Brookhaven Graphite Research Reactor Decommissioning Project

DRAFT FINAL
Remedial Design/Remedial Action Work Plan
For the
Installation of an Engineered Cap and Monitoring System

March 28, 2008

BROOKHAVEN NATIONAL LABORATORY
BROOKHAVEN SCIENCE ASSOCIATES
Under Contract No. DE-AC02-98CH01886 with the
UNITED STATES DEPARTMENT OF ENERGY

TABLE OF CONTENTS

APPENDICES

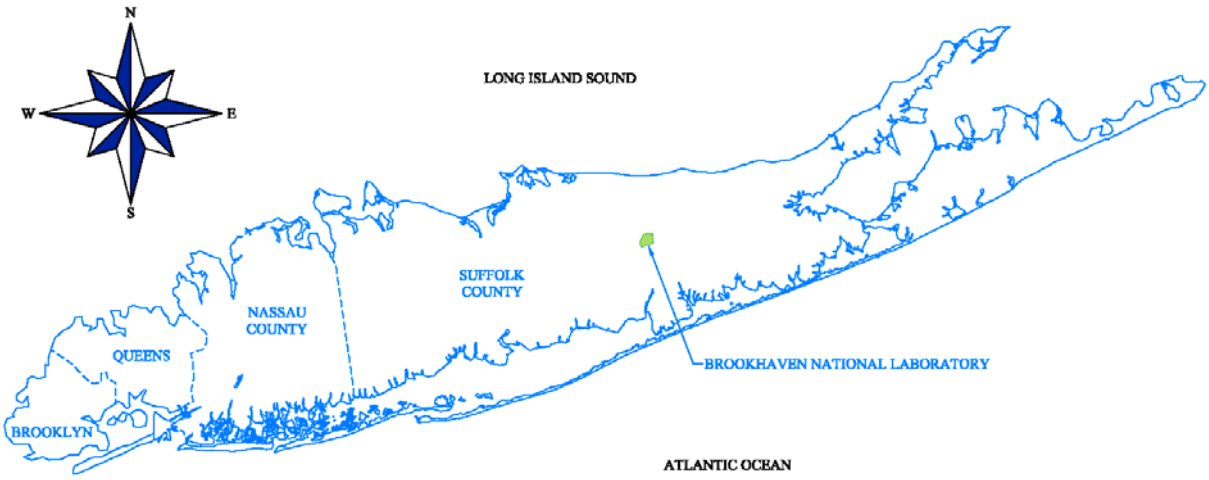
1.0 INTRODUCTION

This Remedial Design/Remedial Action (RD/RA) work plan presents the approach that will be used for the installation of an engineered cap and monitoring system associated with Area of Concern (AOC) 9, Brookhaven Graphite Research Reactor (BGRR) Brookhaven National Laboratory (BNL).

1.1 Site Background

BNL is a federal facility owned by U.S. Department of Energy (DOE). The DOE conducts research in physical, biomedical and environmental sciences and energy technologies. Brookhaven National Laboratory is located about 60 miles east of New York City, in Upton, Suffolk County, New York, near the geographic center of Long Island (Figure 1-1). Distances to neighboring communities from BNL are as follows: Patchogue ten miles west-southwest, Bellport eight miles southwest, Center Moriches seven miles southeast, Riverhead 13 miles east, Wading River seven miles north-northeast, and Port Jefferson eleven miles northwest.

Figure 1-1: Regional Site Location Map.



The BNL property, consisting of 5,321 acres, is an irregular polygon, and each side is approximately 2.5 miles long. The developed portion of the BNL Site includes the principal facilities, which are located near the center of the BNL Site on relatively high ground. The developed portion is approximately 900 acres, 500 acres of which were originally developed for Army use. The remaining 400 acres are mostly occupied by various large research machine facilities. The outlying facilities occupy approximately 550 acres and include an apartment area, Biology Field, Former Hazardous Waste Management Area, Sewage Treatment Plant, firebreaks, and the Former Landfill Area. The terrain is gently rolling, with elevations varying between 40 to 120 feet above mean sea level. The land lies on the western rim of the shallow Peconic River watershed, with a tributary of the Peconic River rising in marshy areas in the northern section of the tract. The sole-source aquifer beneath BNL comprises three water-bearing units: the upper glacial deposits, the Magothy

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

The BGRR is centrally located within the BNL Site (Figure 1-2, Location of the BGRR on BNL Site) and Figure 1-3 illustrates the BGRR complex.

1.2 Site History and Enforcement Activities

The U.S. Army occupied the BNL Site, formerly Camp Upton, during World Wars I and II. Between the wars, the Civilian Conservation Corps operated the BNL Site. It was transferred to the Atomic Energy Commission in 1947, to the Energy Research and Development Administration in 1975, and to DOE in 1977. Brookhaven Science Associates (BSA) operates BNL under a contract with DOE. In 1980, the BNL Site was placed on the New York State Department of Environmental Conservation's (NYSDEC) list of Inactive Hazardous Waste Sites. On November 21, 1989, the BNL Site was included on U.S. Environmental Protection Agency's (EPA's) National Priorities List because of soil and groundwater contamination that resulted from the Laboratory's past operations. Subsequently, the EPA, NYSDEC, and DOE entered into a *Federal Facilities Agreement* (CERCLA-FFA, 1992) (herein referred to as the Interagency Agreement; [IAG]) that became effective in May 1992 to coordinate the cleanup.

The BGRR at BNL was the first reactor built for the sole purpose of providing neutrons for research. During its years of operation, it was one of the principal research reactors in the United States. Construction was completed in August 1950, and initial criticality of the reactor was achieved the same month. The BGRR operated until June 10, 1968, when operation of the reactor was terminated and deactivation of the facility was initiated.

In June of 1972, de-fueling and shipment of the fuel to the DOE Savannah River site was completed. The BGRR complex was described as being in a safe shutdown condition by the U.S. Atomic Energy Commission and became a surplus facility within the DOE complex. From 1977 until 1997, portions of the facility were used as the BNL Science Museum.

In 2005, the *BGRR Final Record of Decision for Area of Concern 9 Brookhaven Graphite Research Reactor* (BSA, 2005a) was signed by the EPA, NYDEC and, the DOE. This agreement requires the removal of the graphite pile, biological shield, canal structure, reasonably accessible contaminated soils, and installation of water infiltration control and monitoring system for remaining structures and subsurface contaminated soils. This RD/RA Work Plan addresses the installation of water infiltration control and monitoring system detailed herein is based on *Brookhaven Graphite Research Reactor Engineered Cap Design Basis* (BSA 2006a). The design included in this RDRA has been modified based on internal BSA review.

Figure 1-2: Location of the BGRR on BNL Site

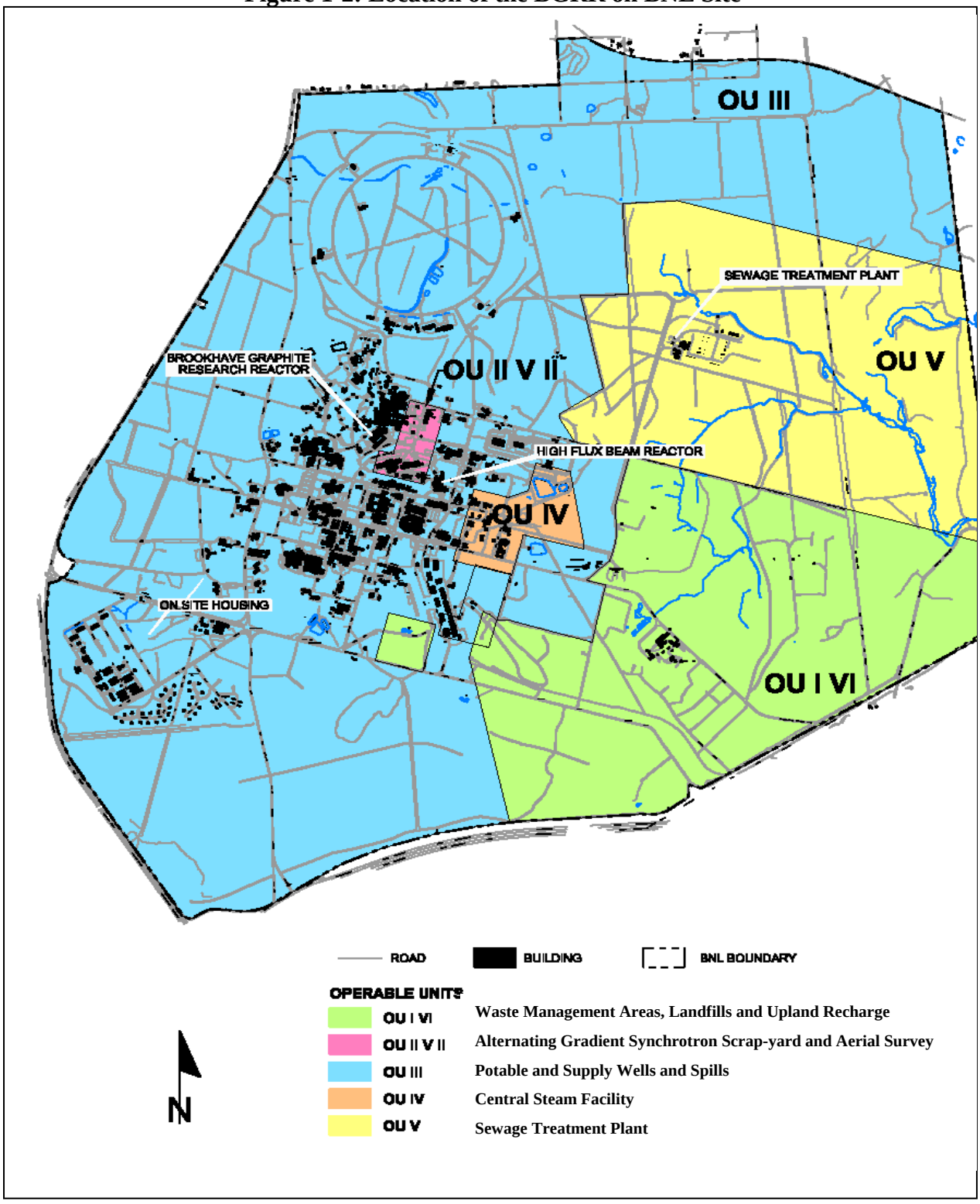
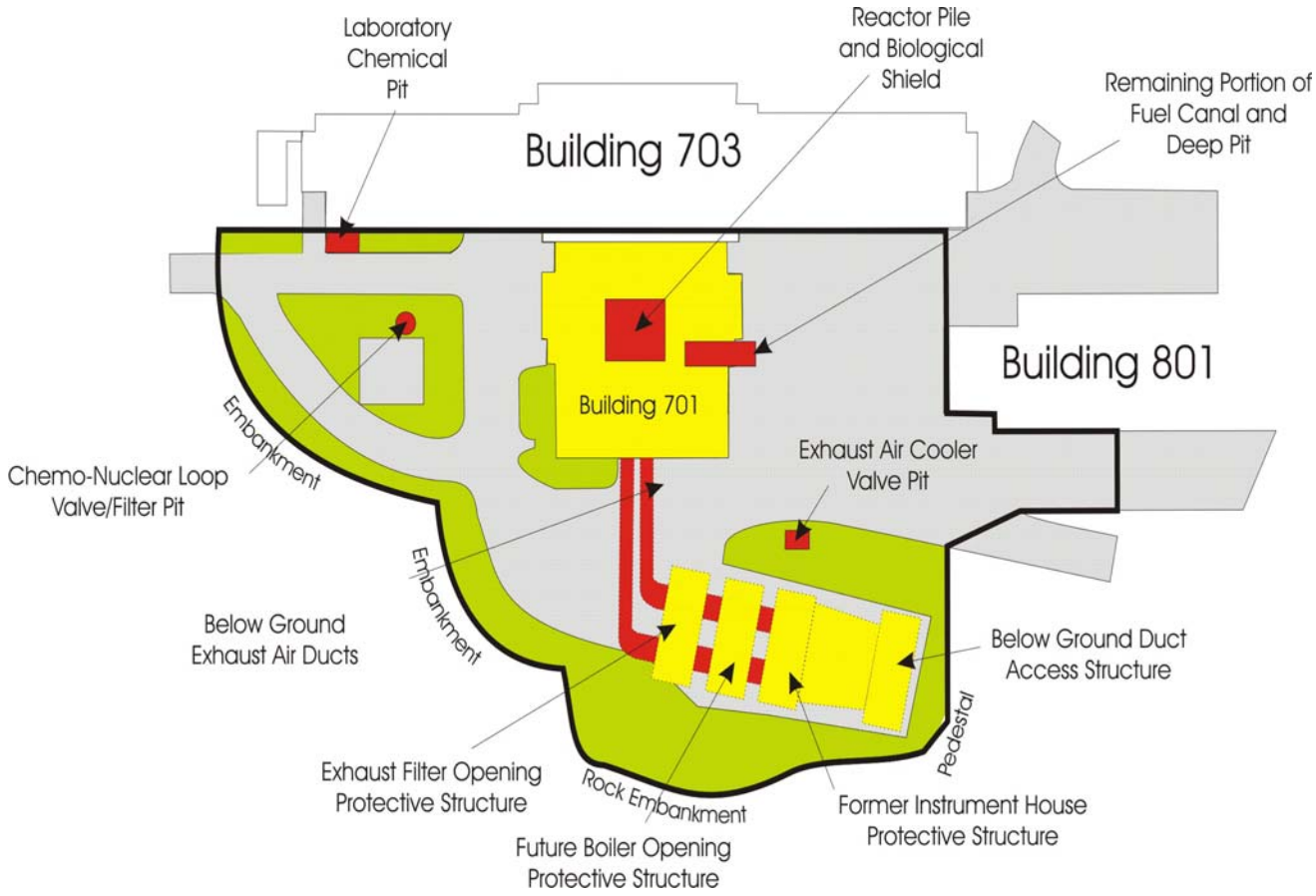


Figure 1-3: BGRR Complex



1.3 Current Status of BGRR Remediation

Decommissioning of the BGRR began in 1997 with the discovery and subsequent removal of approximately 60,000 gallons of contaminated water that had infiltrated and accumulated in the below ground ducts. Additional decommissioning activities to date have included the disposition of:

- Experimental equipment and systems from the reactor building;
- Reactor exhaust fans, motors, valves and instruments;
- Pile fan sump, pipes and associated contaminated soil;
- Above-ground ducts, pipes and associated contaminated soil;
- Canal house and water treatment house, along with associated equipment, pipes, asphalt, concrete and accessible contaminated soils;
- Reactor exhaust cooling coils, filters and primary liner (partial);
- The fuel canal structure outside the footprint of the reactor building;
- Accessible subsurface contaminated soil in the vicinity of the fuel canal, below-ground duct expansion joint #4 and secondary cooling air bustle;
- Isolation of the below-ground duct and demolition of the instrument house;
- Verification that all nuclear instrumentation has been removed;
- Removal and characterization of all experimental components;
- Inspection of all accessible fuel, non-fuel, and Newson channels; and
- Characterization of the boron shot from within the emergency shutdown system.

Remaining actions to be completed include:

- Graphite pile removal including all remaining in-core components (e.g. thermocouples, aluminum shot wells, invar tie rods, control rods, etc.);
- Biological shield removal;
- Design and installation of an engineered system to prevent water infiltration; and
- Establishment and implementation of land use and institutional controls.

1.4 Description of Remaining Contaminated Soils and Below Grade Structures

During removal of the BGRR canal and the deep soil pockets during the spring of 2005, approximately 824 cubic yards of radiologically-contaminated soil and concrete were excavated and disposed of at an approved disposal facility as documented in the *BGRR Canal and Deep Soil Pockets Excavation and Removal Completion Report* (BSA, 2005b). However, pockets of contaminated soil remain at several locations within the BGRR complex and they are the basis for the cap design. The extent of the engineered cap was selected to reduce the potential of surface infiltration of water from coming in contact with the contaminated soil. The engineered cap is depicted in Figure 1 – 4 and the approximate locations of the remaining contaminated soil pockets are shown Figures 1 - 5 and 1 - 6. Figure 1 – 7 details the current Sr-90 plume associated with the BGRR.

1.4.1 Remaining Contaminated Soils and Structures Outside Building 701 Footprint

Below Ground Duct Concrete and Steel Structure – This contaminated structure includes the concrete and steel remaining within the portion of the duct located outside of the foundation of Building 701. This contaminated concrete and steel structure contains approximately 0.825 curies (Ci) of radioactive materials consisting primarily of Cs-137 (0.784 Ci), Sr-90 (0.038 Ci), and Co-60 (0.001 Ci). The remaining radioactivity consists of uranium, plutonium, and americium (~0.002 Ci) in the form of fixed surface contamination.

Bustle Area (Deep Soil Pocket) Soils – This soil pocket is located adjacent to the secondary air bustle on the northeast side of the below ground duct where it exits from Building 701. In April 2005, contaminated soil was removed from between 27 feet below grade to the bottom of the ducts at approximately 33 feet below grade. Remaining contaminated soil exists between 33 feet below grade to 40 feet below grade (27 feet to groundwater) and is contaminated primarily with Cs-137 at a peak level of 89,000 pCi/g and Sr-90 at a peak level of 11,200 pCi/g.

Expansion Joint #4 & Cooler Drain Sumps Soils – This pocket includes soil adjacent to and underneath the north and south below ground duct cooler drains sumps and the duct expansion joint #4. This subsurface soil pocket begins within soil immediately below the expansion joint and extends from a depth of 18 to 30 feet below grade (38 feet above groundwater). The soil is contaminated primarily with Cs-137 at a peak level of 5,907 pCi/g and Sr-90 at a peak level of 676 pCi/g.

Fuel Canal Site Soils – This pocket consists of contaminated soils located directly below the site of the previously removed fuel canal. The pocket is located approximately 25 feet below grade and is contaminated primarily with Cs-137 at a peak level of 269 pCi/g and Sr-90 at a peak level of 54.3 pCi/g.

Drains and Drywells Soils – Three building drain drywells are located outside of the foundation footprint of Building 701 and were connected to the east and west inlet air filter house drains, the west steam trap drains, the control-rod drive mechanism floor drains, the fuel vault floor drains, and the east steam trap drains. The drywells are contaminated primarily with Cs-137 and Sr-90 with an average concentration of 93 pCi/g and 56 pCi/g respectively. The contamination is located approximately 6 to 8 feet below grade (56 to 58 feet above groundwater).

1.4.2 Remaining Contaminated Soils and Structures Within Building 701 Footprint

Drains and Drywells Soils – Two building drain drywells are located under the footprint of Building 701. These drywells were connected to the east and west inlet air plenum drains. The drywells are contaminated primarily with Cs-137 and Sr-90 with an average concentration of 450 pCi/g and 1,730 pCi/g, respectively. The contamination is located approximately 23 feet below grade (46 feet above groundwater).

Below-ground duct soils under the footprint of Building 701 – This pocket consists of contaminated soils located beneath the north duct in the vicinity of the below-ground expansion joint immediately south of the reactor. This subsurface soil pocket begins within soils immediately below the duct foundation pad and extends to a depth of two feet (32 feet above groundwater). The soil is contaminated primarily with Cs-137 at a peak level of 79,000 pCi/g and Sr-90 at a peak level of 2,200 pCi/g.

Deep pit and fuel canal soils under the footprint of Building 701 – This pocket consists of contaminated soils below the deep pit and portions of the canal that are below the foundation footprint of Building 701. This subsurface soil pocket begins within soils below the pile foundation pad and extends to a depth of two feet below the pad (32 feet above groundwater). The soil is contaminated primarily with Cs-137 at a peak level of 405 pCi/g and Sr-90 at a peak level of 103 pCi/g.

Below Ground Duct Concrete and Steel Structure – This contaminated structure includes the concrete and steel remaining within the portion of the duct located underneath Building 701. This contaminated concrete and steel structure contains approximately 0.422 Ci of radioactive materials consisting primarily of Cs-137 (0.399 Ci), Sr-90 (0.022 Ci), and Co-60 (0.001 Ci). The remaining radioactivity consists of uranium, plutonium, and americium (~0.001 Ci) in the form of fixed surface contamination.

