underground storage tanks (USTs) in addition to the primary operations building, 811.

DOE's Brookhaven Site Office is responsible for oversight of remedial action activities at the AOC 10 associated facilities. It is the policy of DOE to perform independent (third party) verification surveys of remedial action activities at DOE sites. The purpose of independent verification is to confirm that remedial actions have been effective in meeting established and site-specific guidelines and that the documentation accurately and adequately describes the radiological conditions at the site. The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) has been designated by the DOE as the independent verification organization (IVO) responsible for this task at the

Brookhaven National Laboratory, and has been requested to verify the current radiological status of the cleanup activities associated with BNL AOC 10.

SITE DESCRIPTION AND HISTORY

Brookhaven National Laboratory, situated on 5,265 acres of land owned by the DOE, is located in Suffolk County, New York (Figure 1). Approximately 25 percent of this area is developed for laboratory and support facilities, while the remainder is wooded and undeveloped. The AOC 10 survey areas consist of 1,400 m^2 of Class 1 area, including the former D tank area and the USTs located west and north of Building 811 (Figure 2). Another 1,850 m^2 of area surrounding Building 811 and excavated areas has been designated as Class 2. Survey unit classification was based on the guiding principles in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (BNL 2001b and NRC 2000).

BNL stored waste at the 811 WCF in three 100,000-gallon aboveground storage tanks (D-1, D-2, and D-3) during the period from 1949 to 1987. Three documented leaks occurred in tanks D-1 and D-3 while the tanks were in service and in 1995 all of the tanks were dismantled and removed for disposal (BNL 2001a).

Six 8,000-gallon stainless steel USTs were located fifty feet north of Building 811. These tanks were contained within concrete storage vaults, hereto referred to as the Vaults (A1, A2, A3, B1, B2, and B3). These six 12-foot by 8-foot vaults were used to store class A and B radioactive wastes. Each vault was double contained, consisting of a primary stainless steel inner tank and a reinforced concrete exterior shell (BNL 2001a). The inner stainless steel tanks were removed after draining the radioactive sludges and liquid. Characterization of the soil in AOC 10 also indicated Cs-137 and Sr-90 contamination in the area of the D Tanks and adjacent to the 811 building (BNL 2001a).

BNL originally planned to address the soil beneath the vault structures after each had been removed; however, all of the structures remained in the ground with the exception of the floor for two of the vaults. The remaining concrete structures will be backfilled after remedial activities have been completed and contaminated soil excavated. The removal of contaminated soil and debris at the WCF 811 A, B, C, and D Yards, including areas adjacent to the Building 811 foundation, out of service piping, and other miscellaneous items associated with the facility, will complete the remedial activities at the WCF.

OBJECTIVES

The objectives of the verification survey were to confirm that remedial actions have been effective in meeting established release criteria and that documentation accurately and adequately describes the final radiological conditions of the areas associated with the AOC 10 remedial action.

DOCUMENT REVIEW

ESSAP reviewed the AOC 10 remedial action work, sampling plan and supporting field documentation for process application and data accuracy (BNL 2001a and b). The information was evaluated to assure that areas identified as exceeding site guidelines were addressed during remedial activities and that residual activity levels satisfy the established radiological criteria.

SURVEY PROCEDURES

ESSAP performed verification surveys within AOC 10 including the C and D Yards and the vaults during the periods of March 13, April 5 to 6 and April 19 to 20, 2005. The surveys were performed in accordance with the site-specific survey plan submitted to and approved by the DOE, and in accordance with ORISE/ESSAP Survey Procedures and Quality Assurance Manuals (ORISE 2005a and 2004a and b). Survey activities were performed at the WCF on the vaults in the A and B Yards and in the C and D Yards. During the IVO presence at the site, the A and B Yards were unavailable for verification activities as a result of the presence of equipment and ongoing remediation activities.

REFERENCE SYSTEM

The reference grid previously established by the contractor was not identifiable. Prominent site and structural features were used for referencing measurement and sampling locations.

SURFACE SCANS

Surface scans for alpha and alpha plus beta radiation were performed on up to 100 percent of accessible areas of the floor and lower walls (up to 2 meters) within each vault. Scans were performed to screen for the presence of alpha elevated activity levels as well as for beta activity above the established criteria. Gas proportional detectors coupled to ratemeter-scalers with audible indicators were used to perform the scans. Locations of elevated radiation were marked and identified for further investigation. Particular attention was given to remediated and adjacent surfaces and cracks and joints in the floors and walls.

Gamma surface scans were completed over 100% of accessible areas in the 811 C and D Yards. Gamma scans were not performed within the deep dig in the C and D yards; however, scans were performed along the perimeter edge of the dig. Gamma scans were performed using NaI scintillation detectors coupled to ratemeters with audible indicators. Locations of elevated radiation were marked for further investigation.

SURFACE ACTIVITY MEASUREMENTS

Total surface activity measurements for alpha and alpha plus beta radiation were performed in at least four locations within each vault at the highest activity readings identified by scans. Additional measurements were also performed at judgmentally selected locations where elevated direct radiation was identified. When determined appropriate, a five-point measurement was made in the contiguous 1 m^2 area surrounding the location of elevated direct radiation to determine area average activity levels. Surface activity measurements were performed using gas proportional detectors coupled to ratemeter-scalers. Direct measurement locations within the vaults are shown in Figure 3.

SOIL SAMPLING

Surface soil samples were collected at a depth of 0 to 15 cm from accessible areas in the C and D Yards. ESSAP collected four soil samples from the C and D Yards during the initial March 2005 verification effort. Three of these samples were collected using a track hoe from the 30 foot deep dig: two from the north and south sides and one from the east side (Figure 4). The fourth sample was collected at flag number 3-55 located approximately 10 meters north and west of the deep dig. ESSAP collected 13 additional soil samples from the C and D yards during the April 19, 2005 verification survey. Twelve samples were collected from random locations; four from the C Yard and eight from the D Yard (Figure 4). One judgmental soil sample was collected in the D Yard.

BNL provided ESSAP with three split soil samples of borings from underneath three vaults and fourteen soil samples from the soil beneath Vault B3 for confirmatory analysis.

SAMPLE ANALYSIS AND DATA INTERPRETATION

Samples and data were returned to ORISE's ESSAP Oak Ridge, Tennessee, facility for analysis and interpretation. Sample analyses were performed in accordance with the ORISE/ESSAP Laboratory Procedures Manual (ORISE 2004c). Direct measurements for total surface activity were converted to units of disintegration per minute per 100 square centimeters (dpm/100 cm^2). Soil samples were analyzed by gamma spectroscopy. Spectra were reviewed for the radionuclide of interest (Cs-137) and any other identifiable photopeaks. Soil sample results were reported in picocuries per gram (pCi/g). Soil samples were also analyzed for Sr-90 and the results reported in pCi/g.

The predominant radionuclides of concern found in the 811 area are Cs-137 and Sr-90, with lesser amounts of Ra-226. BNL calculated the derived concentration guideline levels ($DCGL_W$) for these three radionuclides in soil to correspond with the basic dose limit criterion of 15 millirem per year (mrem/y) using the RESRAD computer code. DOE accepted the RESRAD result and approved the DCGLs submitted by BNL. The $DCGL_W$ calculated were 23 pCi/g for Cs-137, 15 pCi/g for Sr-90, and 5 pCi/g for Ra-226. Cs-137 is used as a surrogate for Sr-90 when Sr-90 data are not available. When this is the case, the criteria of 16.6 pCi/g for Class 1 areas and 22.2 pCi/g for Class 2 areas is applied (BNL 2001b).

The applicable surface activity guidelines for mixed fission products for structural (vaults) surfaces are provided in the final status survey plan and defined in Appendix C (DOE 1993 and 1995 and BNL 2004):

Total Alpha Activity

100 α dpm/100 cm^2, averaged over a 1 m^2 area
300 α dpm/100 cm^2, maximum in a 100 cm^2 area

Total Beta Activity

5,000 β-γ dpm/100 cm^2, averaged over a 1 m^2 area
15,000 β-γ dpm/100 cm^2, maximum in a 100 cm^2 area

Removable Activity

20 α dpm/100 cm^2
1000 β-γ dpm/100 cm^2

Additional information concerning major instrumentation, sampling equipment, and analytical procedures is provided in Appendices A and B.

FINDINGS AND RESULTS

DOCUMENT REVIEW

ESSAP's review of BNL's Remedial Action Field Sampling Plan determined that the final status survey generally followed the guidance provided in the plan and demonstrated compliance with the guidelines. BNL provided interim data for their sampling effort in the A and B Yards, including a summary of the radionuclide concentrations of the soil underneath Vaults A3 and B3 (DOE 2005). Sample data indicated that remedial efforts were sufficient in meeting the established cleanup goals; however, the Cs-137 concentration for one of the twenty-four samples was 26.1 pCi/g, exceeding the approved criterion.

Surface Scans

Surface scans of the vaults identified locations in Vaults A2 (floor), A3 (south and west walls), and B1 (east, southwest, and southeast walls) that required five point measurements for averaging. Surface scans of the B3 Vault identified elevated radiation along the east, south, and west walls. BNL indicated that a hot sump in the floor of the vault could potentially be contributing to the high activity.

The initial gamma scans in the C and D Yards identified one location on the northwest corner of the large dig that was three times background. The location was marked and sampled by ESSAP. BNL remediated the location and ESSAP rescanned on the next trip.

During the return trip to the C and D Yards, gamma scans were performed in the remainder of the area. Scans identified several large areas of contamination, specifically along the north retaining wall, the area near the piping between the 810 and 811 Buildings, and a few areas along the south fence line near the 811 Building. The areas were identified and marked for additional actions by the contractor. As a result of these findings, ESSAP suspended survey efforts in the C and D Yards.

During the third and final survey effort by ESSAP the C and D Yards were rescanned. A few locations of elevated radiation were found. These were immediately removed by the contractor prior to ESSAP sampling. In an area between the 810 and 811 Building, it was difficult to discern whether the activity was from the soil or a contribution from the existing piping in the area or waste materials from the remedial operation in the A and B Yard that were stored nearby. A location was marked in the area for soil sampling.

Surface Activity Levels

Total alpha and beta surface activity levels for each of the six vaults are provided in Table 1. Alpha surface activity ranged from -8 to 210 dpm/100 cm^2. Beta surface activity levels ranged from -1,600 to 42,000 dpm/100 cm^2. The highest beta activity was measured in Vault B3, which contained a hot sump. Beta activity in this vault ranged from 3,900 to 42,000 dpm/100 cm^2. After the addition of shielding over the sump area to reduce the radioactive "shine", the measured surface activity on the walls in that area was still strongly influenced by the remaining contamination. Measurements were not performed on the floor of Vault B3 because the sump and floor of the vault were to be removed.

RADIONUCLIDE CONCENTRATIONS IN SOIL

The primary radionuclide of concern for the WCF is Cs-137 based upon previous characterization information and the results of the contractor's sampling effort during remedial activities. However, Sr-90 was present as a mixed fission product in waste streams that were fed through the system. Therefore, Sr-90 analysis was performed on selected samples where the Cs-137 concentrations were significantly greater than background and for samples where the contractor indicated that higher Sr-90 concentrations were identified. Table 2 provides the radionuclide concentrations in soils collected by ESSAP from the C and D Yards. Radionuclide concentrations in the soils ranged from 0.00 to 139.1 pCi/g for Cs-137, -0.09 to 15.47 pCi/g for Sr-90, and 0.13 to 0.61 pCi/g for Ra-226. The sum-of-fraction (SOF) values ranged from 0.02 to 6.2.

BNL provided ESSAP with three soil samples collected from borings beneath Vaults A2, B1, and B2. ESSAP results are reported in Table 3. Cs-137 concentrations for these samples ranged from 0.03 to 0.45 pCi/g. Following the removal of the Vault B3 floor, BNL collected and forwarded 14 soil samples to ESSAP for comparison analysis. DOE observed the collection of the samples. The ESSAP laboratory analyzed the samples by gamma spectroscopy for Cs-137 as did BNL utilizing a smaller *in situ* object counting system (ISOCS) gamma spectroscopy unit. The results are also provided in Table 3. Radionuclide concentrations ranged from 0.01 to 8.62 pCi/g of Cs-137 for the ESSAP analysis and 0.03 to 5.29 pCi/g of Cs-137 as determined by BNL.