Figure 1 – 4: Extent of BGRR Engineered Cap

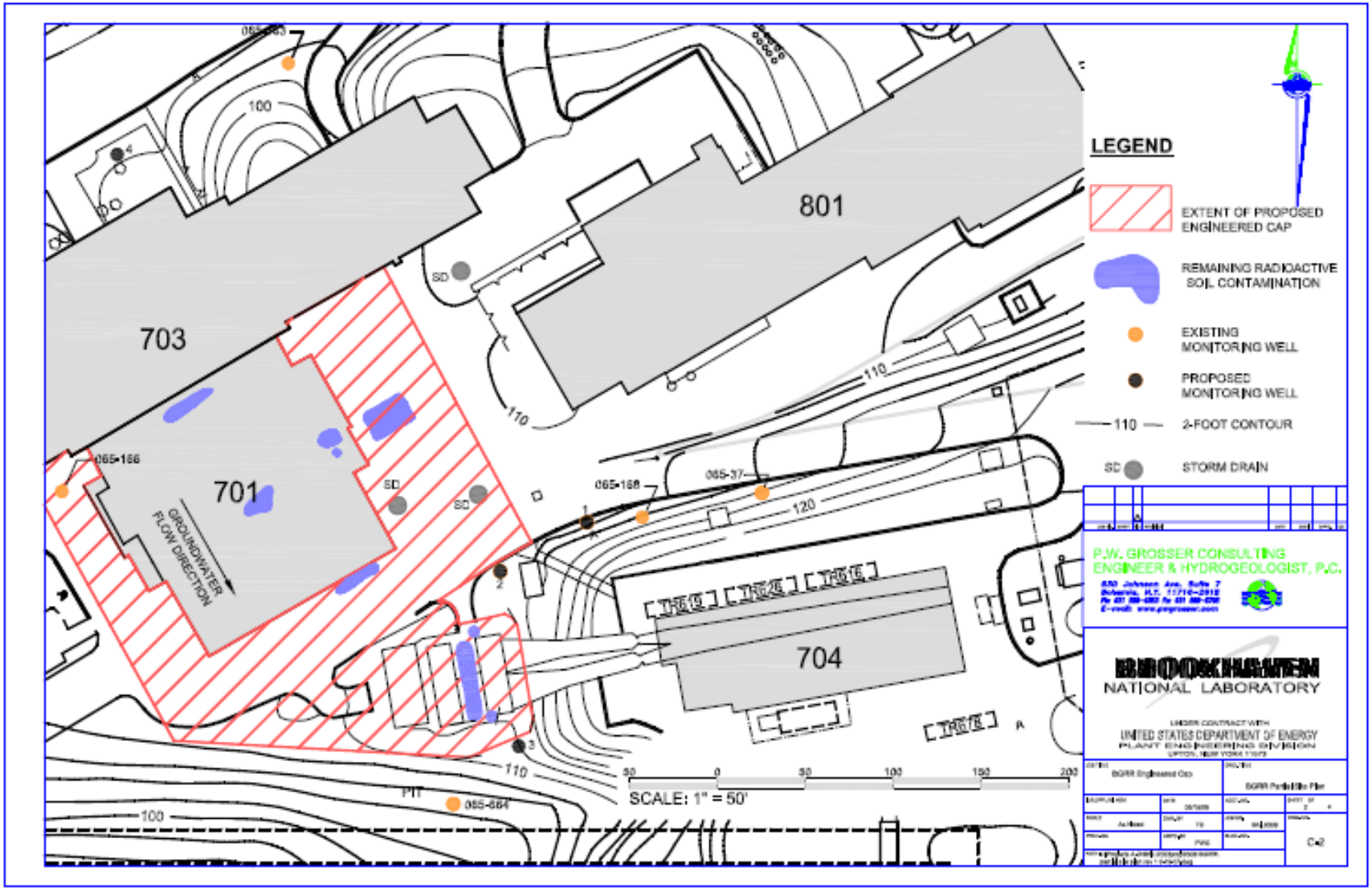


Figure 1 – 5: BGRR Soil Contamination Looking North

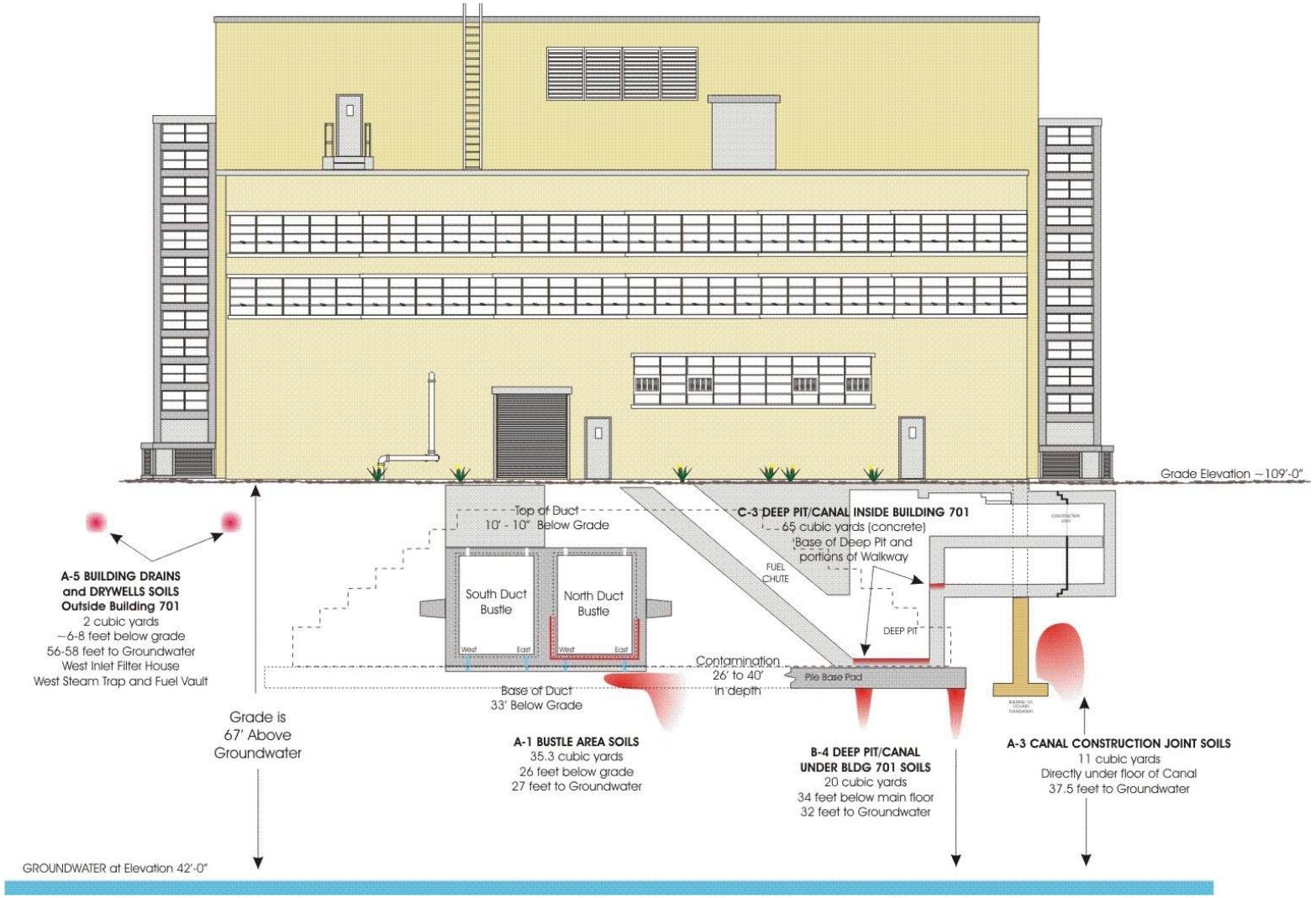
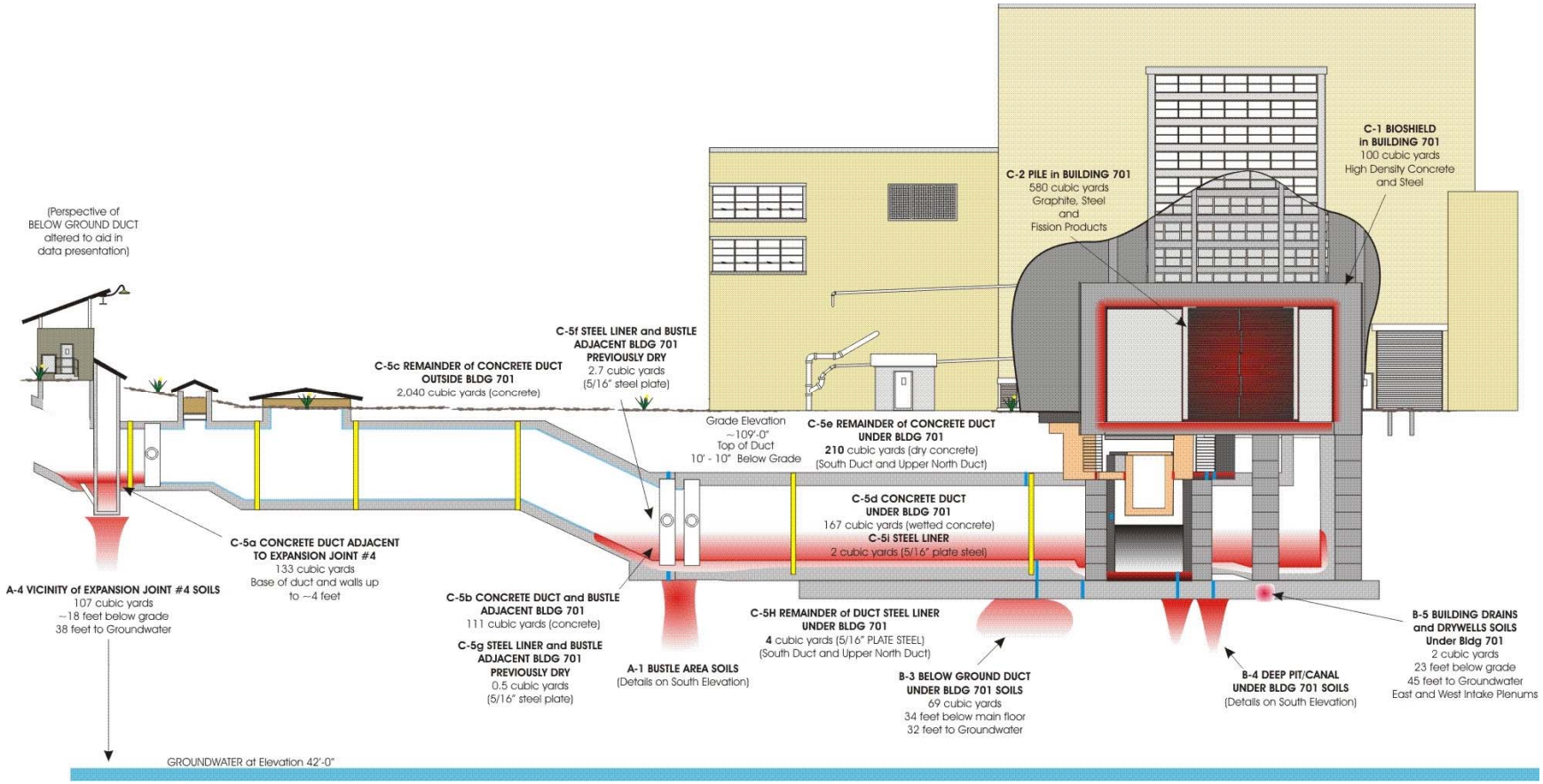


Figure 1 – 6: BGRR Soil Contamination Looking West



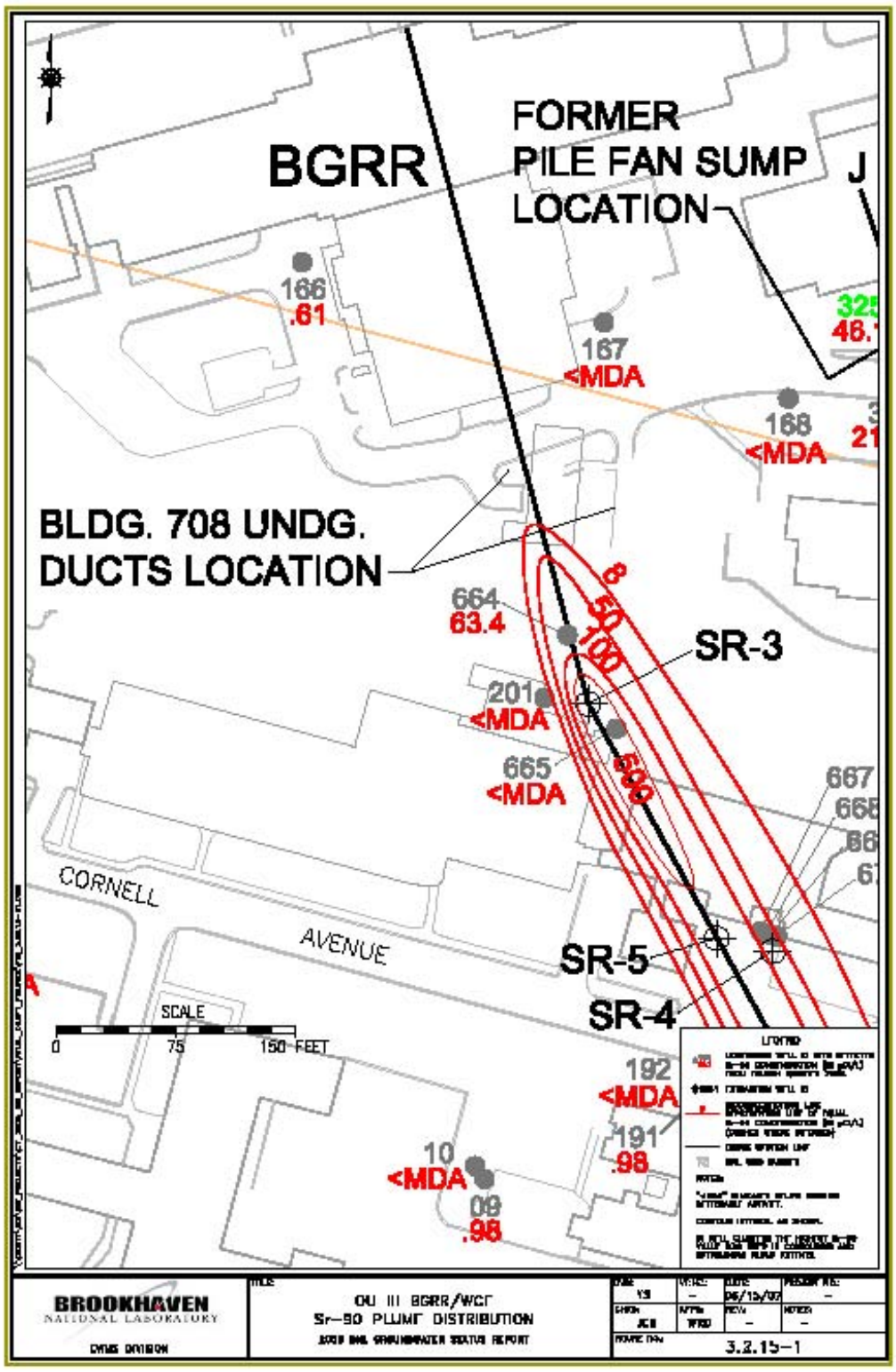


Figure 1 – 7: BGRR Sr-90 Plume

1.5 Objectives

The following remedial action objectives are included in the *BGRR Record of Decision* and will be met through the implementation of this RD/RA work plan:

- Through prudent remedial action, ensure the protection of human health and the environment from the potential hazards posed by the radiological inventory that resides in the BGRR complex. The remedial action should ensure protection of human health and the environment without undue uncertainties.
- Use the As Low As Reasonably Achievable (ALARA) principle, while implementing the remedial action, to reduce further the potential hazard to human health and the environment posed by the considerable radiological inventory that resides in the BGRR complex.

The operational objectives of this project include:

- Through the use of engineered and process controls, prevent the spread of contamination during the installation of the water infiltration control and monitoring system;
- Perform removal, transportation and disposal of wastes using safe and efficient methods; and
- Complete the project with no Occupational, Safety and Health Association (OSHA) reportable injuries or DOE reportable incidents.

1.6 Site Cleanup Criteria

The completion criterion for this remedial action is the installation of an engineered cap on the grounds outside of Building 701 which will serve to prevent water intrusion into radiologically-contaminated sub-surface components and soils remaining on the BGRR complex. Though radiologically-contaminated soils are not expected at the depth of the engineered cap, a complete radiological walkover survey will be performed and independently verified by the U.S. Department of Energy (DOE) following removal of the existing overlying asphalt and soil to a depth of 18 inches. Additionally, equipment will be released from the work areas in accordance with BSA FS-SOP-1005 *Radiological Surveys Required for Release of Materials from Areas Controlled for Radiological Purposes*.

2.0 SUMMARY OF REMEDIAL DESIGN/REMEDIAL ACTION

2.1 Engineered Cap Design

An engineered cap, as part of an infiltration management system, will be installed to prevent water intrusion into sub-surface components and soils remaining on the BGRR complex following completion of the removal actions. Constructing the cap will involve grading the existing property to create a slope away from the below-ground duct and Building 701, laying a polymer liner over the soil, and covering it with protective soil layers and sealed asphalt. The cap will re-direct surface water away from Building 701 and affected underground structures and sub-surface soils. The preliminary cap design and installation is detailed in Appendix A, Brookhaven Graphite Research Reactor Installation Specifications. The final design plans and drawings will be stamped and signed by a professional engineer licensed in the State of New York.

Additional groundwater monitoring wells will be installed south of the BGRR complex to provide assurance of the protectiveness of the cap. Following installation, groundwater monitoring will be performed as required by the *Brookhaven National Laboratory Operable Unit -III Record of Decision* (BSA, 2000).

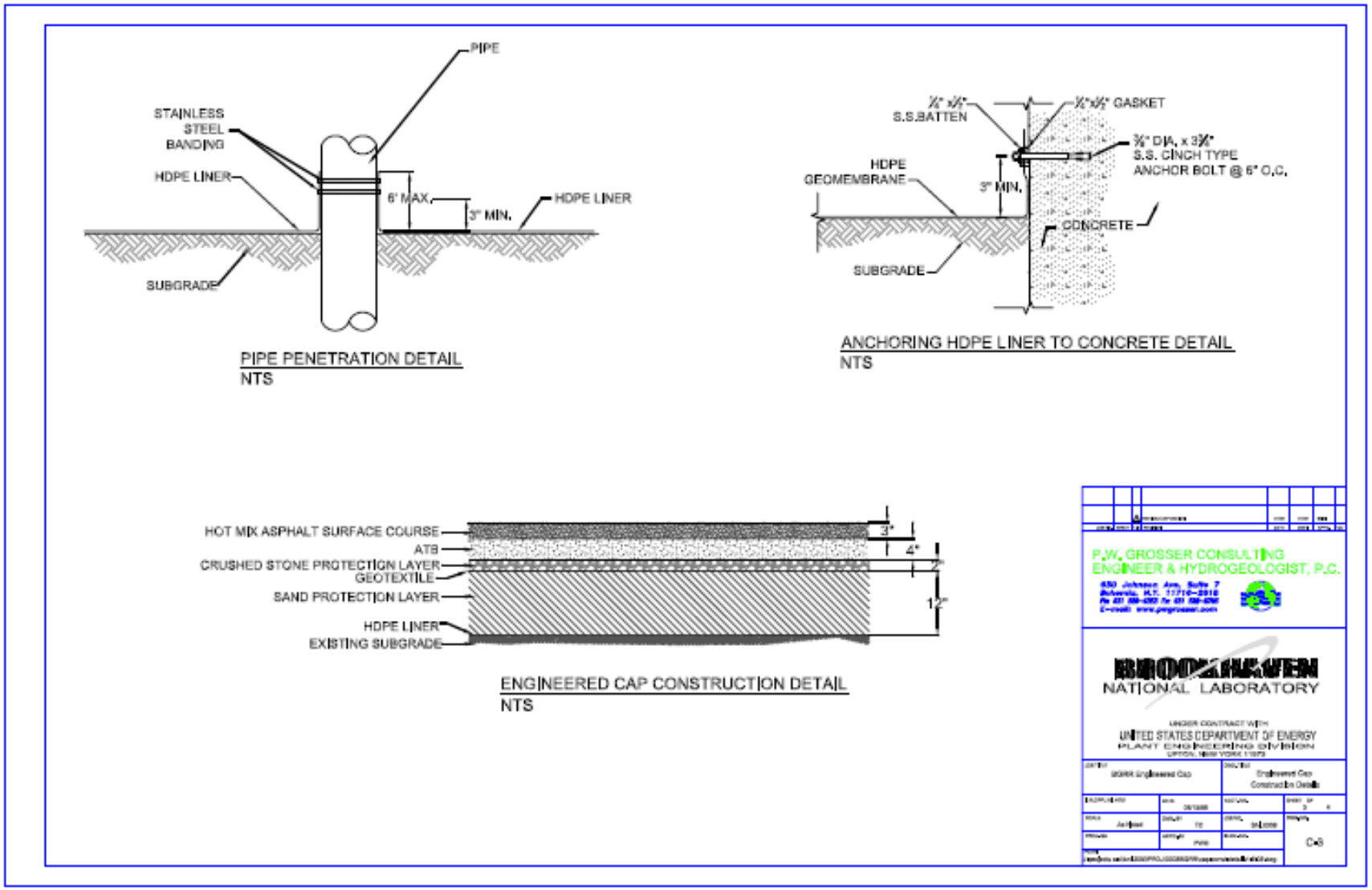
The engineered cap will be installed on the grounds to the west, east, and south of Building 701 and will serve to prevent water intrusion into radiologically-contaminated sub-surface components and soils remaining on the BGRR complex. The grounds immediately adjacent to Building 701 are currently paved with asphalt and are used for parking and light through-traffic. The existing asphalt pavement will be removed prior to installation of the engineered cap. The engineered cap system consists of a multi-layer barrier (Figure 2 – 1) with the following layers from bottom to top:

- 40-mil high-density polyethylene (HDPE) liner;
- 12-inch thick sand protection layer;
- A geotextile layer;
- 2-inch thick crushed stone protection layer;
- 4-inch thick asphalt treated base (ATB) course; and
- 3-inch thick hot-mix asphalt surface course.

The engineered cap will be approximately 32,400 square feet in size. To the east the cap will extend across the entire paved area between Building 701 and Building 801, to the south it will extend approximately 50 feet south of the southern wall Building 701, and then it will extend 25 feet west of Building 701.

Three monitoring wells will be installed along the southern perimeter of the cap to monitor the effectiveness of the cap. Initially, quarterly groundwater contaminant concentrations will be analyzed for trends to determine if radionuclides in the soil and structures underlying the cap are leaching into the groundwater.

Figure 2-1: Engineered Cap Detail



2.1.1 HDPE Liner

The HDPE geomembrane liner provides an impermeable barrier which prevents infiltrating water from contacting buried radiologically-contaminated soils. The geomembrane will be made of 40-mil thick high density polyethylene and will meet the minimum properties listed in Table 2 -1 of this section. It will be manufactured of new virgin polyethylene resin. The material will be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter. The sheets should be manufactured in a minimum 15-foot seamless width.

Table 2 -1
Minimum Values for Black Surfaced Smooth HDPE Geomembranes

Property	Test Method	Unit	Values
Thickness	ASTM D1593	Mils	36
Density	ASTM D1505	g/cc	.915-.930
Melt Flow Index	ASTM D1238-E	g/10 minutes	1.0 max
Carbon Black %	ASTM D1603	%	2.0
Carbon Black Dispersion	ASTM D3015	--	A-2
Tensile Properties	ASTM D6693		
Strength at break		lb/in-width	152
Strength at yield		lb/in-width	84
Elongation at break		%	700
Elongation at yield		%	12
Tear Resistance	ASTM D1004	lb	28
Puncture Resistance	ASTM D4833	lb	72
Environmental Stress Crack	ASTM D1693	Hours	1500
Dimensional Stability	ASTM D1204	% change	± 2
Low temp. brittleness	ASTM D746	Degree C	< -77
Coeff. of Liner Thermal Expansion	ASTM D696	x 10^{-4} cm/cm/^{o}C	2.5 max
Water Vapor Transmission	ASTM E96	g/m^2/day	1.0 max

2.1.2 12-inch Sand Protection Layer

The 12-inch sand protection layer serves to protect the HDPE liner from the puncturing by the crushed stone and asphalt base courses above. The sand protection layer shall conform to the following requirements:

Permeability: 1 x 10^{-3} cm/sec or greater at 85% compaction in accordance with ASTM D-1557.

Slope: 1 foot vertical to 75 feet horizontal.

Compaction: Each 6-inch layer shall be compacted to 90% maximum density (per ASTM D698) or 85% maximum density (per ASTM D1557).

Sieve Size	Percent Passing
1-inch (25 mm)	100
No. 4 (4.75 mm)	80
No. 40 (0.425 mm)	20 to 60
No. 200 (0.075 mm)	5 to 20

2.1.3 Geotextile Layer

The geotextile layer serves to minimize rutting of the asphalt pavement and prevent intermixing of the crushed stone and asphalt base courses with the soft soils below. The specified geotextile shall have an AASHTO Class 1 rating for high strength over soft soils and conform to the following requirements:

Table 2-2
Minimum Values for Geotextile

Property	Test Method	Unit	Values
Tensile Strength	ASTM D4632	Lbs.	315
Elongation at break	ASTM D4632	%	15
Mullen Burst	ASTM D3786	psi	600
Puncture strength	ASTM D4833	Lbs.	145
Trapezoidal tear	ASTM D4533	Lbs.	115
Apparent Opening Size	ASTM D4751	US Sieve	40
Permittivity	ASTM D4491	sec^{-1}	0.02
UV Resistance	ASTM D4355	% retained	90

2.1.4 2-inch Crushed Stone Protection Layer

The purpose of the 2-inch crushed stone protection layer is to provide protection to the geotextile layer from the hot temperatures during installation of the Asphalt Treated Base. The crushed stone protection layer shall conform to the following requirements:

Slope: 1 foot vertical to 75 feet horizontal.

Compaction: The layer shall be compacted to 90% maximum density (per ASTM D698) or 85% maximum density (per ASTM D1557).

Sieve Size	Percent Passing
2-inch (51 mm)	100
1-1/2 inch (38 mm)	90 to 100
1 inch (25 mm)	0 to 15

2.1.5 Asphalt Treated Base (ATB)

The asphalt treated based (ATB) lies above the geotextile layer to provide strength for the surface course. ATB is a dense-graded hot mix asphalt (HMA) with a wide gradation band and lower asphalt content and is intended for use as a base course. ATB costs less than typical HMA mixes because it can be produced with less expensive aggregates and lower percentages of asphalt binder. ATB is advantageous over typical HMA mixes because it can provide:

- A waterproof barrier to prevent fines infiltration into the subgrade and pavement structure.
- An alternative to untreated base material. Structurally, ATB is about three times as strong as an untreated granular base. Therefore, it is possible to use thinner layers for the same structural support, which can save on excavation, hauling, and disposal costs.

For a parking lot, the *Asphalt Institute* recommends an asphalt treated base course with a minimum thickness of 4 inches and conforming to the following requirements:

Asphalt Treated Base Course: 4.0 to 6.0 percent of asphalt cement by weight in mixture in accordance with the following gradation:

Sieve Size	Percent Passing
2 inches (51 mm)	100
1-1/2 inches (38 mm)	90-100
1 inch (25 mm)	78-100
½ inch (13 mm)	57-100
¼ inch (6.4 mm)	40-82
1/8 inch (3.2 mm)	26-63
No. 20 (0.85 mm)	12-36
No. 40 (0.425 mm)	8-25
No. 80 (0.18 mm)	4-16
No. 200 (0.075 mm)	2-8

Since ATB provides a waterproof barrier to the subbase, application of a prime coat is not required.

2.1.6 Hot-Mix Asphalt Surface Course

The HMA surface course is the upper course of the pavement and is constructed immediately above the ATB base course. The HMA surface course in flexible pavements consists of a mixture of mineral aggregates and asphaltic materials. For a parking lot with fair subgrade conditions and a 4-inch thick ATB base course, the *Asphalt Institute* recommends a surface course with a minimum thickness of 3 inches and conforming to the following requirements:

Hot-Mix Surface Course: Type "B", 5.8 to 7.0 percent of asphalt cement by weight in mixture in accordance with the following gradation.

Sieve Size	Percent Passing
1 inch (25 mm)	100
½ inch (13 mm)	90-100
¼ inch (6.4 mm)	55-75
1/8 inch (3.2 mm)	36-58
No. 20 (0.85 mm)	15-35
No. 40 (0.425 mm)	10-21
No. 80 (0.18 mm)	4-16
No. 200 (0.075 mm)	3-6

The surface course will be treated with a fog seal to reduce infiltration of water into the pavement.

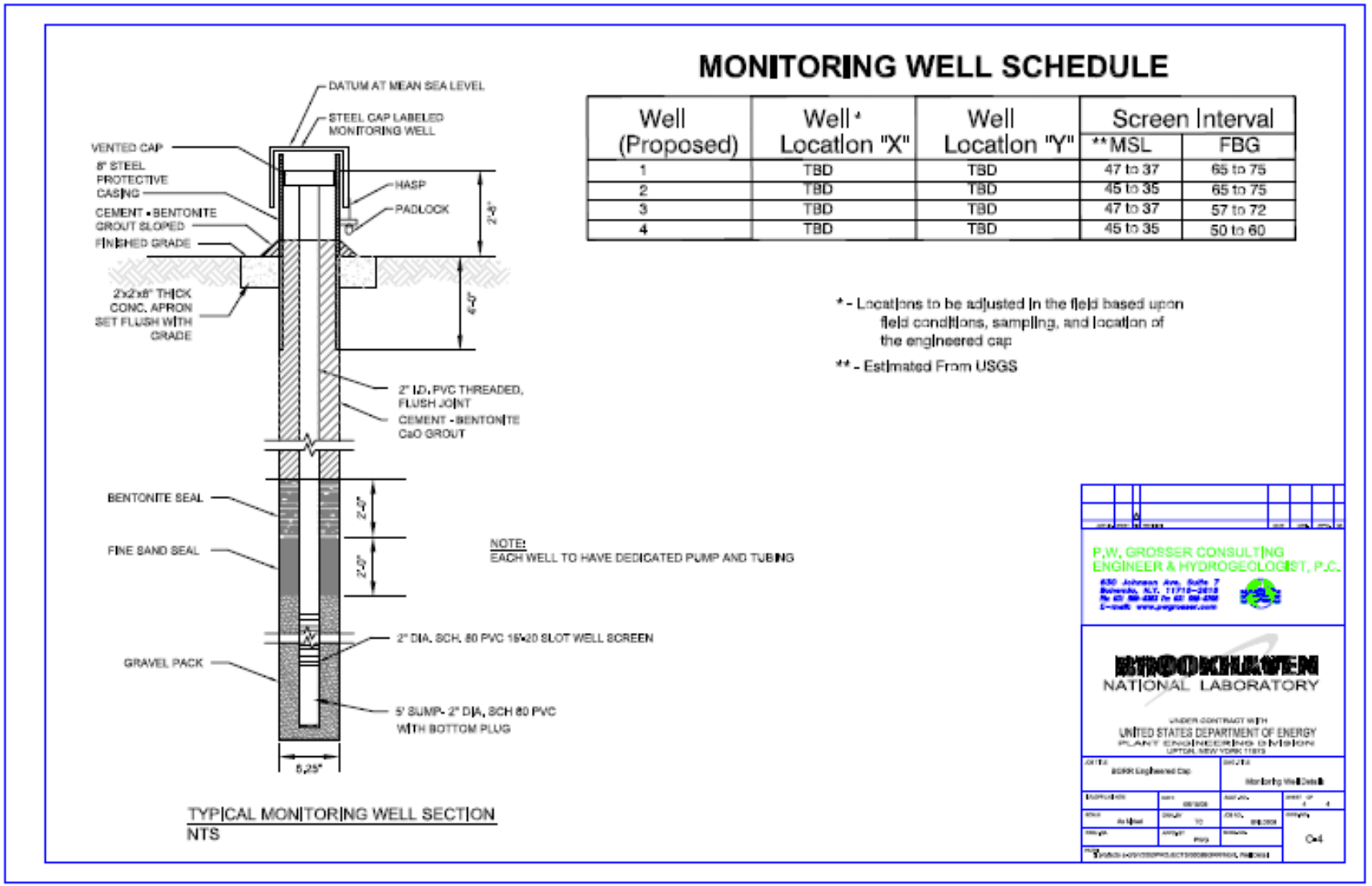
2.1.7 Fog Seal Coat

The surface of the Hot Mix Asphalt will be coated with a fog seal consisting of CSS-1 cationic emulsified asphalt. The recommended dilution rate to achieve the proper viscosity is 50% (equal parts water to equal parts emulsion).

2.1.8 Groundwater Monitoring Wells

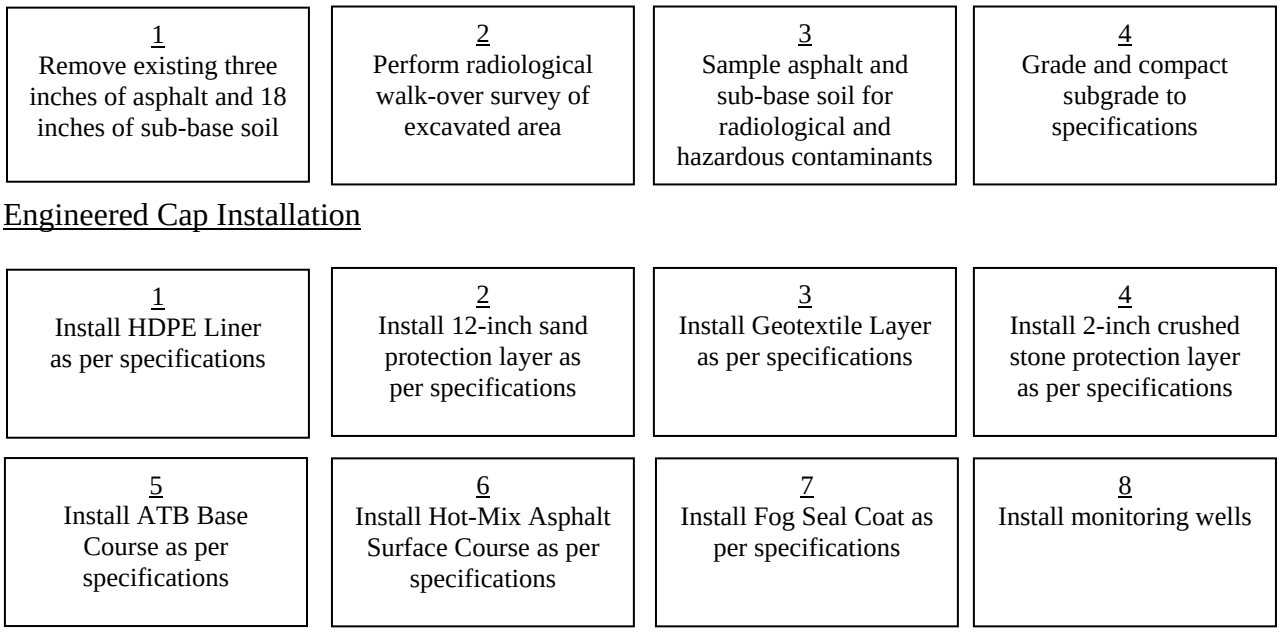
Three groundwater monitoring wells will be installed along the southern perimeter of the engineered cap for the purpose of monitoring the effectiveness of the cap. An additional well will be installed to the north of Building 703 to monitor groundwater up-gradient of the cap. The groundwater elevation in the vicinity of the engineered cap is approximately 45 feet. Each well will be 2 inches in diameter and constructed of 10 feet of PVC well screen and approximately 65 feet of PVC well casing. The well casings will be protected with an orange-painted, non-flush-mount steel protective casing. Details of the monitoring wells, including the well screen intervals, are provided in Figure 2-2.

Figure 2-2: Monitoring Well Details



2.2 Engineered Cap Installation

The sequential steps required to install the engineered cap are provided in the following process flow diagrams and described in the following subsections.



2.2.1 Subgrade Preparation

Prior to installation of the HDPE liner, the existing asphalt wearing and base courses (approximately 3 inches thick) and some existing soil (approximately 18 inches thick) will be removed over the entire area of the engineered cap. The asphalt and soil will be sampled for radiological and hazardous contaminants and based on the results will be disposed off off-site at an approved disposal facility or transported to an on-site borrow area. In addition, a complete radiological walkover survey will be performed prior to the installation of the cap and it will be independently verified by DOE. The subgrade will be graded and compacted to an elevation 21 inches less than the final surface elevation of the asphalt wearing course. The subgrade shall graded at a slope of 1 foot vertical to 75 feet horizontal (1.33% slope) away from the building. Further requirements for subgrade preparation are provided in Appendix A, Section 31 00 00, Part 3.04, Subgrade Preparation – Proof Rolling.

2.2.2 HDPE Liner

The HDPE liner will be installed in accordance with the manufacturer's instructions. The seams between liner sheets shall have a 6-inch overlap and be welded using an extrudate material made from the same resin as the geomembrane. The liner will be anchored to the concrete building foundation using stainless steel battens and concrete anchors to prevent water intrusion along the building foundation wall. The liner will also be anchored to any

penetrations (i.e., piping, storm drains, monitoring well casings) using stainless steel bands to prevent water intrusion at these locations.

2.2.3 12-inch Sand Protection Layer

The 12-inch sand protection layer will be installed on top of the HDPE liner from the puncturing by the crushed stone and asphalt base courses above. The sand protection layer will be installed in 6-inch lifts and compacted to 90% maximum density (per ASTM D698) or 85% maximum density (per ASTM D1557). The sand protection layer shall be graded at a slope of 1 foot vertical to 75 feet horizontal (1.33% slope) away from the building.

2.2.4 Geotextile Layer

The geotextile liner will be installed on top of the sand protection layer in accordance with the manufacturer's instructions. The seams between the geotextile sheets shall have an 18-inch overlap or sewn together. If during placement of overlying cover material the Contractor cannot maintain an overlap for geotextile, sewing will be required. In the presence of wind, all geotextiles shall be weighted with sandbags. Pins shall not be permitted for use to hold down the geotextile since they may puncture the underlying geomembrane.

2.2.5 2-inch Crushed Stone Protection Layer

The 2-inch crushed stone protection layer will be installed on top of the geotextile layer to provide protection to the geotextile layer from the hot temperatures during installation of he Asphalt Treated Base. The crushed stone protection layer will be compacted to 90% maximum density (per ASTM D698) or 85% maximum density (per ASTM D1557). The crushed stone protection layer shall be graded at a slope of 1 foot vertical to 75 feet horizontal (1.33% slope) away from the building.

2.2.6 ATB Base Course

The 4-inch thick ATB base course shall be installed and compacted on top of the geotextile layer in accordance with the specifications.

2.2.7 Hot-Mix Asphalt Surface Course

The 3-inch thick hot-mix asphalt surface course will be installed and compacted on top of the asphalt treated base course in accordance with the specifications.

2.2.8 Fog Seal Coat

The hot mix asphalt surface course will be treated with a fog seal to reduce water infiltration into the asphalt pavement. The fog seal will be installed in accordance with the specifications.

2.2.9 Groundwater Monitoring Wells

Three groundwater monitoring wells will be installed in accordance with the specifications to the south of the engineered cap, and a fourth groundwater monitoring well will be installed to the north of Building 703. The wells will be installed using the hollow-stem auger drilling method at the locations shown on the engineering drawings. The locations of the groundwater monitoring wells to the south of the engineered cap were determined based upon groundwater flow direction of south-southeast. A fourth monitoring well will be installed to the north of Building 703 to monitor groundwater up-gradient of Building 701 and the engineered cap.

2.3 Safety Requirements

Environmental Restoration Projects (ERP) Operations Procedures Manual (OPM) ERP-OPM-4.8, "Occupational Health and Safety Assessment Series (OHSAS) Implementation Manual", describes the internal procedures used within Environmental ERP to implement and satisfy the OHSAS 18001 Standard and provide a safe and healthful work environment for all employees, visitors and contractors. ERP uses the procedures established in BNL's Standards Based Management System (SBMS) for the ongoing identification of hazards, the assessment of risks, and the implementation of necessary control measures. These procedures address routine and non-routine activities, activities of all personnel, including subcontractors and visitors, having access to the workplace, as well as all facilities at the workplace, whether provided by ERP or others.

An ES&H plan will be prepared and will include an analysis of the tasks to be performed to complete the installation of the engineered cap. The Job Risk Assessment (JRA) will be prepared to identify the potential hazards associated with each of the identified tasks. Controls will be used to mitigate the hazards identified in the JRA's and will be reflected in engineered cap installation procedures. The hazards and JRA conclusions will be communicated daily to site workers by the ERP Field Engineer at the Daily Safety Tailgate in accordance with ERP-OPM-3.4, "Field Activity Oversight". Engineered cap installation will be completed in accordance with all of the OSHA requirements in 29 CFR 1910/1926 and BSA Standards Based Management System (SBMS) requirements and applicable ES&H Standards.

All site workers performing or supervising D&D activities will be required to complete the 40-hr OSHA HAZWOPER course and other training detailed in the Brookhaven Graphite Research Reactor Engineered Cap Installation Specifications.

2.3.1 Work Controls and Work Management

All work will be performed with approved work permits which will be prepared, and issued following the requirements of the BSA SBMS "Work Planning and Control for Operations" subject area.

In addition, all ERP work is planned and performed in accordance with ERP-OPM-3.2,

"Work Planning and Control", Appendix B. The purpose of the ERP Work Planning and Control System procedure is to ensure all work performed within ERP is reviewed, planned and controlled in a manner that meets the Laboratory-wide Work Planning and Control for Experiments and Operations Subject Area and is compliant with applicable Authorization Basis Documents (ABDs) and Facility Use Agreements (FUA).

All work performed under the authority of ERP will undergo planning and control to the rigor set forth within this document. Authorized ERP work includes remediation, decommissioning, characterization, construction, maintenance, modification and all other related work performed by ERP staff as well as external Laboratory organizations and non-BSA personnel (including BSA subcontractors) working on ERP projects.

The ERP work planning and control system also coordinates the preparation and approval of all ancillary BSA permits including concrete and masonry penetration, cutting and welding, confined space, digging, and radiation work.

All personnel working under a Radiological Work Permit (RWP) will be required to complete BSA radiological worker training. Personnel will be required to submit radiological dose records to BSA and have whole body counts performed prior to work.

BSA Radiological Control Technicians (RCTs) will perform radiological monitoring during the entire project. Radiological controls will be established by the RCTs in accordance with BSA's Radiological Control Division (RADCON) Manual.

2.4 Long-Term Surveillance & Monitoring

Long-term activities will be conducted to ensure effectiveness of this remedial action. The *BNL Land Use Controls Management Plan (LUCMP)* (BSA, 2007) contains site-wide control measures and land use restrictions to prevent exposure to environmental contamination and to protect the integrity of remedies specified within the *BGRR Record of Decision.* To accomplish this objective, the following specific measures will be incorporated into the Long term Surveillance and Monitoring Plan for the BGRR and will include the following:

- Routine environmental health and safety monitoring;
- Periodic structural inspections of Building 701;
- Water intrusion monitoring;
- Preventive maintenance of Building 701 and the infiltration management system; and
- Groundwater monitoring required as part of the *Brookhaven National Laboratory Operable Unit III – Record of Decision.*

Institutional controls will be established to ensure land use restrictions and reporting requirements are maintained beyond the completion of the remediation of the BGRR complex. In addition to the administrative controls placed on the future land use at BNL, the

following specific institutional controls have been included:

- Control measures for future excavation of residual subsurface contamination at the BGRR will include physical identification of the affected areas and work restrictions to prevent inadvertent personnel exposure to the remaining hazards.

3.0 PROJECT MANAGEMENT

This section of the RD/RA Work Plan describes the project management and control procedures that will be used to ensure that the remedial action objectives are satisfied. Since the remedial action will involve several parties (EPA, NYSDEC, DOE, BSA, BSA subcontractors, etc.), coordination of activities between parties is essential to ensure satisfactory completion of the remedial action.

3.1 Project Management Organization

A summary level organization chart showing the lines of responsibility for the project is provided on Figure 3-1. Listed below are the representatives involved in management of the Engineered Cap Installation Project. A general description of the roles and responsibilities of each representative is given where applicable.

The DOE Site Federal Project Director has overall responsibility on the part of the DOE and will review and approve modification requests. The Site Federal Project Director is also responsible for providing reports to, and acting as a liaison with the NYSDEC and the EPA.

The DOE BGRR Federal Project Director reports to the DOE Site Federal Project Director and is responsible to coordinate the day-to-day technical and regulatory work activities, to ensure compliance, plan and conduct site project meetings to resolve issues, evaluate status, and to ensure the project maintains schedule and baseline commitments.

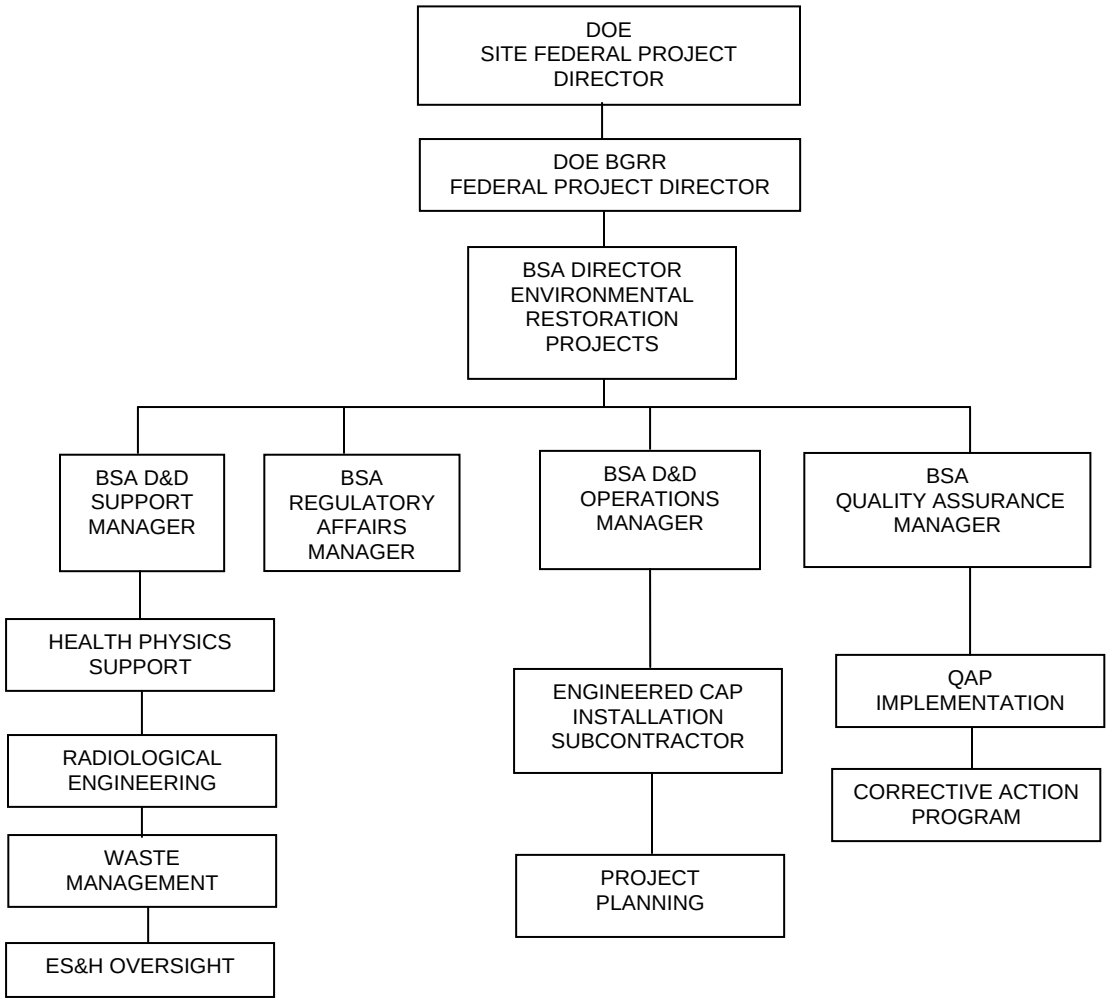
BSA's Director of the ERP organization has overall responsibility for the safe and cost effective completion of the project. The ERP Director is also the designated project manager.

The ERP D&D Operations Manager will be responsible for safely completing the remedial action activities including coordination with DOE, other BSA divisions/departments, and BSA subcontractors. The D&D Operations Manager will also be responsible for ensuring that the completion of the engineered cap installation is completed within the operational envelope described in the Brookhaven Graphite Research Reactor Engineered Cap Installation Specifications and this work plan. The Operations Manager will monitor project schedule and costs, and prepare monthly reports to DOE.

The ERP D&D Support Manager will coordinate and deploy the project oversight and support personnel and services required to complete the engineered cap installation. These oversight and support functions include health physics and radiological controls, waste management, work management and work controls, safety and industrial hygiene and environmental management.

The ERP Regulatory Affairs Manager is responsible for managing the interface with regulatory agencies: EPA, NYSDEC, New York State Department of Health (NYSDOH), Suffolk County Department of Health Services (SCDHS), and other federal State and local government agencies. Working with DOE, the ERP Regulatory Affairs Manager will be responsible for meeting regulatory commitments and for ensuring the effectiveness and timeliness of regulatory interactions (e.g., briefings on project progress, special focus meetings and weekly teleconferences).

FIGURE 3-1
BIOLOGICAL SHIELD REMOVAL PROJECT
PROJECT ORGANIZATION



The BSA ERP Quality Systems Manager will ensure that the general BSA quality management and ERP project specific QAP are implemented.

The engineered cap installation subcontractors working for and under the oversight of BSA will be responsible for the safe completion of the work in accordance with the Brookhaven Graphite Research Reactor Engineered Cap Installation Specifications and this RD/RA Work Plan. The engineered cap installation subcontractors have not yet been selected for this work. The group of subcontractors chosen to bid on the project will be selected from BSA's pre-qualified list of contractors that are / have performed similar work at BNL under a Basic Ordering Agreement (BOA).

3.2 Project Communication

To ensure effective project coordination and execution, the following actions will be performed:

- A readiness evaluation will be conducted prior to beginning engineered cap installation;
- BNL employees will be communicated with via lab wide emails and internal publications;
- The Building Managers of adjacent facility will be communicated with at the monthly Building Manager meetings;
- Daily safety tailgates are conducted with the Contractor's field staff by BSA personnel to communicate the current day's work plan, previous days lessons learned, personnel protective equipment requirements, and expected project hazards and mitigation;
- Weekly meetings among BSA and DOE project personnel will be held to monitor the progress during field activities; and
- Weekly teleconferences are held with the NYSDEC, NYSDOH, SCDHS, and EPA to discuss project progress and issues. BSA uses these teleconferences to discuss all relevant project performance, progress, and issues.

Weekly field status and formal monthly reports will be submitted to DOE describing ongoing engineered cap installation progress. These reports will include the status of the remedial action field activities, project cost and schedule performance analysis, and a discussion of any other issues relevant to the project.

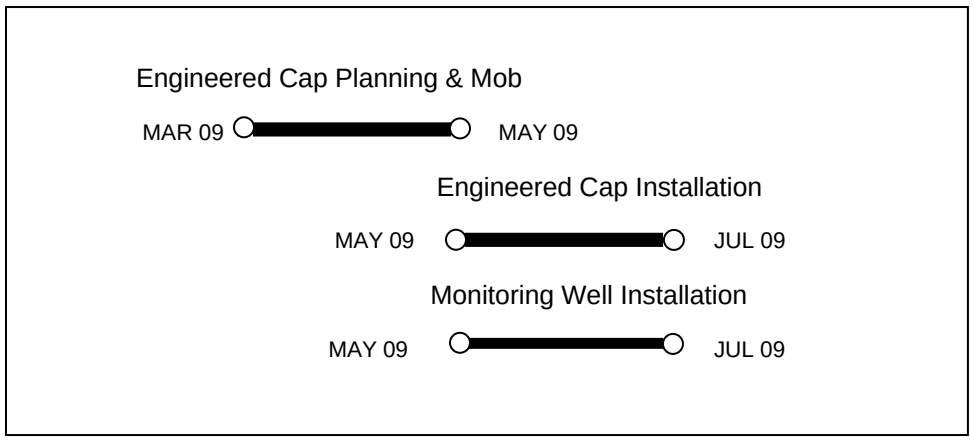
3.3 Project Schedule

The preliminary schedule for field activities is presented in Figure 3-2. As detailed project planning is conducted, the preliminary schedule is subject to changes. The project field activities are anticipated to start in May 2009 and be completed by July 2009. The NYSDEC, NYSDOH, SCDHS, and EPA will be updated on schedule changes during the weekly IAG teleconferences.

3.4 Quality Assurance Plan

To ensure that the remedial action is completed in accordance with the Brookhaven Graphite Research Reactor Engineered Cap Installation Specifications, a Quality Assurance Plan, *Environmental Restoration Projects Directorate Quality Assurance Plan* (BSA 2006), has been developed and will be implemented by BSA for the Engineered Cap Installation Project.
As described in Appendix A, BSA is flowing applicable quality management requirements to its subcontractors.

Figure 3-2
Project Schedule



3.5 Community Outreach and Involvement

The community will be informed of engineered cap installation developments by several methods described below. Complete information regarding community involvement activities can be found on BSA's website for the BGRR Project at http://www.bnl.gov/erd/.

Typical activities to inform the community include briefings to the Community Advisory Council, the Brookhaven Executive Roundtable, elected officials, and, as appropriate, the media.

The BGRR Project website will be updated with status of cleanup work, along with links to the following:

- BGRR Record of Decision
- Final Remedial Design/Remedial Action Work Plans
- Project schedule
- Completion Report

Communications through the Brookhaven Bulletin and the Monday Memo will caution onsite workers and residents about BGRR activities that may impact routine activities on the BNL Site.

4.0 PROJECT CLOSEOUT

The following sections describe the activities for documenting that the engineered cap installation has been completed in accordance with the BGRR ROD**.**

4.1 Closeout Report

The successful completion of the engineered cap installation will be documented in a Project Completion letter to DOE. The AOC 9 Closeout Report will be submitted to the NYSDEC and EPA upon completion of all BGRR remedial actions required to meet the requirements of the BGRR ROD. An outline for the Closeout Report is provided in Section 01 33 00 of Appendix A.

5.0 CONTINGENCY PLAN

The DOE and EPA require the implementation of a Contingency Plan to protect the local community that can be affected (both on-site and off-site), in the event of an accident or emergency. The Contingency Plan identifies the hazards that may arise during the completion of engineered cap installation, assigns responsibilities and authority in the event that an emergency occurs, and describes the emergency responses expected of BGRR project and BSA Emergency Response personnel.

For on-site accidents and emergencies, these Contingency Plan requirements are satisfied through the development and use of the BGRR Local Emergency Plan (LEP). The BGRR LEP, which will be used throughout engineered cap installation, is provided in Appendix C. The BGRR LEP is periodically updated and controlled as part of the ERP OPM.

There are no expected off-site accidents or emergencies associated with the installation of the engineered cap.

REFERENCES

Asphalt Institute. *Full-Depth Asphalt Pavement for Parking Lots, Service Stations and Driveways,* 5th Edition, IS-091.

Asphalt Institute. *Maintenance and Repair of Asphalt Parking Lots*. CL-15.

BSA, 2000, *Brookhaven National Laboratory Operable Unit -III Record of Decision,* prepared by Brookhaven Science Associates for U.S. Department of Energy, Brookhaven Area Office, Upton, New York, April 2000.

BSA, 2002, *Characterization Report for the Below-Ground Ducts and Associated Soils* (BGRR-049, Rev E), dated 22 January, 2002.

BSA, 2003, *Characterization Report for the 701 Below-ground Structures, 702 Pile, and Remaining Soils, Brookhaven Graphite Research Reactor Decommissioning Project*, BGRR-055, Rev. B, Draft, prepared by Brookhaven Science Associates for U.S. Department of Energy, Brookhaven Area Office, Upton, New York, January 2003.

BSA, 2005a, *BGRR Final Record of Decision for Area of Concern 9, Brookhaven Graphite Research Reactor,* prepared by Brookhaven Science Associates for U.S. Department of Energy, Brookhaven Area Office, Upton, New York, March 2005.

BSA, 2005b, *BGRR Canal and Deep Soil Pockets Excavation and Removal Completion Report,* prepared by Brookhaven Science Associates for U.S. Department of Energy, Brookhaven Area Office, Upton, New York, August 2005.

BSA, 2006a, *Brookhaven Graphite Research Reactor Engineered Cap Design Basis,* prepared by Brookhaven Science Associates for U.S. Department of Energy, Brookhaven Area Office, Upton, New York, June 2006.

BSA, 2006b, *Environmental Restoration Projects Directorate Quality Assurance Plan, Rev 5*, prepared by Brookhaven Science Associates for U.S. Department of Energy, Brookhaven Area Office, Upton, New York, January 2006.

BSA, 2007, *BNL Land Use Controls Management Plan (LUCMP),* prepared by Brookhaven Science Associates for U.S. Department of Energy, Brookhaven Area Office, Upton, New York, July 2007.

CERCLA-FFA, 1992, Federal Facility Agreement under CERCLA Section 120, Administrative Docket Number II-CERCLA-FFA-00201, *IAG Agreement*, United States Environmental Protection Agency, Region II, United States Department of Energy, and the New York State Department of Environmental Conservation. In the matter of the U.S. Department of Energy's Brookhaven National Laboratory, 1992.

APPENDIX A

Brookhaven Graphite Research Reactor
Engineered Cap Installation Specifications

BUSINESS PROPRIETARY
(BUSINESS SENSITIVE)

BROOKHAVEN NATIONAL LABORATORY

BROOKHAVEN GRAPHITE RESEARCH REACTOR ENGINEERED CAP INSTALLATION SPECIFICATIONS

Prepared By:

T. Daniels
ERP D&D Operations Manager

Approved By:

L. Hill
ERP Director

March 19, 2008
Revision 4

NSF-ISR
ENVIRONMENTAL MANAGEMENT SYSTEM REGISTERED TO ISO 14001:2004

Prepared by:

Brookhaven National Laboratory
Environmental Restoration Projects
Upton, New York 11973

SECTION 00 01 10 – TABLE OF CONTENTS

Attachments

A. Reference Drawings
B. Environmental Restoration Projects Operations Procedures Manual
C. Hazardous / Radiological Characterization Data

END OF SECTION 00 01 10

DIVISION 00 – TECHNICAL SECIFICATIONS
SECTION 00 01 01 – STATEMENT OF WORK

PART 1 - General

The Contractor's work for installation of the engineered cap over subsurface radiologically-contaminated soils adjacent to the Brookhaven Graphite Research Reactor (Building 701) consists of the following:

A. The Contractor shall provide all labor, materials and equipment to perform the following activities:

   a. Remove and dispose of approximately 32,460 square feet of asphalt wearing course and base course (approximately 320 cubic yards of material);

   b. Excavate and stockpile for re-use approximately 1,803 cubic yards of soil (32,460 square-foot area to a depth of eighteen (18) inches). The Contractor shall provide unit costs for disposal of this soil if it does not meet the specifications for the sand protective layer;

   c. Installation of three monitoring wells to a depth of 85 feet below grade with 20 feet of PVC well screen and 65 feet of PVC well casing;

   d. Installation of approximately 3,607 square yards of 40-mil Gundseal HDPE liner;

   e. Anchor liner to building foundation walls and seal around penetrations (e.g., monitoring well casings);

   f. Place, grade, and compact soil on top of liner to one (1) foot depth (approximately 1,200 cubic yards). The Contractor shall provide a unit cost to obtain and deliver soil that meets the specifications for the sand protective layer in case the excavated in soil in b. does not meet the requirements;

   g. Installation of approximately 3,607 square yards of geotextile;

   h. Place, grade, and compact crushed stone on top of geotextile to two (2) inch depth (approximately 200 cubic yards);

   i. Installation of approximately 3,607 square yards of asphalt base course (ATB) to 4 inches thick and hot-mix asphalt surface course to 3 inches thick; and,

   j. Seal asphalt surface with fog seal coat.