COMPARISON OF RESULTS WITH GUIDELINES

Verification survey data results are compared with the DOE-approved site-specific release criteria established for the BNL. The highest concentration of Cs-137 (139.1 pCi/g) was found in ESSAP's sample 001 collected during the initial verification survey. The sample was collected from a location north and slightly west of the deep dig. The DOE was notified of the findings and BNL remediated the areas.

The final verification survey effort of the C and D Yards identified two samples, 014 and 020, that had Cs-137 concentrations of 26.89 and 54.6 pCi/g and Sr-90 concentrations of 8.41 and 15.47 pCi/g, respectively. The two locations exceeded the criteria for Cs-137 and also exceeded the SOF limit of one. DOE and BNL were notified of the findings as soon as the gamma spectroscopy analysis was completed (ORISE 2005b). Location 014 was from an area where there are active waste lines and location 020 was from a small location adjacent to a non-functioning sewer line. The ambient gamma radiation level during scans around location 014 (between Buildings 810 and 811) was elevated as a result of the contribution from the active waste lines and remediated soil staged nearby. It is ESSAP's understanding that this area still contains active lines and will be addressed in future remediation projects for Buildings 810 and 811.

ESSAP's verification surveys of the A and B Vaults determined that the surface activity levels in Vaults A2, A3, and B1 satisfied the maximum and 1 m^2 average residual activity guidelines. The highest alpha measurement was identified in Vault B3. This was a small isolated spot about the size of a detector width located just above 2 meters from the floor. Visual inspection determined that the contractor had identified the location as having elevated radioactivity. The 210 dpm/100 cm^2 did not exceed the maximum hot spot guideline of 300 dpm/100 cm^2. ESSAP experienced some difficulty in determining the activity in Vault B3 as a result of a highly contaminated sump in the floor of the vault. Shielding was used to reduce the background, but the measured activity was still significant. BNL removed the floor and sump of the B3 Vault and excavated the soil underneath. After excavation of the soil, DOE observed BNL collect samples from several locations from the excavation which were then provided to ESSAP. The results of ESSAP comparison analysis indicated that the Cs-137 concentration in the soil from Vault B3 is below the guideline criterion (Table 3). The gamma spectroscopy results reported by BNL and ESSAP were generally similar with the exception of one sample.

SUMMARY

At the request of the Department of Energy Brookhaven Site Office, the Environmental Survey and Site Assessment Program of the Oak Ridge Institute for Science and Education conducted verification survey activities of the 811 Project C and D Yards and A and B Vaults. ESSAP did not conduct soil verification in the A and B Yards. Verification activities included document and data reviews, independent surface scans, surface activity measurements, and soil sampling during the periods of March 14, April 5 to 6, and April 19 to 20, 2005. The initial visit addressed the deep digs that were on the critical path to be backfilled. No issues were found with the soil collected from the bottom of the digs; however, just north of the northwest corner of the large dig, ESSAP identified gamma radiation exceeding three times the background level. A sample was collected and the Cs-137 concentration was determined to be 139.1 pCi/g. BNL was notified of the findings during a March 29, 2005 conference call and the area was subsequently remediated. During the final verification survey effort, two more soil samples were identified that exceeded the soil criteria. The sample at location 014 is in an area between the 810 and 811 buildings where there are still active process lines. It is ESSAP's understanding that BNL would address this area during future remediation projects.

Subsequent visits included verification surveys of the surfaces in the six A and B Vaults. Total surface activity levels were determined using static measurements at judgmental locations identified during scans. Surface measurements in Vault B3 were impacted as a result of a contaminated sump located in Vault B3. Measurements of the floor of Vault B3 were not obtained because BNL indicated that the sump was scheduled to be removed during excavation of the soil from this area. With the exception of Vault B3, the remaining concrete vault structures were within the guideline criteria for mixed fission products.

Based upon the assessment of verification data obtained by ESSAP, it is ESSAP's opinion that the radiological conditions of the Waste Concentration Facility 811 C and D Yards and A and B Vaults have met the site-specific cleanup goals. However, gamma scans did indicate a potential for additional areas of contaminated soils between Building 810 and 811 due to the remaining active lines in the area. The main building facilities (810 and 811) will be deactivated for future decontamination and decommissioning activities. A radiological investigation of the area should occur after removal of the facilities, associated process systems, and adjoining soil areas.