B. Residual subsurface radiological contamination remains at depths greater than 5 feet below grade following the removal of the BGRR Canal in 2005. All work performed greater than 5 feet below grade (i.e., monitoring well installation) will be considered radiological work, and all work performed between grade and 5 feet below grade will not be considered radiological work (i.e., asphalt removal, shallow earthwork, liner/geotextile installation, asphalt restoration).

C. The Contractor will be responsible for the preparation of various project plans and procedures that are included in BSA's specifications. BSA will review these plans and procedures and provide comments to the Contractor for their incorporation. The Contractor will be responsible

for implementation and execution in compliance with BSA approved plans and procedures. In addition, the Contractor will review and provide comments on the Waste Management Plan (WMP), which will be prepared by BSA. The Contractor will be responsible for the implementation of designated elements of BSA's WMP.

D. The Contractor shall provide field oversight, monitoring equipment, consumables and sampling and analysis services required to implement its Environmental, Safety and Health (ES&H) Plan. The Contractor shall be responsible for providing all PPE necessary to perform the Work.

E. The Contractor will be responsible for all packaging of demolition debris and secondary wastes in roll-off containers. Waste management shall be in accordance with Specifications Section 02 81 00 – Waste Management & Transportation.

F. The Contractor will be responsible for containerizing drill cuttings and well development water in 55-gallon drums. BSA will be responsible for disposal of drill cuttings and well development water.

G. Project closeout activities and documentation including the preparation of a project completion report, all in accordance with BSA's specifications.

H. BSA will provide the following services required to support the work:

1. General employee training in accordance with BSA's specifications;
2. Radiological controls and health physics services to support the Work, including job coverage (oversight of radiological work activities), instrumentation, transportation surveys and personnel and environmental air (radiological) sampling and analysis;
3. Thermo-luminescent dosimeters and bioassays required for personal monitoring; and,
4. Electrical power (460V, 30A, 3-phase and 120V, 30A, single phase).

PART 2 - Products

Not used.

PART 3 - Execution

Not used.

END OF SECTION 00 01 01

DIVISION 00 – TECHNICAL SPECIFICATIONS
SECTION 00 01 25 – ABBREVIATIONS AND ACRONYMS

PART 1 - General

1.00 Abbreviations and Acronyms:

AOC	Area of Concern
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASA	Auditable Safety Analysis
ASTM	American Society of Testing and Materials
AWWA	American Water Works Association
BHSO	Brookhaven Site Office
BGRR	Brookhaven Graphite Research Reactor
BMP	Best Management Practice
BNL	Brookhaven National Laboratory
BOA	Basic Ordering Agreement
BSA	Brookhaven Science Associates
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CIH	Certified Industrial Hygienist
CSP	Certified Safety Professional
DOE	U.S. Department of Energy
dpm	Disintegrations per minute
EMD	Environmental Management Directorate
EMS	Environmental Management System
ERP	Environmental Restoration Projects
ES&H	Environmental Safety & Health
ESHQR&T	Environment, Safety, Health, Quality, Radiological & Training
EWMSD	Environmental Services and Waste Management Division
FAA	Federal Aviation Administration
FP	Fixed Price
FS	Feasibility Study
G&A	General and Administrative
GFI	Ground Fault Interrupter
HASP	Health and Safety Plan
HDPE	High Density Polyethylene
HP	Health Physics
IAG	Interagency Agreement
ISOCS	In-Situ Object Counting System
LCAM	Life Cycle Asset Management
LLW	Low-Level Radiological Waste
LOE	Level of Effort
LTES	Long Term Environmental Stewardship
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MLLW	Mixed Low Level Waste
MOA	Memorandum of Agreement
mR/hr	milli-Roentgen per hour
mrem/yr	milli-rem per year
MS&T	Materials, Supplies & Travel
MSDS	Material Safety Data Sheet

NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NYSDEC	New York State Department of Environmental Conservation
OSHA	Occupational, Safety, and Health Association
OU	Operable Unit
PA/SI	Preliminary Assessment/Site Inspection
PCBs	Polychlorinated Biphenyls
pCi/g	Picocuries per gram
PE	Plant Engineering
PM	Project Manager
PPE	Personal Protective Equipment
PPM	Procurement and Property Management
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAP	Quality Assurance Plan
RA	Removal Action
RCD	Radiological Control Division
RCT	Radiological Control Technician
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SBMS	Standards Based Management System (https://sbms.bnl.gov/)
SCDHS	Suffolk County Department of Health Services
SECON	BNL Security Condition
SOW	Scope of Work
SPDES	State Pollutant Discharge Elimination System
TCLP	Toxicity Characteristic Leaching Procedure
TLD	Thermoluminescent Dosimeter Badge
UL	Underwriters Laboratories
USEPA	U.S. Environmental Protection Agency
USID/SE	Unreviewed Safety Issue Determination/Safety Evaluation
USTs	Underground Storage Tanks
VOCs	Volatile Organic Compounds
WAC	Waste Acceptance Criteria
WBS	Work Breakdown Structure
WM	Waste Management
WMP	Waste Management Plan

PART 2 - Products

Not used.

PART 3 - Execution

Not used.

END OF SECTION 00 01 25

DIVISION 00 – TECHNICAL SPECIFICATIONS
SECTION 00 72 00 – GENERAL CONDITIONS

PART 1 - General

1.00 Definitions

A. As used in these specifications, the following have the meaning shown:

1. BSA - Brookhaven Science Associates, operator of Brookhaven National Laboratory, and its authorized representatives from various Divisions and Departments.

2. BNL – Brookhaven National Laboratory

3. BNL Site – Land occupied by Brookhaven National Laboratory, in Brookhaven Township, Suffolk County, New York.

4. Site – Immediate area of the BNL Site assigned to the Contractor to perform the Work.

5. Work or Project – Includes, but is not limited to, all labor, materials, tools, and equipment required and reasonably inferred by the Contract to complete all work described in the Statement of Work.

6. Contractor – Single person or entity identified in the Contract and responsible for completing the Work.

7. Subcontractor – Person or entity directly contracting with the Contractor, but not including one who merely furnishes materials not so worked.

8. OSHA Recordable Injury – An occupational injury or illness that requires more medical treatment than simple first aid and must therefore be reported to OSHA

9. Days Away, Restricted, or Transferred (DART) Case – A DART case is a type of OSHA Recordable Injury, whereby the injury or illness is severe enough that an individual loses time away from their job by being away from work, by being on restricted duty, or by being transferred to another job function.

B. Wherever the Specifications use the terms "shown on drawings", they shall mean "noted", "indicated", "scheduled", "detailed", or any other diagrammatic or written reference made on the drawings.

C. Wherever the terms "material" or "materials" are used in the Specifications, they shall mean any "product", "equipment", "device", "assembly" or "item" required under the contract, as indicated by trade or brand name, manufacturers' name, standard specification reference, or other description.

D. The term "approval" shall mean the written approval of BSA. (Approval by BSA does not relieve the Contractor from meeting its obligations, specification or Contract requirements.)

E. The terms "directed", "required", "permitted", "ordered", "designated", "prescribed" and similar words shall mean BSA’s direction, requirement, permission, order, designation or prescription.

The terms "approved", "acceptable", "satisfactory" and similar words shall mean approved by, acceptable to, or satisfactory to BSA; and, the terms "necessary", "reasonable", "proper", "correct" and similar words shall mean necessary, reasonable, proper, or correct, in the judgment of BSA.

F. "New" shall mean manufactured within the past twenty-four (24) months and never before used.

1.01 Review and Intent of Contract Documents

A. The Contractor shall, during the bid period and prior to starting the work on any single portion and at frequent intervals during the progress of the work, carefully study and compare the General Documents, General Conditions, Drawings, Specifications, Amendments and other Contract documents and shall at once report to BSA any error, inconsistency or omission the Contractor may discover.

1.02 Reference Drawings

A. Drawings generally are done to scale as noted. The Contractor shall not scale the drawings for establishing dimensions and/or layout. The dimensions shown on the documents or surveyed points (in feet) shall be used.

B. The reference drawings are provided for the Contractor's information. BSA does not imply or warrant the accuracy of the information provided in reference drawings. Critical dimensions, other dimensions, as built and existing configurations, etc. that are important to the Contractor's development of designs, processes and procedures, etc. shall be field verified by the Contractor. BSA will not consider any requested changes or modifications to the Contract that are in any way related to the accuracy or inaccuracy of reference drawings.

C. The Contractor shall give BSA timely notice of any additional design drawings, specifications, or instructions required to define the work in greater detail, or to permit its proper progress, and BSA will provide such information with reasonable promptness so as to not delay the Work.

1.03 Work Permits

A. The Contractor shall perform all Work in accordance with Work Permits, which will be prepared by BSA in accordance with the Integrated Safety Management System (ISMS). Work Permits are further discussed in Section 01 35 23 – Owner Safety Requirements.

1.04 Notice to Proceed

A. The Contractor shall not knowingly, without BSA's written formal notice, prematurely commence operations on the BNL Site. BSA will not issue the Notice to Proceed before BSA receives all required bonds and insurance documents, and required submittals.

B. Work may proceed, however, in preparing and submitting all required work plans and procedures and in ordering materials and equipment that do not require BSA's prior approval.

1.05 Use of Site

A. The right of possession of the premises and the improvements made thereon by the Contractor shall remain at all times with BSA. The Contractor's right to entry and use thereof arises solely from the permission granted by BSA under the Contract.

B. The Contractor shall confine the use of the premises for all purposes, to the areas identified by BSA.

C. It shall be the responsibility of the Contractor to provide necessary and required security measures to safeguard the Site including all materials and equipment from theft, vandalism and intrusion of unauthorized persons during all working hours, non-working hours, weekends and holidays.

1.06 Work Hours

A. The Contractor will not be limited to normal working hour shifts or the number of working days per week, except that no work shall be performed on BSA holidays or when BNL has been closed due to adverse weather conditions. The BSA holiday list can be found at www.bnl.gov/bnlweb/Admin/holidays.asp. The work hours and shift schedules shall be subject to BSA approval.

B. The Contractor's personnel are to be made aware that extended or unusual work shifts may be more stressful physically, mentally, and emotionally on the work crews, leading to increased fatigue, stress, and lack of concentration. These effects lead to an increased risk of operator error, injuries, and/or accidents. The limits provided in Paragraph E, below, will not be exceeded by the Contractor.

C. The normal work hours at BNL are 8:30 am to 5:00 pm, Monday through Friday. The Contractor shall request BSA approval in advance of all planned activities and submit a list of all Contractor and Subcontractor employees who are expected to work on the BNL Site during off-hour periods. All employees working during off-hours must possess a valid BNL contractor employee photo identification badge.

D. BSA will notify BSA Police Headquarters and the main gate of the days and hours outside of normal working hours that work is planned. Failure to notify BSA will be cause for BSA Police to deny access to the BNL Site.

E. Limitation on Extended Work Hours

The Contractor's personnel will be limited to the following work schedule restrictions with no exceptions:

1. A person shall not be permitted to work more than 16 consecutive hours, including shift turnover time;

2. A person shall not be permitted to work more than 24 hours in any 48 hour period, including shift turnover time;

3. A person shall not be permitted to work more than 72 hours in any 7 day period, including shift turnover time;

4. A person shall not be permitted to work more than 14 consecutive days without having two (2) consecutive days off; and,

5. If a person is required to work in excess of 12 continuous hours, his/her duties should be carefully selected. Moreover, this person shall not be assigned any task that could possibly endanger the safety of him/her and others due to fatigue.

F. The Contractor shall compile all labor hours worked on a daily, weekly and monthly basis. This compilation shall include all OSHA Recordable and DART cases and is to be submitted to BSA by the first week of the following month.

1.07 Identification of Employees

A. All Contractor employees must attend the Contractor/Vendor Orientation and be approved by BSA in order to work on the BNL Site. A contractor employee photo identification badge will then be issued in order to have access to the BNL Site.

B. The Contractor shall assure that all employees promptly obtain a current BSA contractor employee photo identification badge. Badges shall be obtained in the lobby of the Research Support Building 400, Monday through Friday, between 8:30 a.m. and 12:00 noon.

C. Proper photo identification (e.g., driver's license, passport) and proof of social security number is required to obtain an identification badge. Access to the BNL Site by foreign nationals, including permanent resident aliens, is subject to BSA approval. Approval may take six or more weeks.

D. Contractor employees shall wear the badge so as to be visible at all times while on-site.

E. Contractor employee identification badges are valid for one (1) year after issuance. After one (1) year, contractors are required to attend the Contractor/Vendor Orientation and renew the photo identification badge. Badges will be provided at no cost to the Contractor. Immediately upon release of employees or project completion, the Contractor shall return badges to Building 400 lobby. (BSA will retain badges for re-issue for one year).

F. Contractor employees shall report lost identification badges immediately to the BSA Badging Office, in the lobby of Building 400.

1.08 Kickoff Meeting

A. BSA will set up a kickoff meeting to discuss and finalize any project plans or issues. The Contractor's non-manual staff is required to attend the kickoff meeting.

1.09 Work Schedule and Notification:

A. The Contractor shall prepare a detailed, resource loaded (labor) schedule that accurately reflects the Contractor's work plan, and supports the schedule completion milestones included in the Contract. Individual activities in this schedule will normally be no longer than five (5) work days in duration. The intent of this requirement is to ensure that the Contractor provides a detailed schedule for managing the project. Where the five-day period is not practical, or is otherwise inconsequential to project management and control, longer durations will be accepted. BSA shall approve the schedule prior to BSA's issuance of a Notice to Proceed. The Contractor shall attend

weekly schedule reviews with BSA, and the Contractor's schedule shall be updated on a weekly basis.

B. BSA must be notified and made aware of all work in progress. BSA will provide appropriate telephone extension numbers for notifications by the Contractor.

C. BSA expects all work to be performed in accordance with the schedule. When activities have not been previously scheduled, the Contractor shall request the authority to proceed with unplanned work no less than 24 hours in advance of the conduct of these unplanned activities. BSA encourages the Contractor to develop work-arounds and identify potential schedule accelerations and will allow the Contractor to perform previously identified stand-by work without the 24-hr advance notification. BSA reserves the right to deny approval to proceed with work that is not on the schedule.

D. BSA oversight is required for all work. For off-hour work not included in the Contract or schedule, the Contractor shall be back charged on an hourly rate based on BSA's published schedule of rates for all resources required for BSA to support unscheduled work. The complete rate schedule is available through BSA's Technical Representative. This back-charge includes off-hour work directed by BSA due to the Contractor's failure to meet schedule completion dates.

1.10 Subcontractor Approval

A. BSA shall approve the Contractor's selection and use of subcontractors.

1.11 Overall Project Coordination and the Flow Down of Contract Requirements

A. The Contractor is responsible for the Work, including that performed by the Contractor's subcontractors, vendors, and service providers at all tiers and of any nature. The Contractor is responsible for the coordination, scheduling and performance of all subcontractors, vendors and service providers. The Contractor shall flow applicable requirements of the Contract to such subcontractors, vendors and service providers.

B. BSA assumes no responsibility for contractual relations between the Contractor and other parties.

1.12 Transportation and Traffic

A. The Contractor shall schedule, confine, and perform work so as not to interfere with BSA traffic on existing roads, walks, parking and other paved areas. The Contractor shall park all vehicles in designated parking areas, and load and unload vehicles where directed by BSA. All Contractor personnel shall comply with all New York State traffic regulations while on the BNL site. Violations will not be tolerated and chronic abusers will be removed from the BNL Site.

B. The Contractor shall coordinate the delivery and removal of all materials and equipment with BSA. Major delivery and removal activities will be included in the schedule, and subject to the same requirements as all project activities. Unless otherwise approved by BSA in advance, the delivery and removal of materials and equipment shall be conducted during normal working hours. The firms providing transportation and logistics services to the Contractor are subcontractors subject to the Contractor's coordination and oversight and must comply with the Contractor's ES&H Plan.

C. All Contractor vehicles (personal or otherwise), trucks, heavy equipment, equipment, material, trailers and any other conveyance or storage area are subject to inspection by BSA. All Contractor vehicles, trucks, heavy equipment, equipment, material, and trailers that are operated or staged within a radiological contaminated work zone must pass through the vehicle radiation monitor upon entry to the BNL Site and when leaving the BNL Site.

D. All Contractor vehicles, trucks, heavy equipment, equipment, and/or material that will be used in a radiological contamination area will be subject to incoming radiation and contamination surveys performed by BSA. Incoming surveys will take approximately four (4) hours per vehicle.

E. All Contractor vehicles, trucks, heavy equipment, equipment, and/or material that will be used in a potential radiological contamination area will be subject to outgoing radiological contamination and dose rate surveys performed by BSA. Any required decontamination required to meet BSA's radiological release criteria is the responsibility of the Contractor. Outgoing surveys will take approximately four (4) hours per vehicle.

F. Transportation vehicles used by the Contractor in connection with on-site waste transportation shall be in compliance with applicable BSA SBMS requirements.

1.13 Protection of Property

A. The Contractor shall be responsible for the safety and security of its property on the BNL Site.

B. The Contractor shall protect materials equipment and other property from damage by and as a result of performing the Work, including disappearance.

C. The Contractor shall repair, refinish, replace and otherwise correct all damage caused by the Contractor, and replace any missing materials, as required or otherwise directed by BSA.

1.14 Project Meetings:

A. The Contractor shall participate in project meetings held weekly unless otherwise designated by BSA. The purpose of these meetings is to review the work planned for the week, previous week's accomplishments, safety issues, and project schedule. In addition, the Contractor shall provide weekly P-3 schedule updates and participate in weekly BSA schedule review meetings.

B. The Contractor's key managers shall attend the weekly project meetings.

C. Decisions, instructions and interpretations agreed upon at such meetings will be recorded in meeting minutes prepared by BSA and furnished to the Contractor and each attendee. The BSA contract technical representative and contracting officer will attend the meeting to ensure that all work discussed is in accordance with the Contract. If BSA provides direction to the Contractor that is contrary to the Contract, a modification will be initiated prior to the performance of the Work.

D. As the need arises, the Contractor shall attend non-routine meetings to discuss special matters with BSA.

PART 2 - Products

Not used.

PART 3 - Execution

Not used.

END OF SECTION 00 72 00

DIVISION 00 – TECHNICAL SPECIFICATIONS
SECTION 00 73 00 – SUPPLEMENTARY CONDITIONS

Part 1 - General

1.00 Definition

A. Substantial Completion is the stage in the progress of the Work when the Work or a designated portion thereof is sufficiently complete, as determined by BSA in accordance with the Contract Documents, so as to be able to be occupied or utilized for its intended use. "Substantially complete" is defined as demolished materials disposed of at an approved disposal facility, and the final paving has been completed.

1.01 BNL Supplied Items

A. Items being supplied to the Contractor by BSA:

1. Training in accordance with Section 01 35 24 Training Requirements.

2. BSA will be responsible for off-site waste transportation and disposal of drill cuttings and well development water.

3. BSA will provide radiological control and health physics services for the drilling work, including job coverage and RWPs. (Note: Non-radiological sampling and analysis to support the Contractor's ES&H Plan is the responsibility of the Contractor.)

4. Thermoluminescent dosimeters and bioassays.

5. Electrical power (460V, 30A, 3-phase and 120V, 30A, single phase).

PART 2 – Products

Not used.

PART 3 – Execution

Not used.

END OF SECTION 00 73 00

DIVISION 01 - GENERAL REQUIREMENTS
SECTION 01 31 00 – PROJECT MANAGEMENT AND COORDINATION

PART 1 - General

1.00 Key Management Personnel

A. The following Contractor positions are designated as key personnel:

1. Project Manager
2. Field Superintendent
3. Site Health and Safety Officer

B. The assignment of key management personnel by the Contractor shall be subject to BSA approval. All key personnel shall meet the qualification requirements provided in BSA's General Information for Bidders. Replacements for key management personnel departing the project shall meet these qualification requirements and are also subject to BSA approval.

PART 2 - Products

Not Used.

PART 3 - Execution

Not Used.

END OF SECTION 01 31 00

DIVISION 01 - GENERAL REQUIREMENTS
SECTION 01 33 00 – SUBMITTALS

PART 1 - General

1.00 Related Sections

A. Section 00 01 01 – Statement of Work

B. Section 01 71 13 – Mobilization/Demobilization

1.01 General

A. BSA will provide a draft copy of its Waste Management Plan (WMP) to the Contractor. The Control will review the WMP and propose changes to the WMP to ensure consistency with the Contractor's detailed work plans and procedures. The WMP along with proposed revisions will be submitted by the Contractor to BSA for final BSA approval.

B. The Contractor shall be responsible for providing submissions in accordance with the Submittal Schedule of this section. Specific requirements for some of these submittals are detailed below. Preparation, review, control, changes, and revisions to the submittals shall be in accordance with ERP-OPM-1.3 "Work Procedure Development and Requirements". Approvals for all documents shall be granted in accordance with ERP-OPM-2.7 "Safety Review Committee". (Note: The ERP OPM is included as an attachment to this specification and the referenced chapters can be found on the BSA provided compact disk.)

1. Environmental, Safety & Health (ES&H) Plan – The ES&H Plan shall be prepared in accordance with 29 CFR 1910.120, 29 CFR 1926, and all applicable BSA SBMS requirements and ES&H standards. The Plan shall also address the risks, hazards and mitigative actions described in the JSA. At a minimum, the following elements shall be included in the Plan:

    a. Certificate of Compliance
    b. Accident prevention program
    c. Contractor/subcontractor responsibilities
    d. Training and communication
        i. Drug-fee workplace
        ii. Hazard communication training
        iii. Pre-shift safety briefings
        iv. Shift turnover briefings
    e. Emergencies
        i. First aid and medical attention
        ii. Fire protection and prevention
        iii. Environmental protection
        iv. BSA notification requirements
    f. Chemical safety
        i. Hazard communication program
        ii. List of hazardous chemicals known to be present
    g. Electrical safety
        i. Electrical safety program and safeguard checklist
        ii. Lock-out/tag-out program

h. Mobile equipment program
    i. Safe operation and maintenance
i. Air Monitoring
    i. Dust/particulates
    ii. Airborne radioactivity
    iii. Dust suppression
j. General PPE
k. Other safety areas

2. Engineered Cap and Monitoring Well Installation Technical Work Procedure - The Technical Work Procedure shall include all of the means and methods and shall include as a minimum:

    a. Pre-demolition survey;
    b. Heavy equipment to be used;
    c. Work sequence;
    d. Site preparation;
    e. Cap installation including hold points for inspections of the subgrade, geomembrane installation, and geotextile installation;
    f. Drilling methodology;
    g. Detailed drawings including post-work survey.

    The Technical Work Procedure shall provide instructions of sufficient detail to ensure the safe and successful completion of the work.

3. Job Risk Assessment (JRA) – The Contractor shall perform a thorough and systematic safety analysis of the work. The analysis shall include the detailed identification of individual job tasks and an assessment of the hazards associated with each task. Following hazard identification, the Contractor shall establish controls and mitigating actions to manage the identified hazards and risks. The results of the JRA shall be reflected in the Contractor's ES&H Plan and Technical Work Procedures. The JRA shall include a cross reference that clearly demonstrates that all identified controls and measures are addressed. BSA approval of the JRA shall be a prerequisite to BSA's final approval of the Contractor's ES&H Plan and Technical Work Procedures. Upon full mobilization, the Contractor shall review with, and solicit the input of, it's manual work force and make resulting revisions to the JRA subject to BSA approval. The JRA shall be periodically reviewed by the Contractor during the course of the work, and changes in the project scope, methodology and/or technical approach shall require the review and revision (if required) of the JRA by the Contractor.

4. Quality Assurance Plan

    A. The Quality Assurance Plan will be prepared by the Contractor to address the criteria in 10 CFR 830.122, BNL SBMS requirements. At a minimum, the following sections shall be included in the Plan as applicable to the Work:

        a. Program
        b. Personnel Training and Qualifications
        c. Quality Improvement
        d. Documents and Records
        e. Work Progress
        f. Design
        g. Procurement

h. Inspection and Acceptance Testing
i. Management Assessment
j. Independent Assessment

6. The Contractor shall also be responsible for providing each of the following:

A. List of proposed heavy equipment, hauling equipment, trucks, drill rigs, and temporary services/facilities, and date of mobilization of equipment.

B. Training records for all Contractor and subcontractor personnel.

C. OSHA 300 logs and Experience Modification Rates (EMR's) for the Contractor and all subcontractors. The EMR's must be less than 1.0.

D. Initial P-3 schedule and weekly schedule updates.

E. Photographs and project documentation for Project Completion Report. The documentation is further defined in Paragraph 1.02 of this Section.

F. Project Completion Report - This Report shall contain a complete description of the Work performed by the Contractor, including:

a. Introduction – general description of the project

b. Summary of existing site conditions

c. Overview of Work Performed
   i. Dates of significant activities (e.g. start, complete, duration)
   ii. Noteworthy challenges and accomplishments
   iii. Demolition Work
      1. Major Tools & Equipment Used
      2. Removal of Asphalt
      3. Excavation
      4. Monitoring well installation
      5. Installation of HDPE Liner
      6. Placement of backfill material
      7. Installation of geotextile
      8. Installation of asphalt base course and wearing course
      9. Description of "as built" conditions
   iv. Waste Management
      1. Waste packaging
      2. Waste disposal
      3. Quantity and types of shipping containers utilized
   v. Figures, including depictions of "as built" conditions
   vi. Photographs showing before, during and after work

G. The Contractor shall submit the above outlined documents in accordance with the following submittal schedule (all durations in provided work days):

Submittal Schedule

Submittal	**Submittal Date**
Copy of Company Record of Injury, Accident, Fire and Property Damage for Past 2 Years, OSHA Form 300A and EMR	With Bid
Organizational Structure and Resumes of Key Personnel – Project Manager, Site Field Superintendent, Site Health & Safety Officer	With Bid
List of Subcontractors	With Bid
Insurance Certificate(s)	14 Days after Contract Signing
Payment and Performance Bond	14 Days after Contract Signing
Standard Form 1413	14 Days after Contract Signing
Letter of Compliance with Safety Requirements and SBMS	20 Days after Contract Signing
Waste Management Plan - comments	20 Days after Contract Signing
Schedule and Resource Loading Charts	20 Days after Contract Signing
Environmental, Safety and Health Plan	30 Days after Contract Signing
Job Risk Assessment	30 Days after Contract Signing
Technical Work Procedures	30 Days after Contract Signing
Quality Assurance Plan	30 Days after Contract Signing
Manufacturer's Product Data and related documentation	30 Days after Contract Signing
Proposed list of heavy equipment and mobilization dates	20 Days after Contract Signing
Training Records	20 Days after Contract Signing
Pre-demolition photographs	20 Days after Contract Signing
Schedule Updates	Weekly (Thursdays)
Post-work photographs	5 Days following restoration work
Project Completion Report including Project Records to BNL	10 Days following Completion of Work

C. Documents/Drawings Format

1. The Contractor shall prepare all documents for submittal using Microsoft Word 98 (or newer format).

2. BSA will provide copies of original construction drawings for mark up. The Contractor shall mark up the appropriate drawings to depict the as-left conditions.