FIGURES

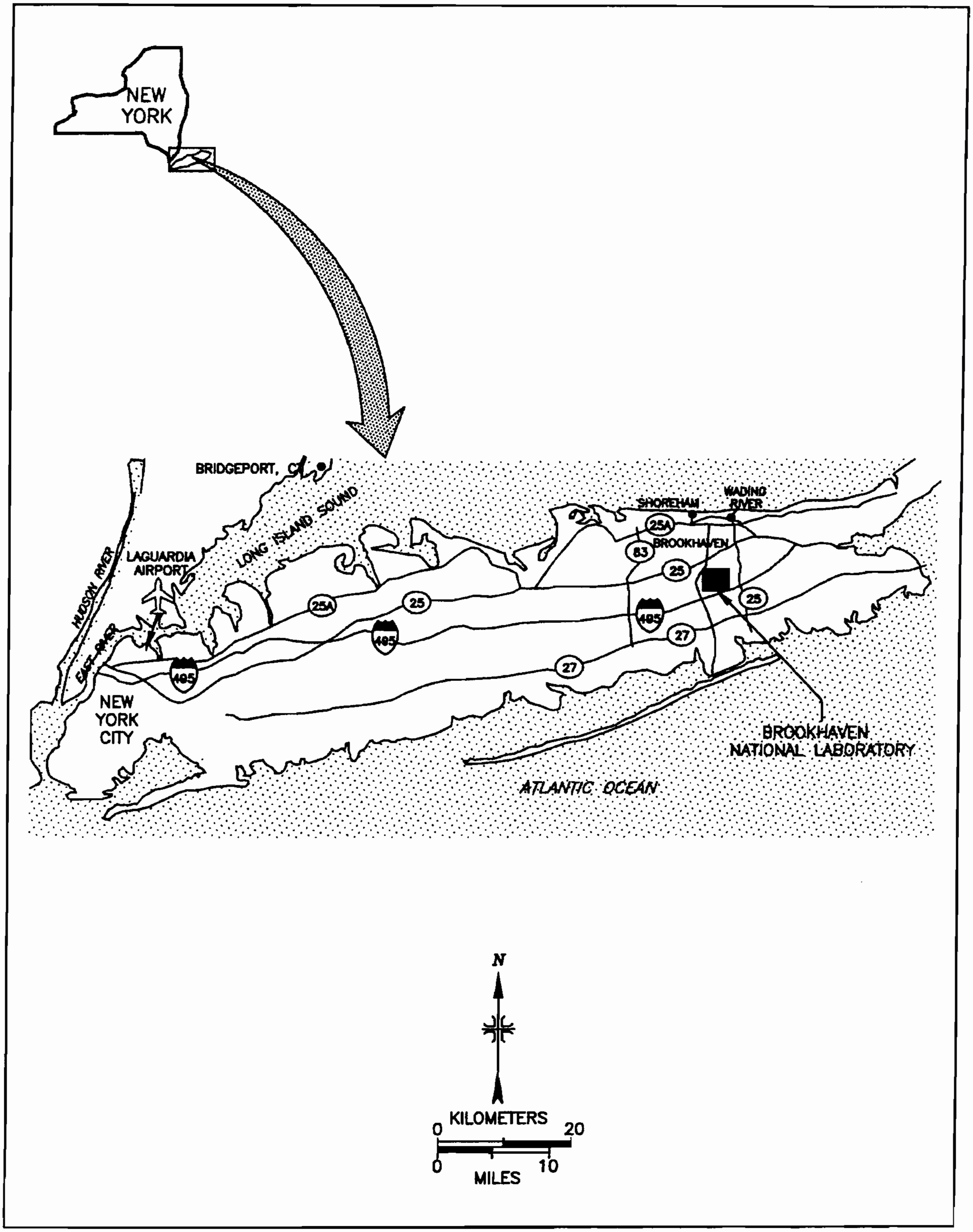

FIGURE 1: Location of Brookhaven National Laboratory, Upton, New York

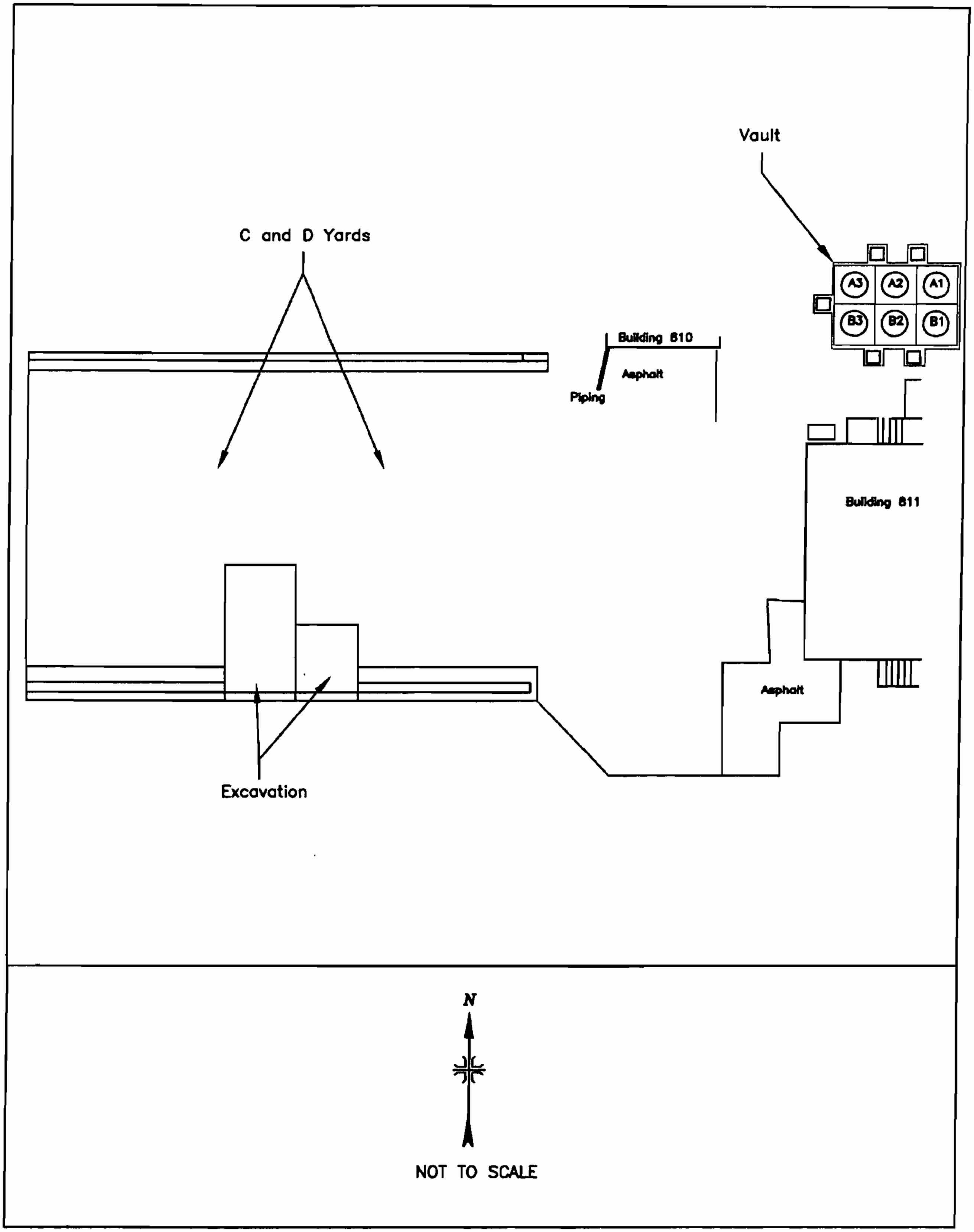