D. Submittal Processing and Approval

1. Before submitting any documents for approval, the Contractor shall check them for accuracy, completeness, and compliance with the Contract requirements. The Contractor shall verify that all work contiguous with, and having bearing on, the Work indicated on documents is accurately described and distinctly illustrated, and that the work shown conforms to the requirements of the Contract.

2. The Contractor shall indicate approval on all submittals as evidence of the required reviews. Documents submitted to BSA without evidence of appropriate Contractor approval will be returned for resubmission.

3. The contractor shall submit the documents in their original electronic form (i.e., not converted to Adobe Portable Document Format (PDF)) including, but not limited to, project plans, schedules, digital photographs, digital video records, recorded voice media, and progress reports.

4. BSA makes no representation of the number of review and rework cycles that will be required to approve submittals as final. BSA is committed to submittal approval using one review and comment cycle. However, this is a function of the quality of the submittals as initially submitted by the Contractor, and the Contractors ability to clearly and completely address BSA's comments and concerns.

NOTE: BSA shall not be liable for the costs associated with the resubmission of documents.

E. Submittal Preparation:

a. The Contractor shall:

i. Place a permanent label or title on each submittal for its proper identification, including the identification of the Contractor's personnel responsible for submittal preparation and approval.

ii. Include the following information on the label:

1. Project name: BGRR Engineered Cap

2. Date.

3. Name and address of the Contractor (and/or subcontractor).

4. Reference project specification section number, if applicable.

F. Submittal Transmittal:

a. The Contractor shall:

i. Package each submittal appropriately for transmittal and handling, and transmit each submittal using a transmittal form. BSA will not accept submittals received from sources other than the Contractor.

ii. On the transmittal, the Contractor shall record relevant information and requests for data. Attach the Contractor's Certification of Specification Compliance forms stating that the information complies with the requirements of the Contract.

b. Address all submittals to:

Brookhaven National Laboratory
Manager of D&D Operations
Building 701, P.O. Box 5000
Upton, New York 11973-5000

c. Mark all transmittal forms as follows:

Project Name: BGRR Engineered Cap

d. The Contractor shall transmit submittals via electronic mail upon request by BSA.

1.02 Project Record Keeping Documents

A. The Contractor shall be responsible for keeping thorough, accurate and up-to-date project record documents. Copies of all project records shall be submitted to BSA within 10 business days of completing the project. The project records shall include, but are not limited to, the following:

1. Daily progress reports. The Contractor shall prepare daily progress reports throughout the duration of the project. The daily progress reports are to be provided to BSA. The daily progress reports shall contain the following information:

a. Date
b. Time
c. Heavy equipment in use
d. Names of all employees in attendance, and their signatures
e. Topics discussed
f. Lessons learned
g. Daily project progress
h. Total hours worked, first aid treatments, OSHA Recordable and DART cases.

2. Waste Documentation: The Contractor shall document and provide all waste container loading data.

3. Photographs: The Contractor shall provide photo documentation of the work activities.

PART 2 - Products

Not used.

PART 3 - Execution

Not used.

END OF SECTION 01 33 00

DIVISION 01 - GENERAL REQUIREMENTS
SECTION 01 35 23 – OWNER SAFETY REQUIREMENTS

PART 1 - General

1.00 General

A. BSA's Integrated Safety Management System (ISMS) integrates Environment (such as environmental protection, pollution prevention), Safety, and Health management into the work of the Laboratory.

B. Construction/demolition-type activities are governed by the "Work Planning and Control for Experiments and Operations," found in BSA's SBMS, and the Job Risk Assessment (JRA) and the Facility Risk Assessment (FRA) processes. The subject area is implemented by organizational procedures using a graded approach that runs from "skill-of-the worker" to the use of formal work permits and/or experimental safety reviews. The subject area requires a screening process (based on a formal graded approach). This process determines when a Laboratory-wide experimental safety review or work permit form is required or when skill-of-the-worker is appropriate. Regardless of the determination, a worker always has the right to request a Laboratory-wide experimental safety review or work permit. These processes supports the entire life cycle of operations, maintenance, construction, and support activities to incorporate the appropriate ES&H considerations and performance expectations.

1.01 Job Risk Assessment (JRA)

A. The JRA process is implemented by breaking down tasks or activities into steps, identifying hazards associated with each step, and evaluating the controls in place. From this information, risk is determined. If the risk is above the established threshold limits, then additional controls must be developed and put in place before the start of work.

B. As described in Section 01 33 00 – Submittals, the Contractor shall perform a thorough and systematic safety analysis of the work. The analysis shall include the detailed identification of individual job tasks and an assessment of the hazards associated with each task. Following hazard identification, the Contractor shall establish controls and mitigating actions to manage the identified hazards and risks.

1.02 Applicable Codes and Standards

A. Applicable codes and standards for material furnished and work performed shall include all state laws, local ordinances, requirements of governmental agencies having jurisdiction, and applicable requirements of the latest editions of the following codes and standards including but not limited to:

ACGIH	American Conference of Governmental Industrial Hygienist
ANSI	American National Standards Institute
ASA	American Standards Association
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
BNL ES&H	BNL Environment, Safety, and Health Standards
BNL RCM	BNL Radiological Control Manual

BNL SBMS	BNL Standards Based Management System
CMAA	Crane Manufactures of America
DOE	Department of Energy
EPA	Environmental Protection Agency
FM	Factory Mutual
NBS	National Bureau of Standards
NEC	National Electrical Code
NEMA	National Electric Manufacturers Association
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association NFPA-101
NYCRR	New York State Codes, Rules and Regulations
NYSBC	New York State Uniform Fire Prevention and Building Code
NYSDEC	New York State Department of Environmental Conservation
NYSDOL	New York State Department of Labor
NYSDOT	New York State Department of Transportation, Office of Engineering, Standard Specification, Construction and Materials
OSHA	Occupational Safety & Health Administration
SCDHS	Suffolk County Department of Health Services
SMACNA	Sheet Metal and Air Conditioners National Association
UL	Underwriter's Laboratories
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency

In case of conflict, the MOST STRINGENT requirements shall govern.

B. Where specific performance requirements are listed herein, it is the intent of this Specification that all manufacturers, fabricators, suppliers, installers, contractors, subcontractors, specialty and sub-subcontractors shall provide services satisfying these requirements whether mentioned by trade or manufacturer's name or submitted for approval as a substitute.

C. Where no explicit quality or standards for materials or workmanship are established for work, such work shall be of such quality consistent with industry standards and of the construction quality established for the Work generally. The Contractor shall conform to specified manufacturer's published specifications and installation instructions unless otherwise specified or indicated.

D. The BNL SBMS provides Lab-wide policies and procedures that BNL needs to support a compliant requirements management program. The ERP Operations Procedures Manual (OPM) provides project specific implementing procedures to meet the BNL SBMS requirements. Project specific documents, plans, procedures, and work instructions are prepared and performed in accordance with the requirements of the ERP OPM.

E. The Contractor shall perform all activities on the BNL Site in accordance with applicable BSA SBMS requirements, Environmental Management System (EMS), ERP OPM, and all project specific documents, procedures, and specifications. If the Contractor identifies any discrepancies between procedures and project documents, the Contractor shall immediately notify BSA and the discrepancy will be resolved prior to performing any affected work. All BSA procedures, standards and other requirements are available on the BSA website (accessible only on site) or will be provided to the Contractor upon request.

The applicable BSA SBMS Subject Areas for the engineered cap removal project includes:

1. Construction Safety
2. Electrical Safety
3. Emergency Preparedness
4. Engineering Design
5. ESH Policy Manual
6. ESH Standards
7. Events/Issues Management
8. Facility Use Agreements
9. Guests and Visitors
10. Hazardous waste Management
11. Industrial Waste
12. Liquid Effluents
13. Material Requiring Special Handling
14. Natural Hazards in the Environment
15. Noise and Hearing Conservation
16. Non-Radioactive Airborne Emissions
17. Personal Protective Equipment
18. Pollution Prevention / Waste Minimization
19. BNL Radiological Control Manual
20. SBMS subject area (13 Radiological Control Procedures)
21. Rad Dose Limits & ACL's
22. Radioactive Airborne Emissions
23. Radioactive Waste Management
24. Radiological Stop Work Procedure
25. Readiness Evaluations
26. Respiratory Protection
27. Spill Response
28. Stop Work – Imminent Danger
29. Storage & Transfer of Haz/Nonhaz Material
30. Traffic Safety
31. Transfer of Rad Material Onsite
32. Transport of Rad Material Offsite
33. Use of BNL Facilities & Grounds
34. Work Planning and Control for Experiments and Operations

Applicable sections of the ERP OPM include the following:

1.1 BSA Integrated Project Team Charter
1.3 Work Procedure Development and Requirements
1.4 Document Review and Modification
1.5 Training Management System
1.7 Training Management Plan
1.8 Training Implementation Procedures
2.1 Quality Assurance Plan
2.2 Corrective Action Program and Condition Reporting System
2.3 Project Operations Review Committee
2.6 Records Management
2.7 Safety Review Committee
3.1 Conduct of Operations
3.2 Work Planning and Control

3.3 Unreviewed Safety Issue Determination
3.4 Field Activity Oversight
3.5 Operating Experience and Internal Lessons Learned Program
3.6 Conduct of Operations Matrix
4.1 Environment, Safety and Health Plan
4.2 Environmental Management System Manual for ERP
4.6 Environmental Management Program for the ERP Directorate
4.7 Safety Observations
4.8 OHSAS Implementation Manual
5.1 BGRR Local Emergency Plan and Building Access Requirements

1.04 General Safety Requirements

A. The Contractor is responsible for preparing and complying with the ES&H Plan prepared in accordance with 29 CFR 1910.120 and 1926, 10 CFR 851, and applicable BSA SBMS and ERP OPM requirements.

B. The Contractor is responsible for performing the Work safely. In addition, the Contractor shall provide:

1. Specific assignment of an individual, employed by the Contractor, as the Site Health & Safety Officer, who shall be responsible for Site construction safety. The Site Safety Officer shall complete a 30-hour OSHA construction safety course. The Contractor must demonstrate, with verification of completion of OSHA construction safety courses and other credentials, the ability of the Site Health & Safety Officer to supervise the type of work to be performed under the Contract.

2. A letter or certificate of compliance indicating that the Contractor is aware of, has reviewed, and shall comply with the safety regulations of both the OSHA Standards (29 CFR 1910/1926), and BSA SBMS and ERP OPM requirements. The letter shall certify that all of these requirements are included in the ES&H Plan prepared by the Contractor.

C. The Contractor shall provide field oversight, Industrial Hygiene monitoring equipment, safety equipment, consumables, and sampling and analysis services required to implement its ES&H Plan. The Contractor shall be responsible for providing all PPE including respiratory protection equipment required to perform the Work.

D. All Contractor personnel shall be able to comprehend the work and safety instructions required to perform the Work. All Contractor personnel shall acknowledge, in writing, that they have read and understood the ES&H Plan prior to the start of work.

E. The Contractor shall be required to include the applicable safety requirements in contracts with all tiers of subcontractors of all kinds. The Contractor shall provide for the oversight of all of its subcontractors. These requirements apply to subcontractors of all kinds including transient, incidental and ancillary service providers.

F. BSA demands that all work is performed safely and in accordance with the requirements of the Contract. BSA will not tolerate unsafe worker behavior and expects full compliance with all safety requirements. These requirements shall include, but not be limited to, all applicable OSHA regulations, BSA SBMS and ERP OPM requirements, other codes and regulations, and the

Contractor's BSA approved JRA and ES&H Plan. BSA has a zero tolerance policy and the Contractor will be directed to replace personnel who do not comply with safety requirements.

G. The following requirements have been established for electrical safety:

1. All electrical equipment brought on-site shall have a label indicating that it has been tested and is in compliance with NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces.

H. All work associated with the project must be performed within the occupational exposure limits for Industrial Hygiene hazards set in OSHA 29CFR1926 and ACGIH *Threshold Limit Values*®. The contractor is required to provide qualified monitoring and hazard assessment personnel (per DOE G4401-3 *Occupational Exposure Assessment*), to conduct monitoring with calibrated equipment using NIOSH or OSHA approved methods, and to have analysis conducted by an AIHA Proficiency Analytical Testing certified laboratory. Copies of all field sampling sheets, laboratory analysis reports, and hazard assessment evaluation reports is to be provided to BSA for inclusion in the BNL Industrial Hygiene records management system.

I. If a safety related event, accident, or a reportable condition occurs, ERP and the Contractors shall immediately gather facts, conduct a causal analysis, identify corrective actions, and prepare the applicable reporting documentation in accordance with ERP-OPM-2.2, "Corrective Action Program and Condition Reporting System". In accordance with ERP-OPM-2.2, the Contractor shall immediately notify BSA and provide accurate reports to BSA of all events, injuries of any kind, accidents, near misses and adverse or unexpected field conditions. The fact finding shall be conducted during the same work shift the safety event/accident/ condition occurred or was discovered. Similarly, statements from all involved parties must be prepared and submitted during the same work shift the safety event/accident/ condition occurred or was discovered.

1.06 Work Permits

A. The Work included in this Contract shall be performed in accordance with Work Permits prepared, approved and issued pursuant to the requirements provided in ERP-OPM-3.2 "Work Planning and Control".

B. The Work Permit and supporting documentation (e.g. RWP's, JRA's, digging permits, etc.) prepared by BSA, and signed and accepted by the Contractor, shall be posted or be on hand at the project Site. By signing and accepting the Work Permit, the Contractor indicates that it understands the job hazards and all of the requirements for performing the Work.

1.07 Conduct of Operations

A. A Tailgate Safety Meeting shall be held at the commencement of each work day, or new work shift if multiple daily shifts are worked, to discuss the activities for the day, specific hazards, and to solicit worker feedback on safety and work process. The Tailgate Safety Meeting shall be conducted by BSA and the Contractor in accordance with ERP-OPM-3.4 "Field Activity Oversight". All workers shall attend this meeting or subsequently briefed as to its contents. If a change in field conditions occurs, or a new task is identified, a separate safety tailgate meeting will be held prior to the performance of the affected work.

B. The Contractor shall ensure all work is performed in accordance with approved Plans, Work Procedures, and Work Instructions. The Contractor shall promptly cease work and place the work area in a safe condition in the event that Work Procedures cannot be performed as written.

C. The Contractor shall ensure that all work is planned, performed, documented, and supervised in accordance with ERP-OPM-3.7 “Conduct of Operations Matrix”.

PART 2 - Products

Not Used.

PART 3 - Execution

Not Used.

END OF SECTION 01 35 23

DIVISION 01 - GENERAL REQUIREMENTS
SECTION 01 35 24 – TRAINING REQUIREMENTS

PART 1 - General

1.00 Related Sections

A. Section 00 72 00 – General Conditions

B. Section 00 73 00 – Supplementary Conditions

1.01 General

A. The Contractor shall be responsible for obtaining all necessary training, certifications, registrations, licenses, etc. for all personnel involved with the Work. Contractor personnel will not be allowed to engage in work activities without first obtaining all proper and required training. Contractor personnel training will be kept up to date throughout the duration of the project. Equivalent training may be acceptable if approved by BSA. For the training services provided by BSA at BNL, the Contractor is responsible for compensating their employees.

1.01 Required Training

A. The Contractor will perform a job training assessment for all personnel to determine the training requirements. The following training will be required as a minimum for the Contractor's employees:

1. OSHA 40 Hr. HAZWOPER

2. OSHA 8 Hr. HAZWOPER Supervisor (for Field Superintendent, Site Health and Safety Officer, and other Contractor supervisory personnel)

3. BSA Contractor Vendor Orientation

4. Medical Surveillance (i.e., whole body count, Bioassay, respirator clearance) (Drilling personnel only)

5. BSA radiological worker training (Drilling personnel only)
   - Radiological Worker I
   - Contamination/Airborne radioactivity (RWT-300A)

6. Four (4) hour ERP OPM training for all subcontractor management and supervisory personnel.

7. Eight (8) hour General Employee and BGRR Specific Training

8. The Contractor's employees must be fully trained on the equipment they will operate.

B. Upon award of the Contract, the Contractor should schedule the required training described herein. All required training will be completed prior to the commencement of Work.

C. If the Contractor is unable to attend the courses at the regularly scheduled times, arrangements for special training classes can be made through BSA. BSA's costs of conducting non-scheduled training classes will be back-charged to the Contractor.

1.03 BSA On-site Computer Based Training

A. All Contractor personnel involved with waste packaging are required to complete the BSA Radioactive Waste Generator (HP-RADIGEN), BSA Hazardous Waste Generator (HP-RADIGEN3), BSA Transportation of Hazardous Material (TQ-HAZMAT-A), and BSA Hazmat Transportation Awareness Training (TQ-HMT-SECURITY) courses. These are BSA web-based courses and will require approximately 60 minutes each to complete the program and quiz.

B. The Contractor's Project Manager, Field Superintendent, and Site Health and Safety Officer are required to complete the BGRR Facility Environmental Training Course (ER-BENV1).

C. Following completion of the Contractor/Vendor Orientation Training (CVO), the Contractor personnel will receive credit for the following BSA computer based training courses: Stop Work Procedure (GE-STOPWORK), Emergency Plan & Response (GE-EMERGPLAN), and Environmental Protection (GE-ENV-GET).

D. All Contractor personnel requiring BNL network access are required to read and understand the computer based training course Cyber Security (GE-CYBERSEC).

1.04 Medical Surveillance

A. Contractor shall provide medical surveillance of its personnel in accordance with OSHA regulations. In addition, Contractor personnel working under an RWP will be required to complete a whole body count and bioassay provided by BSA in order to receive a thermo-luminescent dosimeter (TLD) and work in radiological areas.

1.05 BSA Radiological Worker Training

A. All Contractor personnel working under an RWP are required to complete the BSA Radiological Worker 1 Course (HP-RWT002) and the Contamination/Airborne Course and Practical (HP-RWT-300/A) and be approved by BSA to obtain and wear a TLD in order to work.

B. The Radiological Worker 1 Course is a seven and one-half (7-1/2) hour course, given on the first and third Tuesday of every month between the hours of 9:00 am and 4:30 pm at Bldg. 703. The course is designed for personnel who need unescorted access to Controlled Areas, Radioactive Material Areas, Radiation Areas and High Radiation Areas.

C. The Contamination/Airborne Course is a three (3) hour course, given on the first and third Wednesday of every month between the hours of 9:00 am and 12:00 pm. The Practical Course is a one and one-half (1-1/2) hour course, and follows the Contamination/Airborne Course on the first and third Wednesday of every month. The Contamination/Airborne Course and practical factors demonstration are required for employees who need unescorted access to the Radiological Buffer Areas, Contamination, High Contamination and/or Airborne Radioactivity Areas. Radiological Worker 1 is prerequisite. Note: The practical factors demonstration is a separate

session and must be taken in order for the trainee to receive qualification. The Contractor will be responsible for providing respiratory protection training to its employees in accordance with the requirements of its program that will be approved by BSA.

D. All Contractor personnel shall submit radiological dose records to BSA prior to the issuance of a TLD by BSA and the start of work.

E. All Contractor personnel will be required to have whole body counts prior to the start of work, then on an annual basis and prior to departing the BNL Site. BSA will provide the whole body counts by appointment (two weeks notice is required).

F. All Contractor personnel required to work in contamination will have radiological bioassays prior to the start of work, then on an annual basis, and prior to departing the BNL Site. BSA will provide the bioassays analyses. Submittal of bioassay samples shall be coordinated with BSA in advance.

G. It is the Contractor's responsibility to ensure that departing employees complete required termination whole body counts and bioassays. The Contractor shall be responsible for the cost to return the individuals to complete these requirements if they improperly depart the BNL Site.

1.06 Contractor's Industrial Hygiene/Safety Program

A. The Contractor is responsible for providing general safety and industrial hygiene training to all project personnel that includes the following:

1. Fall protection
2. Back safety
3. Hand and power tool safety
4. Ladder safety
5. Heat stress
6. Electrical safety
7. Noise and hearing conservation
8. Hazard communication
9. Fire extinguisher

1.07 Training Records

A. The Contractor shall maintain current training records at the Site for all personnel.

PART 2 - Products

Not used.

PART 3 - Execution

Not used.

END OF SECTION 01 35 24

DIVISION 01 - GENERAL REQUIREMENTS
SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

PART 1 - General

1.00 Summary

A. This section provides BSA's requirements for temporary services and facilities, including utilities, support facilities, miscellaneous services and protective barriers.

B. The Contractor shall provide all field office facilities, break rooms, and temporary storage buildings, temporary utilities and services required to complete the work. The Contractor will be responsible for the maintenance of such facilities and services in a safe condition for the duration required to support the work, and shall provide for their removal upon work completion. The location of all such facilities must be approved by BSA.

C. Electric power may be made available to the Contractor upon request. BSA reserves the right to deny access to electric power other than that identified for a standard construction trailer.

D. Utilities for a standard construction trailer will include electrical power (460V, 30A, 3-phase and 120V, 30A single phase).

1.01 Regulations

A. The Contractor shall comply with applicable laws and regulations.

1.02 Standards

A. The Contractor shall comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities."

1. Electrical Service: The Contractor shall comply with NEMA, NECA and UL standards and regulations for temporary electric service and shall install service in compliance with National Electric Code (NFPA 70).

2. GFIs: Ground fault circuit interrupters are required for all electric services to and within the Site from other than permanent wiring of a building or structure.

1.03 Inspections

A. The Contractor shall arrange for BSA personnel to inspect and test each temporary utility before its use. The Contractor shall remedy findings and deficiencies identified by BSA inspections within two (2) business days. The Contractor shall immediately remedy safety hazards identified during such inspections.

1.04 Conditions of Use

A. The Contractor shall keep facilities clean and neat, and operate them in a safe and efficient manner. The Contractor shall take necessary fire prevention measures. The Contractor will not

overload facilities or allow hazardous, dangerous or unsanitary conditions. The Contractor will not allow public nuisances to develop or persist on the BNL Site. The Contractor shall perform housekeeping to the satisfaction of BSA.

B. The Contractor shall maintain Material Data Safety Sheets (MSDSs) for all material on-site, provide an inventory and copy of each MSDS to BSA, and provide an updated inventory as material is brought on-site. The Contractor shall store all material properly in accordance with BNL SBMS requirements.

1.05 Field Offices

A. The Contractor shall provide insulated, weather-tight field offices of sufficient size to accommodate its personnel. The field offices shall be prefabricated units or similar construction with lockable entrances, operable windows and serviceable finishes.

1.06 Sanitary Facilities

A. The Contractor shall install self-contained single-occupant toilet units of the chemical type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material. The Contractor shall install the facilities where needed and as approved by BSA. The Contractor shall comply with regulations and local health codes. Toilets must be serviced at least weekly, and more often if needed, as determined by BSA. The Contractor shall provide paper goods and similar disposable materials for each facility.

1.07 Drinking Water Facilities

A. The Contractor shall provide containerized tap-dispenser bottled-water type drinking water units for its employees.

1.08 Fire Extinguishers

A. The Contractor shall provide one (1) portable tank type fire extinguisher per work area containing fifteen pounds of liquid carbon dioxide, complete with seat type valve, three (3) feet of hose and non-shatterable discharge hose (as manufactured by Walter Kiddie & Co., Model 15KS, or equal).

1.09 Project Identification and Temporary Signs

A. The Contractor shall install project identification signs where indicated, or as directed by BSA. The signs shall be supported on frames of preservative-treated wood or steel.

B. BSA will prepare signs for pickup and installation by Contractor.

1.10 Protective Barrier Installation

A. Barricades, Warning Signs, and Lights:

1. The Contractor shall comply with standards and code requirements for erecting barricades. The Contractor shall install appropriate warning signs to inform personnel and the public of the hazard being protected against and where needed, install lighting including flashing lights, if required.

2. The Contractor shall provide precautions to prevent unauthorized entrance, vandalism and theft. The Contractor shall provide a secure, locked facility where materials and equipment are to be stored.

1.11 Environmental Protection

A. The Contractor shall operate temporary facilities and equipment and conduct work by methods that comply with environmental regulations, and minimize the possibility that air, waterways and soil might be contaminated or polluted.

B. When the work requires the Contractor to bring temporary fuel storage facilities on to the BNL Site, the Contractor shall be responsible for providing a temporary impermeable containment area for all fuel transfer operations in accordance with Suffolk County Department of Health Services, Article 12.

C. The Contractor shall submit a spill prevention program that is proactive and effective in preventing spills on the BNL Site. The spill prevention program will be reviewed and approved by BSA.

D. If, during work activities, a release, discharge, or spill of petroleum products or chemicals occurs, the Contractor shall:

1. Immediately notify Safeguards and Security and Fire Rescue at Ext. 2222 or 911 (from a BNL phone) or 631-344-2222 from a cell phone or pay phone, and the BSA Project Manager of the release, discharge, or spill.

2. Immediately initiate cleanup and disposal operations by a BSA- approved hazardous waste management contractor, complete the operations, and be responsible for monitoring and/or sampling in the event of a spill, to the satisfaction of BSA.

3. BSA will coordinate the disposal of contaminated material, with appropriate documentation and disposition forms. The Contractor is responsible for cleanup and disposal costs and all costs incurred as a result of the spill, plus penalties.

E. The Contractor will avoid use of tools and equipment that produce harmful noise, if possible.

F. The Contractor shall make use of temporary enclosures in areas where work may generate airborne contaminants that cannot be controlled with engineering controls or the risk is high for a release to the environment, as determined by NESHAPs. The Contractor shall maintain enclosure contamination levels ALARA. The Contractor shall decontaminate the enclosure to minimize the potential spread of contamination. The enclosure shall be decontaminated at the completion of work or disposed of as waste. BSA will perform NESHAPs evaluations to determine if an enclosure is required based on Contractor provided information.

1.12 Operation

A. The Contractor shall enforce strict discipline in using temporary facilities, limit availability to intended use, minimize abuse, and maintain facilities in safe and good operating condition until their removal.

B. Temporary structures shall be protected from damage by the elements.

1. The Contractor shall maintain operation of enclosures, cooling, heating, humidity control, ventilation and similar facilities on a 24-hour per day basis to achieve indicated results and to avoid damage.

1.13 Termination and Removal

A. The Contractor shall remove each facility when it is no longer needed, or during demobilization. All facilities shall be removed after the completion of the Work.

B. Temporary facilities are the property of the Contractor.

PART 2 – Products

Not used.

PART 3 – Execution

Not used.

END OF SECTION 01 50 00

DIVISION 01 - GENERAL REQUIREMENTS
SECTION 01 71 13 – MOBILIZATION/DEMOBILIZATION

PART 1 - General

1.00 Related sections

A. Section 00 01 01 – Statement of Work

B. Section 01 33 00 – Submittals

C. Section 01 77 00 – Closeout Procedures

PART 2 - Products

Not used.

PART 3 - Execution

3.00 Mobilization

A. Upon award of contract, the Contractor shall submit all the necessary plans and documents stipulated in Section 01 33 00 Submittals to BSA for review and approval.

B. The Contractor shall obtain all required permits from BSA prior to initiating any work activities.

C. The Contractor shall coordinate with BSA regarding equipment, materials, containers, deliveries and access to the BNL Site.

D. The Contractor will be responsible for obtaining the required training for all personnel prior to start of work. Contractor employees will not be granted BNL Site access without required training certifications and documentation.

E. All Industrial Hygiene monitoring equipment (including chemical, noise, confined space atmosphere testing and non-ionizing radiation) shall be inspected, checked for current calibration evidence, and approved by BSA prior to use on the BNL Site

F. The Contractor shall identify and establish all work zones and material staging areas prior to beginning work, with approval by BSA.

G. BSA will perform radiological surveys of incoming heavy equipment that will enter the radiological work area. Incoming radiological surveys of heavy equipment require four (4) hours to complete. The Contractor shall provide 48 hours notice to BSA prior to delivery of equipment. The Contractor shall make the heavy equipment available and accessible to BSA.

H. BSA will perform quality control inspections of waste containers and any waste conveyance, not otherwise specified, prior to use. The Contractor shall provide 48 hours notice to BSA prior to delivery of waste container and waste conveyances. The Contractor shall make waste containers and waste conveyances available and accessible to BSA.

3.01 Demobilization

A. The Contractor shall demobilize completely from the BNL Site within ten (10) business days after completion of the Work.

B. The Contractor shall remove all equipment, temporary facilities, controls, materials, debris, waste, waste containers, used PPE, work zone delineation materials and any other job associated items prior to exiting the site.

C. The Contractor shall coordinate with BSA prior to removing any equipment or materials that were used within the radiologically-posted work areas.

D. The work areas will be left in neat, clean and accessible condition after work activities are complete.

E. The Contractor shall not remove identified equipment or vehicles from the BNL Site until BSA has surveyed the equipment, and the vehicles/equipment passed through BSA's vehicle monitor on Princeton Avenue.

END OF SECTION 01 71 13

DIVISION 01 - GENERAL REQUIREMENTS
SECTION 01 77 00 – CLOSEOUT PROCEDURES

PART 1 - General

1.00 Related Sections

A. Section 00 01 01 – Statement of Work

B. Section 01 71 13 – Mobilization/Demobilization

1.01 General:

A. Project Closeout Inspection

1. When the Work is complete, the Contractor shall notify BSA.

2. Before notifying BSA, the Contractor shall complete the following:

a. The Contractor shall assure that the Work is completed in accordance with the specified requirements and is ready for the requested inspection.

b. Final cleanup has been completed as described in Section 01 71 13, Paragraph 3.01 Demobilization.

3. BSA reserves the right to set up a preliminary project closeout inspection prior to completion of the Work.

4. The Contractor shall provide to BSA a list of items remaining to be completed or corrected.

a. Within a reasonable time after receipt of the list, BSA will inspect the work areas to determine status of completion.

b. Should BSA determine that the Work is not complete:

i. BSA will so notify the Contractor, in writing, giving the reasons therefore.

ii. The Contractor shall remedy the deficiencies and notify BSA when ready for re-inspection.

iii. BSA will then re-inspect the Work.

iv. This procedure will be repeated until all deficiencies have been corrected and Work is accepted by BSA as completed.

5. Results of the completed inspection will form the basis for final acceptance.

B. Final Acceptance

1. Before requesting final acceptance of the Work and the last payment, the Contractor shall complete the following:

a. The Contractor shall close out all user accounts for goods and services purchased by the Contractor from BSA.

b. The Contractor shall submit a copy of the final inspection list stating that each item has been completed or otherwise resolved for BSA acceptance.

c. The Contractor shall submit a letter to BSA certifying that all subcontractors have been paid.

C. Record Document Submittals

1. The Contractor shall submit Record Documents in accordance with Section 01 33 00 (Submittals).

D. Record Drawings

1. The Contractor shall provide redlined revisions to BSA-provided drawings to depict "as-built" conditions

E. Record Specifications

1. The Contractor shall provide a list of variations or changes in actual work performed in comparison with the specifications and addenda. The Contractor shall give particular attention to selection of options and similar information on elements that are concealed and cannot be readily discerned later by direct observation. Such deviations shall be clearly reflected by the Contractor on the Record Drawings.

F. Completion Report

1. The Contractor shall prepare the Project Completion Report for BSA review and approval in accordance with Section 01 33 00 (Submittals).

G. Final Payment

1. After compliance with all of the above requirements and approval in writing by BSA for project closeout, the Contractor shall submit a final payment requesting release of balance of 10% retainage and Contract closeout.

PART 2 - Products

Not used.

PART 3 - Execution

Not used.

END OF SECTION 01 77 00

DIVISION 02 – EXISTING CONDITIONS
SECTION 02 00 00 – EXISTING CONDITIONS

PART 1 - General

1.00 Related Sections

A. Section 00 01 01 – Statement of Work

1.01 References

A. Contract Drawings

1.02 Parking Area East of Building 701

A. Description

The BGRR Canal and Below Ground Duct Deep Soil Pocket were located to the east and south of Building 701 and were removed during March – June 2005.

Radiological surveys of the excavations indicate residual radioactive contamination exists. All excavations greater than 5' will be treated as contaminated work.

The area was backfilled to grade. A 1-1/2 inch thick Type 1A base course and 1-1/2 inch thick asphalt wearing course were installed over the entire parking area to the east and south of Building 701.

PART 2 - Products

Not used.

PART 3 - Execution

3.00 Contractor Responsibilities

A. Contractor shall have full responsibility for reviewing and verifying such information and data, and for coordination of the work with BSA.

END OF SECTION 02 00 00

DIVISION 02 – EXISTING CONDITIONS
SECTION 02 21 13 – SITE SURVEYS

Part 1 - General

1.00 Description

A. This section specifies the requirements for field surveys.

B. Benchmark coordinates and locations will be provided to the Contractor.

1.01 Surveys and Stakeout

A. BSA will provide locations and benchmarks at the BNL site from which the Contractor shall complete the layout of the work to be performed under the Contract. From the basic data established by BSA, the Contractor shall establish reference control points at the work site and complete the layout of work.

B. The Contractor shall be responsible for all measurements that may be required for execution of the work to the exact position and elevation as prescribed in the specifications, shown on the drawings, or as the same may be modified at the direction of BNL to meet changed conditions or as a result of modification to the Contract.

C. The Contractor shall be responsible for the establishment of points required by the Subcontractors in laying out their work.

D. The Contractor shall furnish stakes and other required equipment, tools and materials, and all labor as may be required in laying out any part of the work from the benchmarks established by BSA.

E. If for any reason, bench marks and/or utility location markings, monuments are disturbed, it shall be the responsibility of the Contractor to re-establish them, without cost to BSA, as directed by BSA.

F. BSA may require that work be suspended at any time when location and limit marks established by the contractor are not reasonably adequate to permit checking completed work or the work in progress.

G. BSA will back charge the Contractor for any re-establishment of stakeout performed by BNL that was disturbed by the Contractor.

PART 2 - Products
Not used.

PART 3 - Execution
Not used.

END OF SECTION 02 21 13

DIVISION 02 – EXISTING CONDITIONS
SECTION 02 41 13 – SELECTIVE SITE DEMOLITION

PART 1 - General

1.00 Related sections

A. Section 00 01 01 – Statement of Work

B. Section 01 33 00 – Submittals

C. Section 02 00 00 – Existing Conditions

D. Section 02 81 00 – Waste Management & Transportation

1.01 Section Includes

A. Demolition of concrete curbs and asphalt.

1.02 Codes and Standards

A. OSHA 29 CFR 1926

B. NFPA241 Construction, Alteration, and Demolition Operations

C. NESHAPS 40 CFR 61 Subpart M

D. BSA Standards-Based Management System, ES&H Standards

1.03 General

A. The Contractor shall include means and methods for selective demolition in the Technical Work Procedure (see Section 01 33 00).

B. The Contractor shall furnish all labor, materials, and equipment necessary to provide selective demolition, removals, and legally dispose of non-salvageable material off the BNL site.

C. All removed salvageable and non-salvageable materials and equipment shall pass through the vehicle radiation monitor prior to disposal on the BNL site or exiting the BNL site.

D. Demolition requires the selective removal and disposal of the following:

a. Sawcut and remove portions of asphalt pavement and concrete curb as shown on the drawings.

PART 2 – Products

Not used.

PART 3 - Execution

3.00 Demolition

A. Existing concrete or bituminous pavement shall be removed as required or as directed. The pavement shall be sawed with an approved concrete saw along all removal lines that do not terminate at a joint. The pavement shall be removed in such a manner that the remaining pavement will have a straight and vertical exposed face.

B. Broken concrete, broken bituminous pavement, and all other rubble shall be disposed of at approved locations obtained by the Contractor at no additional expense to BSA.

C. Protect public and all property from flying or falling debris. Control dust and dirt resulting from demolition work.

D. Load rubble and waste for transport and legally dispose of off the BNL site.

E. The Contractor shall monitor the work in accordance with the ES&H Plan.

F. The Contractor shall be responsible for safe practices and operations, and all barricades, warning lights, danger signs and other safety precautions to protect all persons and vehicles, either directly related or incidental to the project, from injury or damage.

G. The Contractor shall promptly replace any items demolished that were not so scheduled to be demolished to the approval of BSA at no additional cost to BSA.

H. Roadways shall remain clear and usable during demolition work to allow for removal of debris.

3.01 Cleaning

A. The Contractor shall clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. The Contractor shall return adjacent areas to the condition existing before demolition operations began.

END OF SECTION 02 41 13

DIVISION 02 – EXISTING CONDITIONS
SECTION 02 81 00 – WASTE MANAGEMENT & TRANSPORTATION

PART 1 - General

1.00 References

A. Environmental Restoration Projects Waste Management Plan

B. BSA SBMS Environmental Management System Description for Environmental Management and Hazardous Materials Transportation

C. BSA SBMS Subject Area's for Radioactive Waste Management

D. BSA SBMS Subject Area's for Radioactive Waste Transportation On- and Off-site

E. FS-SOP-1050, Radiological Survey for Radioactive Material Shipments

F. 10 CFR 835 Appendix E

G. 40 CFR 264.314 and 265.314

H. 49 CFR 173.425, Table of Activity Limits, Excepted Quantities, and Articles

1.01 Related Sections

A. Section 01 33 00 – Submittals

B. Section 02 41 13 – Selective Site Demolition

C. Section 02 51 26 – Radioactive Decontamination

1.01 General – Waste Management

A. The soil and asphalt will be sampled by BSA prior to construction activities to ensure that it can be disposed of as standard industrial waste.

B. The Contractor shall meet all of the requirements included in BSA's WMP.

C. The Contractor shall sort, segregate, inspect and package all waste in accordance with the applicable requirements of the disposal facility's waste acceptance criteria.

1.03 General – Waste Packaging

A. The Contractor shall be responsible for loading debris resulting from the Contractor's demolition activities in roll-off containers.

B. The Contractor shall containerize drill cuttings and well development water in BSA-provided lined 55-gallon drums.

B. The Contractor shall ensure that prohibited waste items are sorted and segregated from the wastes loaded in the containers by the Contractor. Rework, including unpacking and repacking of waste containers will be at the expense of the Contractor.

C. The Contractor will be responsible for all waste handling operations for the work.

D. The Contractor will protect waste containers from puncture, denting, scrapping or otherwise damaging the containers in any way.

E. The Contractor will seal each container according to the manufactures specification after BSA approves the waste container packaging and contents.

F. The Contractor shall develop written procedures for the packaging and handling of waste.

1.04 General – Waste Transportation

A. The Contractor shall ensure that their operators of waste transportation vehicles are in possession of a BSA Waste Control Form at all times when transporting waste outside of the work area. BSA will complete the Waste Control Forms and provide the completed forms to the Contractor.

B. The Contractor's vehicle operators shall have a valid commercial driver's license.

PART 2 - Products

2.00 Equipment

A. The Contractor shall supply all equipment required for sizing waste and loading waste into containers.

PART 3 - Execution

3.00 Collection and Disposal of Office Waste

A. Prohibited items that are suspected to be radiologically contaminated, or items not normally discarded into office area trash containers shall be segregated by the Contractor from typical office trash. Prohibited items include, but are not limited to:

- Tools,
- Equipment,
- Mop heads,
- Hose clamps,
- Floor sweepings,
- Aerosol cans,
- High density material,
- Personal protective clothing (PPE),
- Yellow masslinn,
- Yellow tape/Rad Con tape,
- Herculite,
- Yellow shoe covers,
- Radiological smears,

- Radiological safety signs,
- Plastic sample bottles, and
- Survey instrument cords.

B. If any prohibited or suspect materials are found, the Contractor shall notify BSA.

C. If tools or equipment are found in office area trash containers, the Contractor shall contact BSA for radiological evaluation and the procedure for decontamination and/or disposition.

D. The Contractor shall place office trash in a designated area agreed upon by BSA and the Contractor. BSA will collect office trash daily.

3.01 Waste Storage Areas

A. The Contractor shall be responsible for maintenance and upkeep of the waste storage areas in accordance with the WMP.

B. Signs shall be posted in storage areas identifying empty or full containers.

3.02 Loading Containers

A. The Contractor shall fill containers such that the interior volume is efficiently and compactly loaded as practical up to the maximum gross weight limit of the container. Contents shall be prepared for containerization so as to minimize load shifting or damage to the container during movement.

END OF SECTION 02 81 00

DIVISION 31 - EARTHWORK
SECTION 31 00 00 – EARTHWORK

PART 1 - General

1.00 Related Sections

A. Section 02 41 13 – Selective Site Demolition

B. Section 31 22 00 – Grading

C. Section 31 25 00 – Erosion and Stormwater Control

B. Section 31 25 26.16 – Geomembrane Containment Barriers

C. Section 32 12 16 – Asphalt Paving

1.01 General

A. The work covered in this section shall include:

1. Excavation of soils.

2. Sand bedding layers

3. Backfilling and compaction of soil.

B. Grading is covered under Section 31 22 00 Grading.

1.02 Codes and Standards

A. OSHA 29 CFR 1926

B. BNL Environment, Safety and Health Standards and other applicable areas in the BNL Standards Based Management System

C. ASTM D698 and D1557

1.03 Utilities/Markouts

A. BNL digging permits, identifying all known underground utilities and structures, shall be required prior to starting work.

B. The work described in this section shall not commence until all utilities have been properly disconnected or otherwise addressed, and the work progression to take place has been agreed upon by the Contractor and BSA.

1.04 Submittals

A. The Contractor shall provide the required documents in accordance with Section 01 33 00 - Submittals.

1.05 Definitions

A. Backfill: Soil material used to fill an excavation. Refers to sand protection layer and crushed stone protection layer.

B. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

C. Excavation: Removal of soil material.

D. Fill: Soil materials used to raise existing grades. Refers to sand protection layer and crushed stone protection layer.

E. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

F. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

Part 2 – Products

2.00 Sand Protection Layer

A. The sand protection layer shall conform to the following requirements:

Permeability: 1×10^{-3} cm/sec or greater at 85% compaction in accordance with ASTM D-1557.

Sieve Size	Percent Passing
1-inch (25 mm)	100%
No. 4 (4.75 mm)	80%
No. 40 (0.425 mm)	20 to 60%
No. 200 (0.075 mm)	5 to 20%

2.01 Crushed Stone Protection Layer

A. The crushed stone protection layer shall conform to the following requirements:

Sieve Size	Percent Passing
2-inch (51 mm)	100%
1-1/2 inch (38 mm)	90 to 100%
1 inch (25 mm)	0 to 15%

Part 3 – Execution

3.00 General Excavation Requirements

A. The Contractor shall perform all work in accordance with the Work Plan.

B. The Contractor shall furnish all labor, materials and equipment necessary for excavating, backfilling, and compacting soil.

C. The Contractor shall erect, install, and maintain barriers, signs, warning devices, lighting, bridging, and other items required to safeguard life and property.

D. The Contractor shall excavate with extreme caution when working in areas of known existing utilities until all utilities are found and exposed. The Contractor shall confirm with BSA that the exposed utility is deactivated before further handling and removal. The Contractor shall stop work immediately upon discovering utilities that are not marked out or known to exist.

E. The Contractor shall not excavate either by hand or machine, without the authorization of BSA. This authorization shall not relieve the Contractor of responsibility for damage caused by the Contractor to any active utility.

3.01 Excavation

A. Excavation of soil shall proceed in a controlled manner starting from the site's surface and progressing to depth until required levels have been reached.

3.02 Stockpiling

A. The Contractor shall stockpile potentially clean soils and debris within the work area where there is no surface or subsurface contamination. BSA will coordinate with the Contractor a convenient area for clean stockpiling. Prior to use as backfill, BSA will sample the soil to verify it can be used as backfill.

3.03 Control of Water

A. Before restoring the site, the Contractor shall take all necessary measures to prevent surface water drainage from entering and accumulating in excavations. Surface water infiltration shall be controlled in conformance with Section 31 25 00 - Erosion and Stormwater Control. The Contractor shall include the means and methods to control surface water runoff and accumulation of water in excavations in the Technical Work Plan.

3.04 Subgrade Preparation – Proof Rolling

B. Finish proof rolling on an exposed subgrade free of surface water which would promote degradation of an otherwise acceptable subgrade.

C. After removal of the overlying soil, proof roll the existing subgrade with six passes of either a dump truck loaded with 4 cubic yards of soil or a 15-ton pneumatic-tired roller.

D. Operate the truck or roller in a systematic manner to ensure the number of passes over all areas, and at speeds between 2-1/2 to 3-1/2 miles per hour.

E. When proof rolling, provide one half of the passes made with the truck or roller in a direction perpendicular to the other passes.

F. The Contractor shall correct all deficiencies found.

G. The subgrade shall be sloped away from the building at a slope of 1 foot vertical to 75 feet horizontal (1.33% slope).

3.05 Backfilling and Compaction

A. Clean, stockpiled soils from the excavation shall be used as backfill.

B. Additional backfill materials shall be approved by BSA and obtained from an approved borrow source.

C. The additional backfill soil shall pass the requirements of New York State Department of Environmental Conservation (NYSDEC) TAGM #4046.

D. The borrow/fill soils shall be free from frost, organic matter, loam, clay, trash, boulders, rock larger than 1 inches in any direction, or other deleterious materials.

E. The fill shall be spread evenly (i.e., in lifts and section by section) in horizontal layers not exceeding 6 inches. Each 6" layer shall be compacted to 90% maximum density, (per ASTM D698) or 85% maximum density (per ASTM D1557). Proctor-testing frequency shall be one for every 10,000 cubic yards placed (minimum), and also if there is a change in the source, or type of fill from a source.

H. Compact fill in horizontal lifts to a dry density greater than the percentage of maximum dry density in the table below.

Maximum Laboratory Dry Weight (lb / ft^3)	**Minimum Compaction Requirements in Percent of Maximum Laboratory (lb / ft^3)**
90 to 104.9	102
105 to 119.9	100
120 and more	98

I. In-place density testing shall be one test per lift per 2,500 square feet.

J. The proper moisture content of fill material shall be maintained to permit compaction to the required density.

3.06 Documentation

A. At a minimum, the Contractor shall record, document, and maintain, the following information:

1. Excavation

a. Daily records on:

1. Volume of soil excavated

2. Volume of soil backfilled

3. Summary of work performed each day

2. Site Restoration

    a. Volume of fill placed each day

    b. Source of the fill

    c. Type of fill

    d. Compaction testing results

    e. Analytical data for new fill

END OF SECTION 31 00 00

DIVISION 31 – EARTHWORK
SECTION 31 05 19.13 – GEOTEXTILES FOR EARTHWORK

PART 1 - General

1.00 Section Includes

A. Materials and procedures for installing woven geotextiles.

1.01 References

A. AASHTO M 288: Geotextile Specifications for Highway Applications

B. ASTM D 4791: Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

1.02 Submittals

A. Submit Manufacturer's certificate that each fabric complies with the requirements of this Section.

1.03 Sampling and Testing

A. Prior to shipment, test each individual shipment and lot of geotextile and send testing reports with the shipment to the job site. Clearly label all rolls as being part of the same production run certified as meeting all material requirements.

1.04 Packaging, Shipping, and Storage

A. Protect the geotextile from direct sunlight, chemicals, mud, dirt, and debris during shipment and storage. Replace at the Contractor's expense any geotextile damaged or deteriorated during shipping, storage or construction.

B. Labeling and Tagging:
   1. Identify each package by a tag or label securely affixed to the outside of the roll on at least one end.
   2. Provide the following required information on the tag:
      a. Name of the geotextile manufacturer.
      b. Brand name of the product, width, length, and package weight of geotextile.
      c. Lot Number.

1.05 Acceptance

A. BSA will reject geotextile at installation if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transport, handling or storage.

PART 2 – Products

2.00 Separation Geotextile

A. Manufacturer

1. US Fabrics, Inc.
2. Approved equal.

B. Furnish Class 1 fabric as specified in AASHTO M 288, with apparent opening size of 40 US Sieve maximum average roll value.

C. Woven geotextile shall meet the requirements shown in the following table for the following material.

Minimum Values for Woven Geomembrane

Property	Test Method	
Tensile Strength (lbs.)	ASTM D 4632	315
Elongation @ break (%)	ASTM D 4632	15
Mullen Burst (psi)	ASTM D 3786	600
Puncture Strength (lbs.)	ASTM D 4833	145
Trapezoidal Tear (lbs.)	ASTM D 4533	115
Apparent Opening Size (US Sieve)	ASTM D 4751	40
Permittivity (sec^{-1})	ASTM D 4491	0.02
UV Resistance, % Retained	ASTM D 4355	90

PART 3 – Execution

3.00 General

A. Place geotextile on areas that are smooth, and free of projections or depressions. Do not drag the geotextile across the subgrade. Roll geotextile out as smoothly as possible.

B. Do not operate construction equipment or traffic directly on geotextile.

C. Overlap the geotextile a minimum of 18 inches for all longitudinal and transverse joints, or sew the geotextile.

D. Repair: Place patch over damaged area and extend 3 feet beyond the perimeter of the tear or damage.

E. In the presence of wind, all geotextiles shall be weighted with sandbags. Do not use pins to secure the geotextile, as it may damage the geomembrane liner underneath.

F. When placed for construction, cover the geotextile with indicated cover material as soon as possible. Do not leave uncovered for more than five days. Place cover material on the geotextile in a manner that the geotextile is not torn, punctured, or shifted.

END OF SECTION 31 05 19.13

DIVISION 31 – EARTHWORK
SECTION 31 22 00 – GRADING

PART 1 - General

1.00 Related Sections

A. Section 02 21 13 – Site Surveys

B. Section 31 00 00 – Earthwork

1.01 General

A. The Contractor shall furnish all labor, materials, and equipment necessary for grading operations of backfilled and disturbed areas.

1.02 Codes and Standards

A. OSHA 29 CFR 1926

B. BNL Environment, Safety and Health Standards and other applicable areas in the BNL Standards Based Management System.

C. Applicable regulations, codes and standards.

1.03 Quality Assurance

A. Failure Criteria for grading includes, but is not limited to, the following:

1. Formation of pools of water; and,

2. Settlement of fill.

PART 2 - Products

Not Used.

PART 3 - Execution

3.01 Grades

A. The Contractor shall provide final grading of areas to match existing grades and slopes.

B. The Contractor shall shape the surface of areas to within 0.10 foot above or below existing elevation of surrounding area and compact as specified. Abrupt changes in slope shall be rounded.

C. The Contractor shall slope grades to direct water away from buildings and to prevent formation of pools of water.

3.02 Maintenance

A. The Contractor shall repair and reestablish grades in settled, eroded, rutted, or otherwise damaged areas. In damaged compacted areas, the surface shall be scarified, reshaped, and compacted to required density.

END OF SECTION 31 22 00

DIVISION 31 – EARTHWORK
SECTION 31 25 00 – EROSION AND STORMWATER CONTROL

PART 1 - General

1.00 Related Sections

A. Section 31 00 00 – Earthwork

1.01 References

A. 6NYCRR700-705 “Surface Water Quality Standards”

B. 6NYCRR750-758 “State Pollution Discharge Elimination System” (SPDES)

C. 40 CFR141.11-16 “National Primary Drinking Water Regulations” (NPDWR)

D. SBMS Subject Area “Liquid Effluents”

1.02 Submittals

A. The Contractor shall submit to BSA the means and methods of controlling stormwater and erosion as part of the Technical Work Plan.

PART 2 - Products

2.00 Silt Barrier

A. The Contractor shall construct a silt barrier to control silt-laden runoff from traveling off the work site. The silt barrier shall consist of geotextile fabric affixed to wooden stakes with the bottom of the fabric buried approximately 12 inches below grade. The geotextile fabric shall be made of ultra-violet resistant material, silt-film fabric having the following characteristics:

1. Grab strength (ASTM D 4632): 90 lbs.

2. Burst strength (ASTM D 751): 145 lbs.

3. Elongation (ASTM D 4632): 15% at 45 lbs.

4. Permeability coefficient (ASTM D 4751): 0.2 mm/sec at constant head of 50 mm.

5. Apparent opening size (ASTM D 4751): U.S. Standard Sieve Number 20, minimum.

6. Retained strength after accelerated weathering and ultra-violet exposure (ASTM D 4355): 70%.

PART 3 - Execution

3.00 General

A. Use the procedures and physical controls specified in the Work Plan for controlling stormwater, slope erosion, and accumulation of water in the work areas.