FIGURE 2: Plot Plan – Waste Concentration Facility 811 C and D Yards and Vault

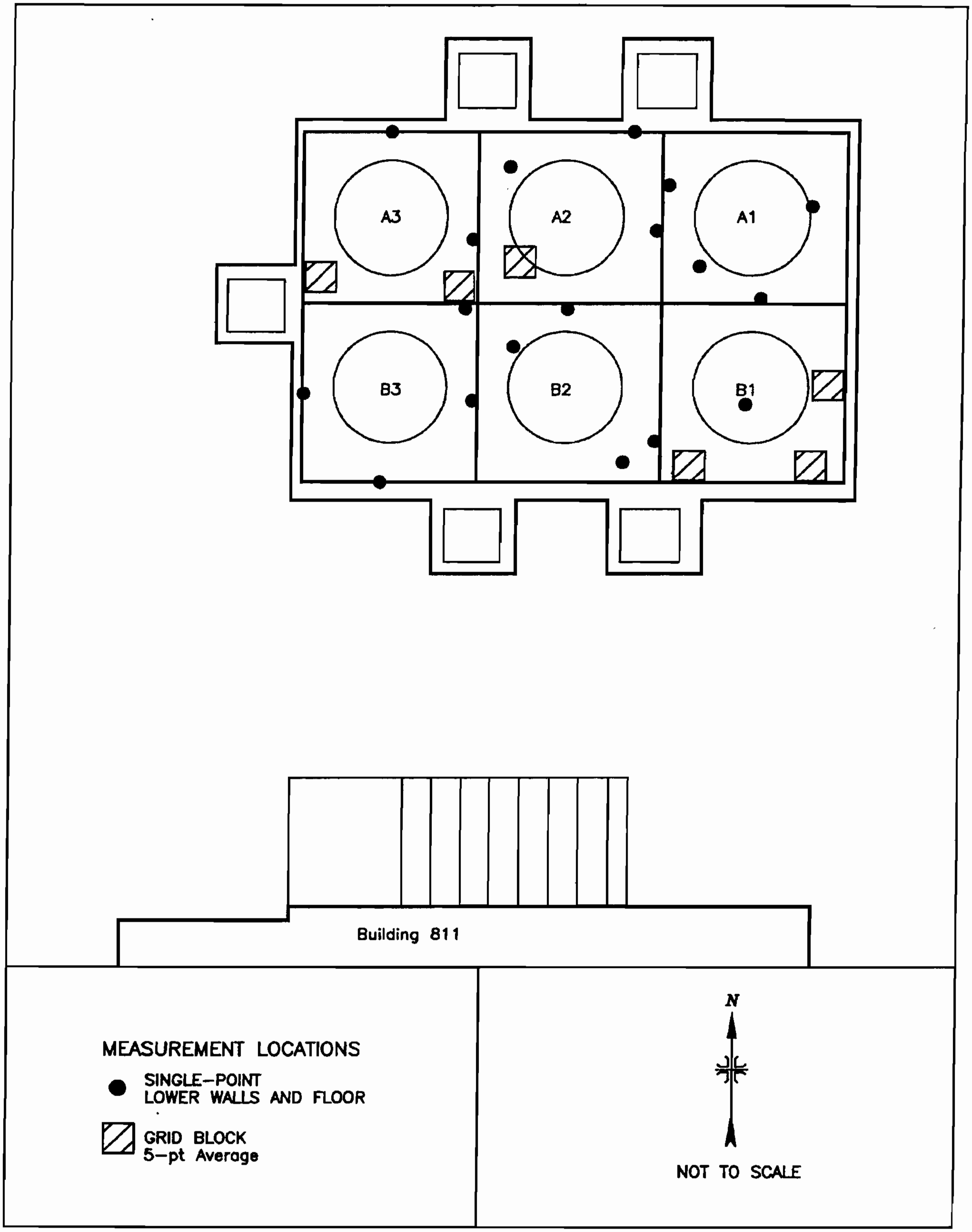

FIGURE 3: Waste Concentration Facility 811 A and B Vaults – Measurement Locations

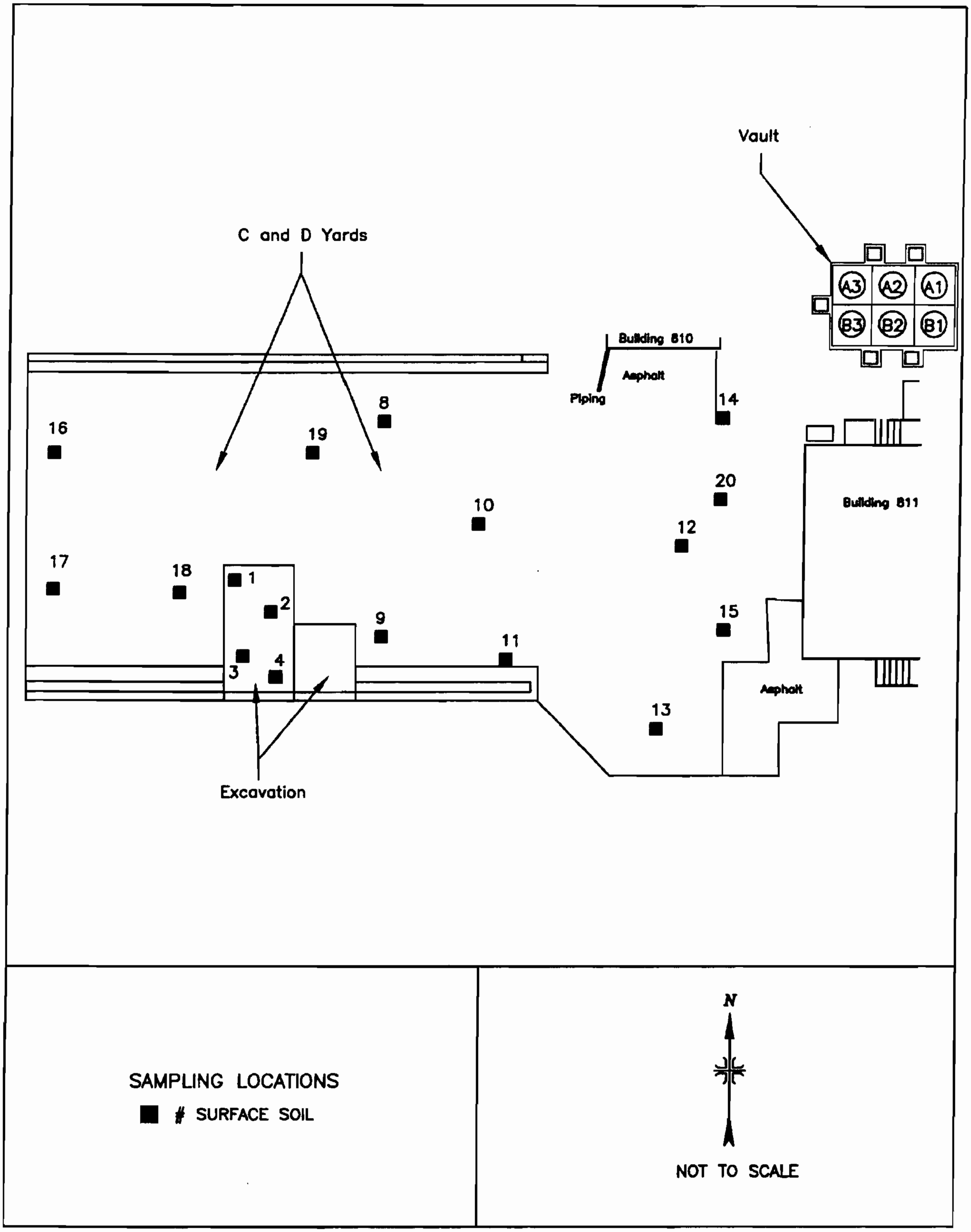

FIGURE 4: Waste Concentration Facility 811 C and D Yards – Sampling Locations

TABLES

TABLE 1

SURFACE ACTIVITY LEVELS
811 A AND B VAULTS
BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK

Vault	Location[a]	Total Alpha Activity (dpm/100 cm^2)	Total Beta Activity (dpm/100 cm^2)
A1	Floor (East)	0	-720
	Floor (West)	24	-1,100
	Wall (West)	16	-1,600
	Wall (South)	0	-1,300
A2	Floor (Southwest)[b]	10	3,500
	Floor (Northwest)	16	990
	Wall (North)	87	-940
	Wall (East)	16	-540
A3	Wall (West)[b]	27	3,600
	Wall (South)[b]	13	2,800
	Wall (East)	0	950
	Wall (North)	0	2,200
B1	Wall (Southwest)[b]	24	1,400
	Wall (Southeast)[b]	17	3,200
	Wall (East)[b]	13	1,300
	Floor (Center)	0	260
B2	Floor (Southeast)	71	2,900
	Floor (Northwest)	8	1,900
	Wall (North)	-8	-890
	Wall (East)	0	-860
B3	Wall (North)	210	3,900
	Wall (East)	16	31,000
	Wall (South)	0	29,000
	Wall (West)	0	42,000

[a]Refer to Figure 3.
[b]Grid block average for measurement location.

TABLE 2

RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES
811 C AND D YARDS
BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK

Sample No.[a]	Radionuclide Concentration (pCi/g)			
	Cs-137	Sr-90	Ra-226[c]	Sum-of-Fractions
001	139.1 ± 4.2	1.69 ± 0.21	0.22 ± 0.18	6.2
002	2.82 ± 0.12	1.23 ± 0.20	0.19 ± 0.06	0.24
003	0.16 ± 0.03	0.37 ± 0.14	0.14 ± 0.04	0.1
004	0.00 ± 0.01	-0.09 ± 0.12	0.13 ± 0.03	0.02
008	2.10 ± 0.11	--[b]	0.58 ± 0.09	--
009	0.62 ± 0.05	--	0.37 ± 0.06	--
010	7.15 ± 0.24	1.03 ± 0.31	0.37 ± 0.07	0.45
011	0.91 ± 0.06	--	0.43 ± 0.06	--
012	3.05 ± 0.13	--	0.45 ± 0.07	--
013	4.01 ± 0.16	--	0.43 ± 0.07	--
014	26.89 ± 0.82	8.41 ± 0.63	0.47 ± 0.09	1.8
015	4.95 ± 0.18	--	0.25 ± 0.06	--
016	0.12 ± 0.03	--	0.61 ± 0.06	--
017	4.67 ± 0.18	--	0.33 ± 0.07	--
018	0.05 ± 0.01	--	0.42 ± 0.05	--
019	8.43 ± 0.29	1.52 ± 0.34	0.28 ± 0.08	0.52
020	54.6 ± 1.8	15.47 ± 0.87	0.55 ± 0.18	3.5

[a]Refer to Figure 4.
[b] --Samples not analyzed for Sr-90.
[c] Ra-226 was determined based on the Pb-214 peak.

TABLE 3

COMPARISON OF RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES 811 A AND B VAULT AREA BROOKHAVEN NATIONAL LABORATORY UPTON, NEW YORK

Sample ID[a] BNL (ESSAP)	C-137 Radionuclide Concentration (pCi/g)	
	ESSAP	BNL[b, c, d]
A/3-1 (21)	0.09 ± 0.01	0.06 ± 0.01
A/3-2 (22)	0.03 ± 0.02	0.06 ± 0.02
A/3-3 (23)	0.01 ± 0.01	0.05 ± 0.01
A/3-4 (24)	8.62 ± 0.29	2.27 ± 0.02
A/3-5 (25)	0.02 ± 0.01	0.07 ± 0.01
A/3-6 (26)	0.01 ± 0.01	0.06 ± 0.01
B/3-1 (27)	3.70 ± 0.15	5.29 ± 0.01
B/3-2 (28)	0.46 ± 0.04	0.06 ± 0.01
B/3-3 (29)	0.36 ± 0.03	1.67 ± 0.02
B/3-4 (30)	0.37 ± 0.03	0.08 ± 0.02
B/3-5 (31)	0.30 ± 0.03	0.03 ± 0.02
B/3-6 (32)	0.49 ± 0.03	0.09 ± 0.01
B/3-7 (33)	1.05 ± 0.06	1.50 ± 0.02
A-3 bottom of sump excavation (34)	1.24 ± 0.07	3.96 ± 0.03
B1-2-02[e] (5)	0.35 ± 0.04	0.43
B2-1-04[e] (6)	0.03 ± 0.02	---[f]
A2-3-02[e] (7)	0.45 ± 0.05	---[f]

[a]Samples collected by BNL.
[b]ISOCS spectral analysis
[c]BNL ISOCS data for Vault A3 referenced from e-mail (BNL 2005a).
[d]BNL ISOCS data for Vault B3 referenced from e-mail (BNL 2005b).
[e]Soil collected by BNL from underneath vaults.
[f]BNL data not available.

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APPENDIX A
MAJOR INSTRUMENTATION

APPENDIX A

MAJOR INSTRUMENTATION

The display of a specific product is not to be construed as an endorsement of the product or its manufacturer by the author or employer.