B. Minimize the ponding of surface water runoff on contaminated areas of the site.

C. Implement controls to minimize the flow of stormwater into excavation areas, whether contaminated or not.

D. Incorporate accordingly, waste minimization efforts and contingency disposal paths into the Technical Work Plan.

3.01 Erosion and Stormwater Control

A. Plan and execute the excavation in a manner to prevent stormwater runoff from the excavated areas to areas outside of the excavation area.

B. Minimize amounts of exposed work and waste at any one time.

C. Provide temporary measures, as required, to prevent water flow and erosion. These measures include berms, dikes, drains, sediment control (silt) fences, and hay or straw bales.

3.02 Stormwater Collection

A. The Contractor shall ensure that any collected stormwater from excavated areas is sampled and analyzed to meet BNL's requirements, state and federal regulations (i.e. 6NYCRR700-705 "Surface Water Quality Standards", 6NYCRR750-758 "State Pollution Discharge Elimination System" (SPDES), and 40 CFR141.11-16 "National Primary Drinking Water Regulations" (NPDWR)).

B. Authorization is requested from BSA via the SBMS Subject Area "Liquid Effluents" for discharge of collected and sampled stormwater to the sewage treatment plant. Accordingly, all analytical results are to be reviewed and approved prior to disposal on-site.

1. The following criteria shall apply to discharge at the sewage treatment plant:

   a. Radionuclide at source < NPDWR,

   b. All radionuclides < MDL Minimum Detection Limit using standard analytical methods, counting time, and volume: i.e., the propagated analytical error would be less than 50% at 2 standard deviations.

   c. Cs-137, Sr-90, Be-7 (minus background) < MDL,

   d. H-3 < 25% of NPDWR.

C. Collected stormwater that does not meet BNL's sewage treatment plant acceptance criteria is shipped off-site for treatment and disposal. Should this occur, the Contractor is responsible for providing the following:

1. Sufficient storage capacity for contaminated stormwater that can not be discharged on-site, and,

2. A plan describing the path chosen for off-site treatment and disposal of contaminated surface water, including criteria for selecting a treatment and disposal facility.

END OF SECTION 31 25 00

DIVISION 31 – EARTHWORK
SECTION 31 35 26.16 – GEOMEMBRANE CONTAINMENT BARRIERS

PART 1 - General

1.00 Section Includes

A. Specifications and guidelines for manufacturing and installing high-density polyethylene (HDPE) geomembrane liner.

1.01 References

A. American Society for Testing and Materials (ASTM)

1. D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
2. D 1238 Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
3. D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
4. D 1603 Test Method for Carbon Black in Olefin Plastics
5. D 3895 Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
6. D 4791: Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
7. D 4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
8. D 5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
9. D 5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
10. D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
11. D 5994 Standard Test Method for Measuring Core Thickness of Textured Geomembranes
12. D 6392 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
13. D 6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes

B. Geosynthetic Research Institute

1. GRI GM 13 Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
2. GRI GM 17 Test Properties, Testing Frequency and Recommended Warranty for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes

1.02 Definitions

A. Lot - A quantity of resin (usually the capacity of one rail car) used in the manufacture of geomembranes. Finished roll will be identified by a roll number traceable to the resin lot used.

B. Construction Quality Assurance Consultant (CONSULTANT) - Party, independent from MANUFACTURER and INSTALLER that is responsible for observing and documenting activities related to quality assurance during the lining system construction.

C. ENGINEER - The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.

D. Geomembrane Manufacturer (MANUFACTURER) - The party responsible for manufacturing the geomembrane rolls.

E. Geosynthetic Quality Assurance Laboratory (TESTING LABORATORY) - Party, independent from the OWNER, MANUFACTURER and INSTALLER, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the OWNER.

F. INSTALLER - Party responsible for field handling, transporting, storing, deploying, seaming and testing of the geomembrane seams.

G. Panel - Unit area of a geomembrane that will be seamed in the field that is larger than 100 ft^2.

H. Patch - Unit area of a geomembrane that will be seamed in the field that is less than 100 ft^2.

I. Subgrade Surface - Soil layer surface which immediately underlies the geosynthetic material(s).

J. Owner – Brookhaven Science Associates (BSA).

1.03 Submittals

A. Furnish the following product data, in writing, to BSA prior to installation of the geomembrane material:
   1. Resin Data shall include the following.
      a. Certification stating that the resin meets the specification requirements (see Section 1.09).
   2. Geomembrane Roll
      a. Statement certifying no recycled polymer and no more than 10% rework of the same type of material is added to the resin (product run may be recycled).

B. The INSTALLER shall furnish the following information to BSA prior to installation:
   1. Installation layout drawings
      a. Must show proposed panel layout including field seams and details
      b. Must be approved prior to installing the geomembrane
         1. Approved drawings will be for concept only and actual panel placement will be determined by site conditions.
         2. Installer's Geosynthetic Field Installation Quality Assurance Plan

C. The INSTALLER will submit the following to the ENGINEER upon completion of installation:
   1. Certificate stating the geomembrane has been installed in accordance with the Contract Documents
   2. Material and installation warranties
   3. As-built drawings showing actual geomembrane placement and seams including typical anchor trench detail

1.04 Quality Assurance

A. BSA will engage and pay for the services of a Geosynthetic Quality Assurance Consultant and Laboratory to monitor geomembrane installation.

1.05 Qualifications

A. MANUFACTURER
   1. Geomembrane shall be manufactured by the following:
      a. GSE Lining Technology, Inc.
      b. Approved equal
   2. MANUFACTURER shall have manufactured a minimum of 10,000,000 square feet of polyethylene geomembrane during the last year.

B. INSTALLER
   1. Installation shall be performed by one of the following installation companies (or approved equal)
      a. GSE Lining Technology, Inc.
      b. GSE Approved Dealer/Installers
   2. INSTALLER shall have worked in a similar capacity on at least five projects similar in complexity to the project described in the contract documents, and with at least 40,000 square feet of HDPE geomembrane installation on each project.
   3. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.
   4. The INSTALLER shall provide a minimum of one Master Seamer for work on the project.
      a. Must have completed a minimum of 1,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for the use on this Project.

1.06 Material Labeling, Delivery, Storage, and Handling

A. Labeling: Each roll of geomembrane delivered to the site shall be labeled by the MANUFACTURER. The label will identify:
   1. Manufacturer's name
   2. Product identification
   3. Thickness
   4. Length
   5. Width
   6. Roll number
   7. Lot Number

B. Delivery: Rolls of liner will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.

C. Storage: The on-site storage location for geomembrane material, provided by the CONTRACTOR to protect the geomembrane from punctures, abrasions and excessive dirt and moisture for should have the following characteristics:
   1. Level (no wooden pallets)
   2. Smooth
   3. Dry
   4. Protected from theft and vandalism
   5. Adjacent to the area being lined

D. Handling: Materials are to be handled so as to prevent damage.

1.07 Warranty

A. Material shall be warranted, on a pro-rata basis against Manufacturer's defects for a period of 5 years from the date of geomembrane installation.

B. Installation shall be warranted against defects in workmanship for a period of 1 year from the date of geomembrane completion.

PART 2 - Products

2.00 Geomembrane

A. Material shall be textured polyethylene geomembrane as shown on the drawings.

B. Resin
1. Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane.
2. Natural resin (without carbon black) shall meet the following minimum requirements:

Property	Test Method	HDPE	LLDPE
Density [g/cm^3]	ASTM D 1505	0.932	0.915
Melt Flow Index [g/10 min.]	ASTM D 1238 (190/2.16)	≤ 1.0	≤ 1.0
OIT [minutes]	ASTM D 3895 (1 atm/200°C)	100	100

C. Geomembrane Rolls
1. Do not exceed a combined maximum total of 1 percent by weight of additives other than carbon black.
2. Geomembrane shall be free of holes, pinholes as verified by on-line electrical detection, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.
3. Geomembrane material is to be supplied in roll form. Each roll is to be identified with labels indicating roll number, thickness, length, width and MANUFACTURER.
4. All liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in section 1.09, B, and be tested by an acceptable method of inspecting for pinholes. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation.

D. Textured surfaced geomembrane shall meet the requirements shown in the following table(s) for the following material(s).

Minimum Values for Black Surfaced Coextruded Textured HDPE Geomembranes

Property	Test Method[(1)]	
Thickness, mil (mm)	ASTM D 5994	
Minimum Average		40 (0.75)
Lowest Individual Reading		27 (0.69)
Density, g/cm^3	ASTM D 1505	0.94

Carbon Black Content, %	ASTM D 1603, modified	2.0
Carbon Black Dispersion	ASTM D 5596	*Note 4*
Tensile Properties[2]*:*	ASTM D 6693	
(each direction)		
Strength at Yield, lb/in (kN/m)		63 (11)
Strength at Break, lb/in (kN/m)		45 (8)
Elongation at Yield, %	(1.3" gauge length)	13
Elongation at Break, %	(2.0" gauge length)	150
Tear Resistance, lb (N)	ASTM D 1004	21 (93)
Puncture Resistance, lb (N)	ASTM D 4833	54 (240)
Notched Constant Tensile Load [3], hours	ASTM D 5397, appendix	400
Oxidative Induction Time, min.	ASTM D 3895	100

[1] Some test procedures have been modified for application to geosynthetics. All procedures and values are subject to change without prior notification.
[2] The combination of stress concentrations due to coextrusion texture geometry and the small specimen size results in large variations of test results. Therefore, these tensile properties are minimum average roll values.
[3] NCTL on coextruded textured product is conducted on representative smooth membrane samples.
[4] Only near spherical agglomerates are considered. 9 of 10 views shall be Category 1 or 2. No more than one view Category 3.

E. Extrudate Rod or Bead
   1. Extrudate material shall be made from same type resin as the geomembrane.
   2. Additives shall be thoroughly dispersed.
   3. Materials shall be free of contamination by moisture or foreign matter.

PART 3 - Execution

3.00 Equipment

A. Welding equipment and accessories shall meet the following requirements:
   1. Gauges showing temperatures in apparatus (extrusion welder) or wedge (wedge welder) shall be present.
   2. An adequate number of welding apparati shall be available to avoid delaying work.
   3. Power source must be capable of providing constant voltage under combined line load.

3.01 Deployment

A. Assign each panel a simple and logical identifying code. The coding system shall be subject to approval and shall be determined at the job site.

B. The subgrade shall be thoroughly inspected by BSA and the installer prior to laying out the geomembrane panels for debris that could potentially damage the geomembrane.

C. Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.

D. Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:
   1. Unroll geomembrane using methods that will not damage geomembrane and will protect underlying surface from damage (spreader bar, protected equipment bucket).
   2. Place ballast (commonly sandbags) on geomembrane which will not damage geomembrane to prevent wind uplift.

3. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage it. Smoking will not be permitted on the geomembrane.
4. Do not allow heavy vehicular traffic directly on geomembrane. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than 6 psi.
5. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.

E. Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material.

3.02 Field Seaming

A. Seams shall meet the following requirements:
1. To the maximum extent possible, orient seams parallel to line of slope, i.e., down and not across slope.
2. Minimize number of field seams in corners, odd-shaped geometric locations and outside corners.
3. Slope seams (panels) shall extend a minimum of five-feet beyond the grade break into the flat area.
4. Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the CONSULTANT and INSTALLER.
5. Align seam overlaps consistent with the requirements of the welding equipment being used. A 6-inch overlap is commonly suggested.

B. During Welding Operations
1. Provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.

C. Extrusion Welding
1. Hot-air tack adjacent pieces together using procedures that do not damage the geomembrane.
2. Clean geomembrane surfaces by disc grinder or equivalent.
3. Purge welding apparatus of heat-degraded extrudate before welding.

D. Hot Wedge Welding
1. Welding apparatus shall be a self-propelled device equipped with an electronic controller which displays applicable temperatures.
2. Clean seam area of dust, mud, moisture and debris immediately ahead of hot wedge welder.
3. Protect against moisture build-up between sheets.

E. Trial Welds
1. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.
2. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.
3. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.
4. Cut four, one-inch wide by six-inch long test strips from the trial weld.
5. Quantitatively test specimens for peel adhesion, and then for shear strength.
6. Trial weld specimens shall pass when the results shown in Table 3 are achieved in both peel and shear test.

a. The break, when peel testing, occurs in the liner material itself, not through peel separation (FTB).
b. The break is ductile.

7. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.
8. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.

F. Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation. INSTALLER shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.

G. Defects and Repairs
1. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.
2. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

3.03 Field Quality Assurance

A. MANUFACTURER and INSTALLER shall participate in and conform to all terms and requirements of the Owner's quality assurance program. CONTRACTOR shall be responsible for assuring this participation.

B. Quality assurance requirements are as specified in this Section and in the Field Installation Quality Assurance Manual if it is included in the contract.

C. Field Testing
1. Non-destructive testing may be carried out as the seaming progresses or at completion of all field seaming.
a. Vacuum Testing
1) Shall be performed in accordance with ASTM D 5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
b. Air Pressure Testing
1) Shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.
c. Other approved methods.
2. Destructive Testing (performed by CONSULTANT with assistance from INSTALLER)
a. Location and Frequency of Testing
1) Collect destructive test samples at a frequency of one per every 1500 lineal feet of seam length.
2) Test locations will be determined after seaming.
3) Exercise Method of Attributes as described by GRI GM-14 (Geosynthetic Research Institute, http://www.geosynthetic-institute.org) to minimize test samples taken.
b. Sampling Procedures are performed as follows:
1) INSTALLER shall cut samples at locations designated by the CONSULTANT as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered.
2) CONSULTANT will number each sample, and the location will be noted on the installation as-built.

3) Samples shall be twelve (12) inches wide by minimal length with the seam centered lengthwise.
4) Cut a 2-inch wide strip from each end of the sample for field-testing.
5) Cut the remaining sample into two parts for distribution as follows:
   a) One portion for INSTALLER, 12-inches by 12 inches
   b) One portion for the Third Party laboratory, 12-inches by 18-inches
   c) Additional samples may be archived if required.
6) Destructive testing shall be performed in accordance with ASTM D 6392, Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
7) INSTALLER shall repair all holes in the geomembrane resulting from destructive sampling.
8) Repair and test the continuity of the repair in accordance with these Specifications.

3. Failed Seam Procedures
   1) If the seam fails, INSTALLER shall follow one of two options:
      a) Reconstruct the seam between any two passed test locations.
      b) Trace the weld to intermediate location at least 10 feet minimum or where the seam ends in both directions from the location of the failed test.
   2) The next seam welded using the same welding device is required to obtain an additional sample, i.e., if one side of the seam is less than 10 feet long.
   3) If sample passes, then the seam shall be reconstructed or capped between the test sample locations.
   4) If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

3.04 Repair Procedures

A. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.

B. Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.

C. INSTALLER shall be responsible for repair of defective areas.

D. Agreement upon the appropriate repair method shall be decided between CONSULTANT and INSTALLER by using one of the following repair methods:
   1. Patching- Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.
   2. Abrading and Re-welding- Used to repair short section of a seam.
   3. Spot Welding- Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.
   4. Capping- Used to repair long lengths of failed seams.
   5. Flap Welding- Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap.
   6. Remove the unacceptable seam and replace with new material.

E. The following procedures shall be observed when a repair method is used:
   1. All geomembrane surfaces shall be clean and dry at the time of repair.

2. Surfaces of the polyethylene which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.
3. Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.

F. Repair Verification
1. Number and log each patch repair (performed by CONSULTANT).
2. Non-destructively test each repair using methods specified in this Specification.

3.05 Measurement and Pricing

A. Net lined area is defined to be the true area of all surfaces to be lined plus designed burial in all anchor trenches, rubsheets, and sacrificial layers.

B. Prices shall include full compensation for furnishing all labor, material, tools, equipment, and incidentals.

C. Prices also include doing all the work involved in performing geomembrane installation completely as shown on the drawing, as specified herein, and as directed by the ENGINEER.

END OF SECTION 31 35 26.16

DIVISION 32 – EXTERIOR IMPROVEMENTS
SECTION 32 12 16 – ASPHALT PAVING

Part 1 – General

1.00 Related Sections

A. 00 01 01 – Summary of Work

B. 31 00 00 – Earthwork

1.01 Codes and Standards

A. AI MS-2 – Mix Design Methods for Asphalt Concrete and other Hot Mix Types.

B. AI MS-8 – Asphalt Paving Manual.

C. ASTM D242 – Mineral Filler for Bituminous Paving Mixtures.

D. ASTM D546 – Test Method for Sieve Analysis of Mineral Filler for Road and Paving Materials.

1.02 Submittals

A. Submit under provisions of Section 01 33 00 Submittals.

B. Supplier: Submit name of asphalt supplier to be used on the project prior to placement of any asphalt on the project.

1.03 Quality Assurance

A. Obtain materials from the same supplier throughout the duration of the project.

B. Do not alter from mix design requirements.

1.04 Environmental Requirements

A. Do not place asphalt when base surface temperature is less than 40 degrees F (4 degrees C), or if surface is wet or frozen.

B. Do not place asphalt when precipitation is occurring.

PART 2 - Products

2.00 Materials

A. Asphalt Cement: AC-20; homogeneous, and shall not foam when heated to 347 degrees F (175 degrees C).

B. Fine aggregate: Material passing the 1/8 inch (3.2 mm) sieve; natural sand of hard, strong, durable particles which are free from coatings or injurious amounts of clay, loam or other deleterious substances.

C. Coarse aggregate: Material retained on the 1/8 inch (3.2 mm) sieve; crushed stone or gravel; clean, durable, sharp angled fragments of rock of uniform quality.

D. Mineral Filler: ASTM D242, finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter; 100 percent shall pass the No. 30 (0.60 mm) sieve; a minimum of 85 percent shall pass the No. 80 (0.18 mm) sieve; and a minimum of 65 percent shall pass the No. 200 (0.075 mm) sieve as measured in accordance with ASTM D546.

E. Asphalt Binder: AASHTO MP 1, PG 70-22.

2.01 Equipment

A. Rollers: Minimum weight of 10 tons (89 kN) or 2 tons (18 kN) if equipped with a vibratory device; equipped with lubricating devices for the roller wheels.

2.02 Accessories

A. Tack Coat: Homogeneous, medium curing, liquid asphalt.

B. Wheel lubricant: Oil-water mixture containing maximum 10 percent lubricating oil.

2.03 Mixes

A. Use dry material to avoid foaming. Mix uniformly.

B. Asphalt Treated Base Course: 4.0 to 6.0 percent of asphalt cement by weight in mixture in accordance with the following gradation:

Sieve Size	Percent Passing
2 inches (51 mm)	100
1-1/2 inches (38 mm)	90-100
1 inch (25 mm)	78-100
½ inch (13 mm)	57-100
¼ inch (6.4 mm)	40-82
1/8 inch (3.2 mm)	26-63
No. 20 (0.85 mm)	12-36
No. 40 (0.425 mm)	8-25
No. 80 (0.18 mm)	4-16
No. 200 (0.075 mm)	2-8

C. Hot-Mix Surface Course: Type “B”, 5.8 to 7.0 percent of asphalt cement by weight in mixture in accordance with the following gradation.

Sieve Size	Percent Passing
1 inch (25 mm)	100
½ inch (13 mm)	90-100
¼ inch (6.4 mm)	55-75
1/8 inch (3.2 mm)	36-58

No. 20 (0.85 mm)	15-35
No. 40 (0.425 mm)	10-21
No. 80 (0.18 mm)	4-16
No. 200 (0.075 mm)	3-6

PART 3 - Execution

3.00 Examination

A. Verify that proof-rolled subbase is dry and ready to receive work of this Section.

B. Verify gradients and elevations of base are correct.

C. Verify that all castings are properly installed and are at the correct elevation.

D. Beginning of installation means installer accepts existing conditions.

3.01 Preparation

A. Apply tack coat at uniform rate of 0.03 to 0.07 gal/sq. yard (0.14 to 0.32 L/sq. meter) to contact surfaces of curbs, gutters and any asphalt or concrete material.

B. Do not apply tack coat to wet or frozen surfaces.

3.02 Installation

A. Install work in accordance with AI MS-8.

B. Maintain asphalt temperature between 250 and 325 degrees F (121 and 163 degrees C) during placement.

C. Place asphalt within 24 hours of applying tack coat.

D. Place asphalt to the following compacted thicknesses.

Open Graded Hot-Mix Asphalt Surface Course – 3 inches;
ATB Base Course – 4 inches.

When multiple course pavement is to be used, place top course within 24 hours of placing bottom course. If more than 24 hours elapse, a tack coat will be required to be placed over the entire surface of the bottom course prior to any additional paving.

E. Compact pavement by rolling. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

F. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.03 Tolerances

A. Maximum Variation from Flatness: 1/8 inch (3 mm) measured with 10-foot (3 m) straight edge.

B. Maximum Variation from Scheduled Compacted Thickness: 1/8 inch (3 mm).

C. Maximum Variation from True Elevation: ¼ inch (6 mm).

3.04 Field Quality Control

A. Take samples and perform tests in accordance with AI MS-2.

3.05 Protection

A. Immediately after placement, protect pavement from mechanical injury until project is accepted by BNL.

END OF SECTION 32 12 16

DIVISION 32 – EXTERIOR IMPROVEMENTS
SECTION 32 12 36.13 – ASPHALTIC SEAL AND FOG COATS

Part 1 – General

1.00 Related Sections

A. 32 12 16 – Asphalt Paving

1.01 Description

A. The Work under this Section includes providing all labor, materials, tools, and equipment necessary to apply a fog seal coat to all new asphalt surfaces. This fog seal coat shall be composed of a slow setting asphalt emulsion and diluted with water. Blotting the fog seal with sand after the emulsion breaks is required.

1.02 Environmental Requirements

A. Do not place fog seal when atmospheric temperature is below 50 degrees F (10 degrees C).

B. Do not place fog seal when the asphalt surface temperature is less than 59 degrees F (15 degrees C).

C. Do not place fog seal when precipitation is occurring or if asphalt surface is wet or frozen.

PART 2 - Products

2.00 Materials

A. The type of asphalt material used for the fog seal coat shall be CSS-1 cationic emulsified asphalt.

B. The blotter material shall be suitable clean sand.

PART 3 - Execution

3.00 General

A. The Contractor shall provide equipment for heating and applying the asphalt emulsion and for applying blotter material and removing blotter material.

B. The surface shall be clean and free from all loose material.

C. The rate of application shall be between 0.08 and 0.15 gallons per square yard.

D. The dilution rate of 50% (equal parts water to equal parts emulsion) is recommended to achieve the proper viscosity.

E. After application of the fog seal coat, blotter sand shall be applied by a ten (10) yard capacity truck with a rear-mounted spreader at a rate of three (3) to five (5) pounds per square yard.

F. Blotting sand shall be removed by means of a rotary broom and vacuum truck within ten (10) days after application of the fog seal coat.

END OF SECTION 32 12 36.13

DIVISION 32 – EXTERIOR IMPROVEMENTS
SECTION 32 16 41 – CONCRETE SIDEWALK AND CURB REPAIR

PART 1 - General

1.00 Related Sections

A. Section 31 00 00 – Earthwork

1.01 Section Includes

A. Replace areas removed or repair areas damaged by Work to match existing.

1.02 Environmental Requirements

A. Apply concrete in dry weather when pavement and atmospheric temperatures are forty (40) degrees Fahrenheit or above and are anticipated to remain above forty (40) degrees Fahrenheit for four (4) hours after completing application.

PART 2 - Products

2.00 Cement

A. Cement shall be Portland Cement and shall conform to current specifications of ASTM D-175 Air-Entrained Portland Cement or ASTM D-150 Portland Cement. If non air-entrained cement is used, an air-entraining agent shall be used to produce an air content of 4 to 6%.

2.01 Fine Aggregate

A. Fine aggregate shall conform to the latest revision of ASTM C-33 and shall have the following gradation:

Passing 3/8” screen	100%
Passing #4 screen	95-100%
Passing #8 screen	80-100%
Passing #16 screen	50-85%
Passing #30 screen	25-60%
Passing #50 screen	10-30%
Passing #100 screen	2-10%

2.02 Coarse Aggregate

A. Coarse aggregate shall conform to the latest revision of ASTM C-33 and shall have the following gradation:

Passing #1 screen	100%
Passing ¾” screen	90-100%
Passing 3/8” screen	20-55%
Passing #4 screen	10%

2.03 Concrete Mixture

A. The proportions of the concrete mixture shall be such to produce a minimum of 3,000 psi compressive strength concrete in 28 days with a minimum cement content of 5-1/2 bags of cement and a maximum of 6 gallons of water per cubic yard of concrete.

2.04 Reinforcement

C. Wire mesh reinforcement shall conform to the Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement of ASTM.

D. Deformed reinforcing bars shall conform to the Standard Specifications for Billet Steel Concrete Reinforcement Bars of the designation ASTM A615.

2.05 Expansion Material

A. Expansion joint material shall conform to ASTM Standard Specification D-544 Type 5. It shall be ½-inch in thickness and shall have a width equal to the full depth of the slab in which it is to be used.

2.06 Fill Material

A. Fill used for subbase under the concrete shall be a well-graded granular material.

2.07 Forms

A. Forms shall be metal or wood free from warp and of sufficient strength to resist springing during the process of placing the concrete against them. Wood forms shall be at least 1-1/2 inch thick except for sharply curved sections where a flexible material shall be used. Forms shall be of a depth equal to the sidewalk or curb and shall be securely braced to retain the correct line and grade. Forms should be thoroughly cleaned and oiled or wetted before concrete is placed against them and be sufficiently tight to prevent mortar leakage between them.

PART 3 - Execution

3.00 Removal of Existing Concrete Sidewalks and Curbs

A. Existing concrete sidewalks and curbs shall be removed to full depth up to the expansion joint of undamaged sidewalks and curbs. The old concrete shall not be left in place beneath the new concrete.

3.01 Alignment and Grade

A. Prior to the construction or reconstruction of the sidewalk or curb, the Contractor shall set a line and grade for the construction, as described in Section 02 21 13 – Site Surveys

B. Where necessary, the Contractor shall provide offset line stakes.

C. The grade of restored concrete shall match existing grade lines.

3.02 Preparation of the Subgrade

A. All soft areas or unsuitable material shall be removed and replaced with suitable material and the subgrade compacted to a firm uniform surface.

3.03 Preparation of the Subbase

A. The granular subbase material shall be placed between the forms and compacted to a firm uniform surface by means of a hand tamper or vibratory compactor, then leveled off to the proper grade.