SCANNING INSTRUMENT/DETECTOR COMBINATIONS

Alpha-Beta

Ludlum Ratemeter-Scaler Model 2221
coupled to
Ludlum Gas Proportional Detector Model 43-68, Physical Area: 126 cm^2
(Ludlum Measurements, Inc., Sweetwater, TX)

Gamma

Ludlum Model 12
(Ludlum Measurements, Inc., Sweetwater, TX)
coupled to
Victoreen NaI Scintillation Detector Model 489-55, Crystal: 3.2 cm x 3.8 cm
(Victoreen, Cleveland, OH)

DIRECT MEASUREMENT INSTRUMENT/DETECTOR COMBINATIONS

Beta

Ludlum Ratemeter-Scaler Model 2221
coupled to
Ludlum Gas Proportional Detector Model 43-68, Physical Area: 126 cm^2
(Ludlum Measurements, Inc., Sweetwater, TX)

LABORATORY ANALYTICAL INSTRUMENTATION

Low Background Gas Proportional Counter
Model LB-5100-W
(Oxford, Oak Ridge, TN)

LABORATORY ANALYTICAL INSTRUMENTATION (CONTINUED)

High Purity Extended Range Intrinsic Detector
CANBERRA/Tennelec Model No: ERVDS30-25195
(Canberra, Meriden, CT)
Used in conjunction with:
Lead Shield Model G-11
(Nuclear Lead, Oak Ridge, TN) and
Multichannel Analyzer
DEC ALPHA Workstation
(Canberra, Meriden, CT)

High Purity Extended Range Intrinsic Detector
Model No. GMX-45200-5
(AMETEK/ORTEC, Oak Ridge, TN)
used in conjunction with:
Lead Shield Model SPG-16-K8
(Nuclear Data)
Multichannel Analyzer
DEC ALPHA Workstation
(Canberra, Meriden, CT)

High-Purity Germanium Detector
Model GMX-30-P4, 30% Eff.
(AMETEK/ORTEC, Oak Ridge, TN)
Used in conjunction with:
Lead Shield Model G-16
(Gamma Products, Palos Hills, IL) and
Multichannel Analyzer
DEC ALPHA Workstation
(Canberra, Meriden, CT)

APPENDIX B

SURVEY AND ANALYTICAL PROCEDURES

APPENDIX B

SURVEY AND ANALYTICAL PROCEDURES

PROJECT HEALTH AND SAFETY

The survey and sampling procedures were evaluated to ensure that any hazards inherent to the procedures themselves were addressed in current job hazard analyses (JHAs). All survey and laboratory activities were conducted in accordance with ORISE health and safety and radiation protection procedures.

A walkdown of the survey areas was performed in order to evaluate and identify potential health and safety issues. BNL provided general site-specific safety awareness training and because the team would enter the vaults, fall protection and confined space training were also provided. Verification survey activities were performed according to ORISE generic health and safety plan requirements, a site-specific integrated safety management (ISM) pre-job hazard checklist, and the safety procedures discussed during the training provided by BNL.

QUALITY ASSURANCE

Analytical and field survey activities were conducted in accordance with procedures from the following documents of the Environmental Survey and Site Assessment Program:

- Survey Procedures Manual, (September 2004)
- Laboratory Procedures Manual, (August 2004)
- Quality Assurance Manual, (August 2004)

The procedures contained in these manuals were developed to meet the requirements of Department of Energy (DOE) Order 414.1B and the U.S. Nuclear Regulatory Commission *Quality Assurance Manual for the Office of Nuclear Material Safety and Safeguards* and contain measures to assess processes during their performance.

Quality control procedures include:

- Daily instrument background and check-source measurements to confirm that equipment operation is within acceptable statistical fluctuations.

- Participation in MAPEP, NRIP, and ITP Laboratory Quality Assurance Programs.
- Training and certification of all individuals performing procedures.
- Periodic internal and external audits.

CALIBRATION

Calibration of all field and laboratory instrumentation was based on standards/sources, traceable to the National Institute of Standards and Technology (NIST), when such standards/sources were available. In cases where they were not available, standards of an industry-recognized organization were used.

Detectors used for assessing surface activity were calibrated in accordance with ISO-7503[1] recommendations. The total efficiency (ε_{total}) was determined for each instrument/detector combination and consisted of the product of the 2π instrument efficiency (ε_i) and surface efficiency (ε_s): $\varepsilon_{total} = \varepsilon_i \times \varepsilon_s$.

Tc-99 was used as the calibration source (maximum beta energy of 292 keV) as it provides a conservative representation of the radionuclide mixture. ISO-7503 recommends an ε_s of 0.25 for beta emitters with a maximum energy of less than 0.4 MeV (400 keV) and an ε_s of 0.5 for maximum beta energies greater than 0.4 MeV. An ε_s of 0.25 was selected in order to calculate a conservative ε_{total}.

Surface Scans

Hand-held detectors were placed on contact with the calibration sources. A postulated hot-spot size of 100 cm^2 was assumed *a priori* for determining scanning instrument efficiencies. The scanning ε_i value was 0.40 for the hand-held gas proportional detector; the calculated scanning ε_{total} value was 0.10 for Tc-99. Calibration source emission rates were not corrected for geometry when sources larger than the detectors were used.

[1] International Standard. ISO 7503-1, Evaluation of Surface Contamination - Part 1: Beta-emitters (maximum beta energy greater than 0.15 MeV) and alpha-emitters. August 1, 1988.

Surface Activity Measurements

The calibration ε_i value for the hand-held gas proportional detectors used for the confirmatory survey was 0.40 for Tc-99. Calibration source emission rates were corrected to the active area of the detector when the calibration source area exceeded the detector area. The static ε_{total} value used for Tc-99 was 0.10.

SURVEY PROCEDURES

Surface Scans

Surface scans were performed by passing the detectors slowly over the surface; the distance between the detector and the surface was maintained at a minimum - nominally about 1 cm. Vault floor and wall surfaces were scanned using small area (126 cm^2) hand-held detectors with a 0.8 mg/cm^2 window. Identification of elevated levels was based on increases in the audible signal from the recording and/or indicating instrument.

Scan minimum detectable concentrations (MDCs) were estimated using the calculational approach described in NUREG-1507[2]. The scan MDC is a function of many variables, including the background level. Site beta background levels ranged from 311 to 386 cpm with an average of 349 cpm for the hand-held gas proportional detectors. Additional parameters selected for the calculation of scan MDC included a one-second observation interval, a specified level of performance at the first scanning stage of 95% true positive rate and 25% false positive rate, which yields a d′ value of 2.32 (NUREG-1507, Table 6.1), and a surveyor efficiency of 0.5. To illustrate an example for the hand-held gas proportional detectors with 0.8 mg/cm^2 windows, the minimum detectable count rate (MDCR) and scan MDC can be calculated as follows:

$$b_i = (311\text{ cpm})\,(1\text{ s})\,(1\text{ min}/60\text{ s}) = 5.2\text{ counts}$$

$$MDCR = (2.32)\,(5.2\text{ counts})^{1/2}\,[(60\text{ s/min})/(1\text{ s})] = 317\text{ cpm}$$

$$MDCR_{surveyor} = 317/(0.5)^{1/2} = 448\text{ cpm}$$

The scan MDC is calculated using the total scanning efficiency (ε_{total}) of 0.10:

[2]NUREG-1507. Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions. US Nuclear Regulatory Commission. Washington, DC; June 1998.

$$\text{Scan MDC} = \frac{MDCR_{surveyor}}{\varepsilon_{total}}\ \text{dpm/100 cm}^2$$

The scan MDC was calculated to be 4,500 dpm/100 cm^2. For the given background ranges, the following table summarizes the calculated scan MDC values.

Detector	Scan MDC Range (dpm/100 cm^2)
	0.8 mg/cm^2 Window
Hand-Held Gas Proportional	4,500 to 5,000

The scan MDCs for the NaI scintillation detector for the contaminants of concern in surface soil were obtained directly from NUREG-1507 when available. The scan MDCs provided in NUREG-1507 are 10.4 pCi/g for Cs-137 and 4.5 pCi/g for Ra-226. The scan MDCs for other major gamma-emitting contaminants of concern were not provided in NUREG-1507. In such a case, it is standard procedure for ESSAP staff to pause and investigate any locations where gamma radiation is distinguishable from background levels.

Surface Activity Measurements

Surface activity measurements were performed on poured concrete. Surface activity was calculated by determining the net count rate, subtracting the shielded measurement from the unshielded measurement, then correcting for total efficiency and detector area size.

The static beta MDC—calculated using the calibration check-out background count rate of 380 cpm—for the gas proportional detectors used for direct measurements was 740 dpm/100 cm^2. The physical surface area assessed by the gas proportional detector used was 126 cm^2.

RADIOLOGICAL ANALYSIS

Strontium-90 Analyses

Soil samples are dissolved by a combination of potassium hydrogen fluoride and pyrosulfate fusions. The fusion cake was dissolved and strontium was coprecipitated on lead sulfate. The strontium was separated from residual calcium and lead by reprecipitating strontium sulfate from

EDTA at a pH of 4.0. Strontium was separated from barium by complexing the strontium in DTPA while precipitating barium as barium chromate. The strontium was ultimately converted to strontium carbonate and counted on a low-background gas proportional counter. The typical MDC of the procedure is 0.8 pCi/g for one hour count time.

Gamma Spectroscopy

Samples of soil were dried, mixed, crushed, and/or homogenized as necessary, and a portion sealed in a 0.5-liter Marinelli beaker or other appropriate container. The quantity placed in the beaker was chosen to reproduce the calibrated counting geometry. Net material weights were determined and the samples counted using intrinsic germanium detectors coupled to a pulse height analyzer system. Background and Compton stripping, peak search, peak identification, and concentration calculations were performed using the computer capabilities inherent in the analyzer system. All total absorption peaks (TAP) associated with the radionuclides of concern were reviewed for consistency of activity. Total absorption peaks used for determining the activities of radionuclides of concern and the typical associated MDCs for a one-hour count time were:

Radionuclide	TAP (MeV)	MDC (pCi/g)
Cs-137	0.662	0.05
Ra-226 (from Pb-214)	0.351	0.19

Spectra were also reviewed for other identifiable TAPs.

UNCERTAINTIES AND DETECTION LIMITS

The uncertainties associated with the analytical data presented in the tables of this report represent the total propogated uncertainties for that data. These uncertainties were calculated based on both the gross sample count levels and the associated background count levels.

Detection limits, referred to as minimum detectable concentration (MDC), were based on 3 plus 4.65 times the standard deviation of the background count $[3 + (4.65\sqrt{BKG})]$. Because of variations in background levels, measurement efficiencies, and contributions from other radionuclides in samples, the detection limits differ from sample to sample and instrument to instrument.

APPENDIX C

SUMMARY OF DEPARTMENT OF ENERGY RESIDUAL RADIOACTIVE MATERIAL GUIDELINES

APPENDIX C

RESIDUAL RADIOACTIVE MATERIAL GUIDELINES SUMMARIZED FROM DOE ORDER 5400.5 (DOE 1990)

BASIC DOSE LIMITS

The basic dose limit for the annual radiation (excluding radon) received by an individual member of the general public is 100 mrem/yr. In implementing this limit, DOE applies as low as reasonably achievable principles to set site-specific guidelines.

EXTERNAL GAMMA RADIATION

The average level of gamma radiation inside a building or habitable structure on a site that has no radiological restriction on its use shall not exceed the background level by more than 20 μR/h and will comply with the basic dose limits when an appropriate-use scenario is considered.

SURFACE CONTAMINATION GUIDELINES

	Allowable Total Residual Surface Contamination (dpm/100 cm^2)[a]		
Radionuclides[b]	Average[c,d]	Maximum[d,e]	Removable[d,f]
Transuranics, Ra-226, Ra-228, Th-230 Th-228, Pa-231, Ac-227, I-125, I-129	100	300	20
Th-Natural, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000	3,000	200
U-Natural, U-235, U-238, and associated decay products	5,000α	15,000α	1,000α
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5,000β-γ	15,000β-γ	1,000β-γ

[a] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[b] Where surface contamination by both alpha- and beta-gamma-emitting radionuclides exists, the limits established for alpha- and beta-gamma-emitting radionuclides should apply independently.

[c] Measurements of average contamination should not be averaged over an area of more than 1 m^2. For objects of less surface area, the average should be derived for each such object.

[d] The average and maximum dose rates associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h and 1.0 mrad/h, respectively, at a depth of 1 cm.

[e] The maximum contamination level applies to an area of not more than 100 cm^2.

[f] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping an area of that size with dry filter or soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. The numbers in this column are maximum amounts