3.04 Reinforcing Steel

A. All reinforcing steel shall be supported mid-depth by means of approved support "chairs."

3.05 Dimensions

A. Dimensions of sidewalks and curbs shall match dimensions of the sidewalks and curbs that were removed.

3.06 Placement of Concrete

A. The subbase shall be moistened immediately prior to placing the concrete. The concrete shall be placed on the moist subbase and spread uniformly with as little handling as possible.

3.07 Contraction Joints

A. Contraction joints shall be constructed as to divide the sidewalk into square slabs the greatest horizontal dimension of which shall not exceed 6 feet.

B. Contraction joints shall be constructed as to divide the curb into 30-foot intervals.

3.08 Finishing

A. Immediately after placing, the concrete shall be floated down to a uniformly dense surface. The concrete surface shall have a slightly rough wood-float finish or a light broom finish. No apparent surface defects shall be allowed.

END OF SECTION 32 16 41

DIVISION 33 - WELLS
SECTION 33 24 00 – MONITORING WELLS

PART 1 - General

1.00 Related Sections

A. Section 00 01 01 – Summary of Work

1.01 Summary

A. The Contractor shall supply and provide all materials, fabrication, drawings, permits, installation, development and delivery of services as specified in this section and/or on the drawings for complete installation of the monitoring wells.

B. The wells shall be installed in accordance with Environmental and Waste Management Services Division Standard Operating Procedure (SOP) "Installation of Groundwater Monitoring Wells and Piezometers (EM-SOP-102)".

C. This section covers the requirements for the functional design, performance, materials, construction features, testing, quality and handling of the equipment described herein.

1.02 Qualifications

A. The Contractor shall be licensed by the Water Resources Division of the New York State Department of Environmental Conservation (NYSDEC), and shall comply with all regulations and perform all work to meet the requirements of this section.

B. Submit statement of experience and qualifications with inventory of major equipment. No portion of the work may be subcontracted without the written permission of BSA.

C. Submit Certificates of training for each worker, verifying completion of 40-hour course and 8-hour refresher for OSHA Comprehensive Health and Safety Training for Hazardous Waste Operations and Emergency Response as mandated by 29 CFR 1910.120.

1.03 Type of Construction

A. In accordance with well installation and abandonment guidelines issued by the U.S. Department of Environmental Conservation (NYSDEC) for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA).

B. PVC, single cased, gravel packed and grouted construction, as shown on the Drawings.

C. Acceptable Methods of Construction: Hollow stem auger.

1.04 Permits and Regulations

A. BSA shall assign temporary well identification numbers, locate all drilling sites, mark all underground utilities, and obtain BSA Digging Permits prior to drilling.

B. The Contractor shall obtain well permits for each well from NYSDEC Water Supply Unit, and submit to BSA at project completion.

1.05 Supervision

A. Provide notification and opportunity for observation, of all work to BSA hydrogeologist.

B. All drilling, well construction, well development, soil and water sampling shall be supervised by a qualified hydrogeologist, who shall remain present at the time of these operations.

1.06 Submissions

A. Follow the guidelines of 01 33 00 Submittals.

B. Manufacturer's literature for well construction materials.

C. Proposed ratios and method of mixing and placement for grouts and concrete.

D. Geologic logs and soil samples with description of results.

E. Well construction logs with certification that work was performed in accordance with specifications. Submit within one week following completion of each well.

PART 2 - Products

2.00 Casings

A. Only new material shall be used.

B. 2-inch diameter, ASTM F480, type 1, Grade 1, 1120 polyvinyl chloride (PVC). Schedule 40 for all monitoring wells.

C. Joints shall be watertight flush threaded with Buna-N O-rings. Under no circumstances shall PVC cement be used.

D. Individually and separately wrapped in 4-mil protective polyethylene wrapping following factory cleaning. Factory cleaning shall consist of scrubbing while soaking in alkaline degreaser detergent, rinsing with clean warm water, then air-drying. Use of materials having polyethylene wrappings that are damaged or missing will not be accepted.

2.01 Screen

A. 2-inch diameter PVC, completely factory fabricated, with machine slotted openings. Slot size to be 0.020 inches.

B. A screen termination sealed with threaded PVC plug shall be supplied below each screen.

C. Individually and separately wrapped in 4-mil protective polyethylene wrapping following factory cleaning. Factory cleaning shall consist of scrubbing while soaking in alkaline degreaser detergent, rinsing with clean warm water, then air-drying. Use of materials having polyethylene wrappings that are damaged or missing will not be accepted.

2.02 Filter Pack

A. Clean, pre-washed sand, Number 1 Morie, or equivalent.

2.03 Cement-Bentonite Grout

A. Mixture of cement (ASTM C150), bentonite and water in the ratio 94 lbs. / 3.5 lbs. / 6.5 gallons.

2.03 Protective Casing

A. Carbon steel pipe, minimum 4 inches greater in diameter than the well casing diameter, stick-up.

PART 3 – Execution

3.00 Method of Construction

A. The wells may be constructed using hollow stem auger methods.

B. The minimum borehole diameter shall be 6 inches greater than the well diameter. The Contractor shall ensure that adequate space is available for proper emplacement of the filter pack, bentonite seal and grout.

C. Wear clean, disposable plastic or rubber gloves when removing polyethylene wrappings or handling PVC casing and screens. At no time shall well casing or screen materials be placed on the ground. Place on clean plastic sheeting.

D. Drill hole, obtain split spoon samples as directed, set screen and casing, emplace gravel pack around, and 1 foot above screen utilizing a tremie pipe. Continuously measure the placement depth of the filter pack sand with a tape measure during emplacement.

E. Place 2-foot thick bentonite seal above filter pack. Emplace seal using a viscous bentonite slurry (consisting of granular bentonite and water) conveyed through a tremie pipe.

F. Seal the borehole with cement/bentonite grout or an environmentally tested, pure bentonite, high solid grout. Emplace grout using a tremie tube extending to the bottom of the zone being grouted. Maintain borehole integrity during grouting by alternating retrieval of auger or drive casing sections with grout pumping. End grouting approximately at land surface. Allow slurry to settle overnight. Sound well with tape measure before and after grouting and record total depth. Record amount of grout emplaced.

G. Document all construction details and provide a monitoring well construction log upon completion.

H. Develop well after well seal and grout has set (24 hours minimum). Supervise well development and record procedures, quantities, and characteristics of water removed in a field notebook. Provide copies of data to BSA.

I. BSA will perform a radiological survey of the well prior to sampling activities.

3.01 Decontamination

A. Decontaminate all equipment prior to arrival at site, between each borehole and prior to leaving site with a high pressure steam cleaner. Maintain minimum 220 degrees F. and 5 psig.

B. Avoid contaminating clean areas. Contain decontamination fluids when contamination above regulatory limits is encountered or expected, or when directed by BSA.

C. Ensure all equipment is free of oil and grease.

3.02 Waste Handling

A. Place all drill cuttings on, and covered with, plastic or place in drums, depending on moisture content. Place dry drill cuttings into drums. Place wet drill cuttings onto plastic on a slight incline to drain and collect the water for consolidation with the development water. Place the dewatered drill cuttings into either drums or onto plastic as per BSA instructions. Properly label and mark all materials generated. Locate materials to maintain use of roadways and access to buildings. All drums to be labeled in accordance with DOT and BSA requirements. For quality assurance, BSA will provide all drums.

B. BSA will be responsible for the ultimate dispositions of drill cuttings and wastewater.

3.03 Soil Sampling and Coring

A. Within screened interval, or as directed otherwise, obtain split spoon samples at five-foot intervals, or more frequently whenever a significant change in soil characteristics is detected.

B. Collect split spoon samples utilizing 24-inch long by 2-inch O.D. carbon steel split spoon sampler. Drive with a 140-lb. Hammer by drill rod method or wire-line with down-hole hammer.

C. Record blow counts for each 6-inch interval of penetration.

D. Resample when recovery of representative, non-heave material is less than 70% of total length.

E. Place soil samples in glass jars. Label with well number, sample interval and date. Affix label to the jar, not the lid.

F. Develop a geologic log for each boring utilizing standard BNL “Geologic Log” form. Record for each sample:
   1. The structure of soils sampled, including layering and stratification features and dominant soil types.
   2. Color of soils using Munsell Soil Color Charts.
   3. Soil grain features, including grain sizes, degree of sorting or grading, angularity and mineralogy. Visually classify soils using ASTM method D2488.
   4. Identify any rock fragments, organic material, or other components.
   5. Consistency of clay-dominated soils.
   6. Depth to groundwater.

G. Record distinctive soil types within each sample, designate using the Unified Soil Classification System.

3.04 Plumbness and Alignment of Well

A. Complete wells round, plumb and true to line as defined in AWWA A100-84, Section 8, Appendix C6. Verify and document proper alignment. Utilize decontaminated plummet consisting of rigid spindle with round plates at both ends. Outer diameter of end plates to be 0.5 inches smaller than the inside of the hole or casing being tested. Distance between the end plates should be a minimum of 1.25 times the diameter of the hole or casing being tested. Plummet to be sufficiently heavy to keep the line taut. Plummet must move freely throughout the depth of the well. Alternative plumbness methods can be used after approval by BSA.

B. Submit record of plumbness tests showing deviation from true plotted northerly and westerly directions.

C. The well shall be as plumb as possible. In no case will a well be acceptable with a deviation from the vertical in excess of one-half the diameter of the casing per 100 feet of depth.

3.05 Development

A. The Contractor shall furnish all equipment necessary for proper development of the well. Initial development shall be accompanied by using a decontaminated surge block to move heavier sediment and provide surging action through the filter pack.

B. Utilize a decontaminated submersible pump for final development. Pump until water is clear, and free of silt and clay (30 minutes minimum). Pumping rates should be as low as possible to prevent diverting contaminant plumes toward the well. Move the pump up and down throughout the screened interval during well development.

C. Monitor and record turbidity, pH, temperature, and conductivity of each well volume pumped during development. Continue development until turbidity is below 50 NTU and pH, temperature, and conductivity stabilize within 10% on successive well volumes.

D. Pump development water to a portable tank supplied by BSA. Contain development water in accordance with BSA's SBMS procedures.

E. Upon completion of the development and pumping of the well, the Contractor shall notify BSA in writing that the well is ready for sampling.

3.06 Well Capping

A. At all times during the progress of the work, the Contractor shall protect the well in such manner as to effectively prevent either tampering with or foreign matter entering the well.

B. Wells installed before the installation of a geotextile fabric shall have a temporary steel casing extended to 24 inches above grade and sealed with a welded airtight cap to protect the well casing from construction vehicle damage.

C. When final well capping is to be performed, cut the well casing to 3 inches below grade and place a small v-shaped notch on the north side of the well casing as a measuring point. Install 8-inch diameter well box over the well casing, ensuring that the top of the box is flush with grade.

D. Construct forms and pour concrete apron 2 feet by 2 feet by 6 inches thick, sloped away from the well on all sides. Set a "PK" survey nail in the northeast corner of the apron as a survey marker.

E. Touch up prime paint on protective cover and apply 2 coats of finish paint in accordance with manufacturer's recommendation.

F. Locks for all wells will be provided by BSA. Provide appropriate clasps for use with stainless steel body, high security lock.

END OF SECTION 33 24 00

APPENDIX B

ERP OPM 3.2 Work Planning and Control

ERP Operations Procedures Manual

3.2 WORK PLANNING AND CONTROL

Text Pages 1-15
Attachments: 7

Approved:  Date: 10/25/07

ERP Director
Les Hill

Preparer: B. Lein

ERP-OPM-3.2, Revision 1

ONLINE COPY – ERP OPERATIONS PROCEDURES MANUAL

REVISION LOG

SECTION	PAGE #	REV. #	DATE	REASON FOR REVISION
3.2	6 and 7	1	10/25/07	Added guidance to clarify when Work Instructions can be used in lieu of Work Procedures.
4.2, 4.3, 4.4, 4.5 and 4.6	7, 8 and 9	1	10/25/07	Added administrative controls for prohibited activities, and for the use of flammable, combustible and hazardous materials.
All	All	1	10/25/07	Editorial/format corrections throughout the procedure.

3.2 WORK PLANNING AND CONTROL

1.0 PURPOSE AND SCOPE

The purpose of the Environmental Restoration Projects (ERP) Work Planning and Control procedure is to ensure all work performed within ERP is reviewed, planned and controlled in a manner that meets the requirements of the Brookhaven National Laboratory (BNL) Standards Based Management System (SBMS) Subject Area, "Work Planning and Control for Experiments and Operations" (Reference 1) and is compliant with the Brookhaven Graphite Research Reactor (BGRR) and High Flux Beam Reactor (HFBR) Safety Basis Documents (SBDs) and Facility Use Agreements (FUAs).

All work performed under the authority of ERP will undergo planning and control to the rigor set forth within this document. Authorized ERP work includes remediation, decommissioning, characterization, construction, maintenance, modification and all other related work performed by ERP staff as well as external BNL organizations and non-BNL personnel (including BNL subcontractors) working on ERP projects.

Activities associated with routine surveillance and maintenance within ERP facilities were considered during the development of the facility specific SBDs and the Department of Energy – Safety Evaluation Report (DOE-SER) approval process. ERP facility specific Surveillance and Maintenance (S&M) Manuals define the scope of routine activities. Because of their inherent repetitive nature, planning and control measures applicable to work involving routine maintenance, surveillance and operations activities do not require issuance of a Work Permit as defined in this procedure.

2.0 RESPONSIBILITIES

2.1 ERP Director

2.1.1 Shall appoint the ERP Work Control Manager (WCM).

2.1.2 Shall provide leadership to ensure line management ownership of the work planning and control system.

2.1.3 Shall serve as chairperson of the Safety Review Committee (SRC) and have final approval authority for all Field Work Packages.

2.2 ERP Decontamination and Decommissioning (D&D) Operations Manager

2.2.1 Shall resolve technical issues regarding D&D project work activities (radiation protection, waste management, health and safety, etc.).

2.2.2 Shall review and approve Field Work Packages and forward them to the SRC for final approval.

2.2.3 Shall provide oversight of work planning and control for project D&D work activities.

2.2.4 Shall assist project personnel in generating Work Permits and associated work documentation.

2.2.5 Shall remain cognizant of project work activities by inspecting work in progress and completed work as appropriate.

2.2.6 Shall determine whether work activities should be temporarily halted for review of work practices and/or a Lessons Learned session.

2.3 ERP D&D Support Manager

2.3.1 Shall resolve technical issues regarding facility maintenance and support services (radiation protection, waste management, health and safety, etc.).

2.3.2 Shall review and approve Field Work Packages and forward them to the SRC for final approval.

2.3.3 Shall provide oversight of work planning and control for facility maintenance work activities.

2.3.4 Shall assist project personnel in generating Work Permits and associated work documentation.

2.3.5 Shall remain cognizant of project work activities by inspecting work in progress and completed work as appropriate.

2.3.6 Shall determine whether work activities should be temporarily halted for review of work practices and/or a Lessons Learned session.

2.4 ERP WCM

2.4.1 Shall appoint Work Control Coordinators (WCC) for each ERP facility.

2.4.2 Shall monitor the performance of the Work Planning and Control by participating in the ERP Self Assessment Program.

2.4.3 Shall upgrade and maintain the ERP Work Planning and Control procedure.

2.4.4 Shall ensure that personnel are trained on the requirements of this procedure.

2.4.5 Shall coordinate with other Laboratory WCMs through periodic meetings to promote consistency across the site in applying the graded approach to work control and hazard analysis.

2.4.6 Shall review all Work Permits and associated work documentation for completeness, job feedback and lessons learned.

2.4.7 Shall assist the WCC in the screening of work and determination of the work planning effort required.

2.5 ERP WCC

2.5.1 Shall initiate all Work Permits and maintain the Work Permit Logbook.

2.5.2 Shall assist Subject Matter Experts (SMEs) in the preparation of supporting work documentation (e.g., Radiological Work Permits (RWPs), Job Risk Assessments (JRAs), digging permits).

2.5.3 Shall designate the Primary Reviewer.

2.5.4 Shall notify the facility Building Manager of any activity that may impact the facility.

2.5.5 Shall notify the facility Building Manager of changes that would affect the Environment, Safety and Health (ES&H) concerns and the crosshatching of the facility's Key Plan.

2.5.6 Shall review Work Permits for completeness and verify that the work area has been returned to an acceptable condition.

2.5.7 Shall submit completed Field Work Packages to the WCM for filing.

2.6 ERP Safety and Industrial Hygiene (S&IH) Manager

2.6.1 Shall assist project personnel in generating Work Permits, JRA and associated work documentation.

2.6.2 Shall serve as a member of the Work Permit Review Team.

2.6.3 Shall provide safety and industrial hygiene oversight throughout the planning and conduct of work.

2.7 ERP Authorization Basis Engineer (ABE)

2.7.1 Shall review all Field Work Packages and Work Permits for potential impact on facility SBD and compliance issues.

2.7.2 Shall perform Unreviewed Safety Issue Determination (USID) screening on all Work Permits and develops associated Safety Evaluations as needed.

2.7.3 Shall serve as a member of the Work Permit Review Team.

2.8 ERP Environmental Compliance Representative (ECR)

2.8.1 Shall review all Work Procedures and Work Instructions for environmental management concerns and compliance issues.

2.8.2 Shall serve as a member of the Work Permit Review Team if environmental compliance issues are identified.

2.9 ERP Radiation Protection Manager (RPM)

2.9.1 Shall review all Work Procedures and Work Instructions and develops radiological control requirements.

2.9.2 Shall prepare RWP and support development of JRAs to address radiological controls.

2.9.3 Shall serve as a member of the Work Permit Review Team if radiological issues are identified.

2.10 ERP Quality Management Services (QMS) Manager

2.10.1 Shall perform assessments of the ERP Work Planning and Control to verify compliance with BNL SBMS and the ERP Operations Procedures Manual (OPM) requirements.

2.10.2 Shall report to the ERP Director the results of assessments along with recommendations.

2.11 ERP Work Package Manager (WPM)

2.11.1 Shall plan and develop Work Procedures and Work Instructions and serve as a member of the Work Permit Review Team.

2.11.2 Shall assist SMEs in the preparation of supporting work documentation (e.g., RWPs, JRAs, digging permits).

2.11.3 Shall coordinate the review, comment resolution, and approval process of the Field Work Packages.

2.11.4 Shall perform configuration control of the approved Field Work Packages.

2.11.5 Shall elicit worker feedback during work and at the completion of the job and incorporate improvements and/or Lessons Learned into the Work Permit and associated work documentation.

2.11.6 Shall review completed Field Work Packages prior to submittal to the WCC for closeout.

2.12 ERP Field Engineer (FE)

2.12.1 Shall assist the WPM to plan and develop Work Procedures and Work Instructions.

2.12.2 Shall assist SMEs in the preparation of supporting work documentation (e.g., RWPs, JRAs, digging permits).

2.12.3 Shall assist the WPM in the coordination, review, comment resolution, and approval process of the Field Work Packages.

2.12.4 Shall perform configuration control of the approved Field Work Packages.

2.12.5 Shall elicit worker feedback during work and at the completion of the job and incorporate improvements and/or Lessons Learned into the Work Permit and associated work documentation.

2.12.6 Shall assist the WPM in the review of completed Field Work Packages prior to submittal to the WCC for closeout.

2.13 ERP Work Permit Primary Reviewer

2.13.1 Shall establish the Work Permit Review Team.

2.13.2 Shall ensure that the supporting documentation (e.g., JRA, RWP, digging permit) within the Field Work Package is complete.

2.13.3 Shall obtain approval signatures from the Work Permit Review Team.

2.14 ERP Work Permit Review Team Members

2.14.1 Shall review and provide comments on Field Work Package materials relevant to their field of expertise.

2.14.2 Shall assist the primary reviewer in ensuring that the supporting documentation (e.g., JRA, RWP, digging permit) within the Field Work Package is complete.

2.15 Work Requesters (Non-ERP personnel)

2.15.1 Shall provide an accurate description of the Scope of Work and provide detailed plans, instructions, procedures, etc., commensurate with the complexity of the work.

2.16 Workers

2.16.1 Shall comply with the terms of the Work Permit and associated documentation.

2.16.2 Shall serve on the Work Permit Review Team when requested.

2.16.3 Shall promptly cease work and place the work area in a safe condition in the event that the work as prescribed in the Field Work Package cannot be followed as written.

2.16.4 Shall provide feedback during and at the completion of a job, for continuing improvement in the current job as well as future job planning.

3.0 PREREQUISITES

3.1 With the exception of activities identified within ERP facility specific S&M Manuals, all ERP work activities shall be controlled by a Work Permit.

3.2 Written guidance identifying the authorized scope of work and methodology to perform the work must be submitted with each Work Permit as part of the associated work documentation. Types of documents authorized for use include Work Procedures, Work Instructions, and operating manuals.

3.2.1 Work Procedures shall be developed and maintained in accordance with ERP-OPM-1.3, “Work Procedure Development and Requirements” (Reference 2).

3.2.2 Work involving multiple, integrated tasks require the use of Work Procedures.

3.2.3 Work involving a discrete task may be performed utilizing Work Instructions in lieu of Work Procedures in accordance with the following:

- Work Instructions are developed to guide specific tasks within the defined work scope of a Work Permit.
- A discrete task shall be identifiable, short in duration, or routinely performed by the service provider.

- Work Instructions may be used to implement the S&M activities identified within the BGRR and HFBR S&M Manuals.

- Work Instructions shall be developed in accordance with Attachment 1 – Work Instruction (Sample).

- Work Instructions other than those for S&M activities are considered void upon completion of the job and filed as a part of the Work Permit.

3.2.4 Routine maintenance performed within the scope of the facility specific S&M Manuals may utilize pre-approved Departmental procedures in lieu of ERP Work Procedures and Work Instructions.

- When utilized, a copy of Departmental procedures originating outside of ERP must be included as part of the work documentation.

3.2.5 Operating manuals provided by manufacturers and equipment suppliers may be used to supplement Work Procedures or Work Instructions.

- When utilized, a copy of an operating manual with applicable sections highlighted must be included as part of the Field Work Package.

3.3 Work Permits shall be screened in accordance with ERP-OPM-3.3, "Unreviewed Safety Issue Determination" (Reference 3). Clarifications and/or answers to questions needed in regard to interpretations of the administrative controls and limits shall be formally documented.

3.4 All work shall be reviewed for potential impact on the facility specific SBDs and FUA.

3.5 All work planning shall include reviewing DOE/BNL Lessons Learned for applicable events that relate to the work activity.

4.0 PRECAUTIONS AND LIMITATIONS

4.1 Personnel assigned to the various positions within this procedure are identified in Attachment 2 - Designation of Work Permit Primary Reviewers.

4.2 Field Work Package documents shall be reviewed to ensure none of the following HFBR SBD prohibited activities are contained within their scope:

- The presence including the storage or use of fuels (e.g., propane, diesel, and gasoline) on the Experimental Level of Building 750, including the presence, storage or use of equipment that are powered by these fuels.

- Intrusive activities performed on the containers holding the beam plugs or collimators (i.e., transfer casks, Beam Plug Storage Facility).

- Any activity that results in a physical change to the HFBR reactor vessel, Beam Plug Storage Facility, transfer casks or biological shield.

- Any physical activity associated with the activated control rod blades, reactor vessel internals, beam plugs, and other activities affecting the thermal shield and biological shield structures.

- No cranes will be operated over the biological shield or reactor vessel, the Beam Plug Storage Facility or the transfer casks.

4.3 Field Work Package documents shall be reviewed to ensure none of the following BGRR SBD prohibited activities are contained within their scope:

- Welding/torch cutting on or within 18 inches of the biological shield.

- Bringing additional radioactive material into the BGRR facility, excluding the temporary introduction of sealed sources to calibrate instruments, or sealed sources to image inaccessible areas.

4.4 Field Work Package documents containing activities involving the use of flammable materials shall be subject to the following restrictions as described in the HFBR SBDs:

- Best management practices will be used to preclude the need for and limit the use of flammable materials in Building 750 required to perform work activities.

- If required, flammable materials in Building 750 shall be limited to only the quantities required to complete work activities, and excess or residual quantities of flammable materials will be removed from Building 750 upon work activity completion.

- Flammable materials shall not be left unsupervised in Building 750. Flammable materials shall either be under the direct supervision and control of HFBR workers, or stored in the approved Flammable Material Storage Locker located on the Building 750 Experimental Level.

4.5 Field Work Package documents containing activities involving the use of combustible materials shall be subject to the following limitations as described in the BGRR and HFBR SBDs:

- Best management practices will be used to limit the need for, entry and use of combustible materials in connection with work activities.

- If required, combustible materials shall be limited to only the quantities required to complete work activities, and excess or residual quantities of combustible materials will be removed upon work activity completion.

4.6 Field Work Package documents shall be reviewed to ensure that hazardous materials are limited to only the quantities required to complete work activities, and excess or residual quantities of hazardous materials are removed upon work activity completion.

4.7 WPM/FEs shall ensure that personnel assigned to perform work governed by the Work Permit have completed all specified training, related to the hazards identified, prior to the start of work.

4.8 Field oversight of work shall be in accordance with ERP-OPM-3.4, "Field Activity Oversight" (Reference 4).

4.9 Original Work Permits shall be printed on green paper.

5.0 PROCEDURE

NOTE 1: *The process by which a Work Permit is developed is outlined in the Work Permit Development Flow Chart (Attachment 3).*

NOTE 2: *The Work Permit form is provided in the SBMS Subject Area, "Work Planning and Control for Experiments and Operations".*

5.1 A Work Permit is initiated by the individual(s) requesting (Work Requestor) to perform work within a facility. The Work Requestor submits the work documentation to the WCC for Work Permit initiation. Work Permits are required for ALL activities with the exception of:

5.1.1 General administrative type work.

5.1.2 Routine surveillance and operation/maintenance of infrastructure system such as lighting, heating, air conditioning, treatment system sampling, etc., that is defined in the facility specific S&M Manuals.

5.2 The WCC will enter the task into the Work Permit Logbook. Once assigned a number, the WCC completes Section 1 of the Work Permit.

5.3 The Field Work Package will be developed as follows:

5.3.1 The Work Requestor, with assistance from the WCC, shall create a new folder within the appropriate "Work Permits" folder, which is located on the BNL network at U:\Field Work Packages\Work Permits. Contained within the Work Permits folder are several sub-folders broken down by

facility (BGRR or HFBR) and type. The Work Permit Logbooks are maintained within the Work Permit folder.

5.3.2 The WCC shall complete the fields in the Work Permit Logbook and assign a Work Permit number. The new Work Permit shall be initiated and maintained electronically in the newly created folder.

5.3.3 ERP-controlled support documentation such as JRAs, USID screening forms, and Work Instructions shall be initiated and maintained electronically in the newly created folder with the Work Permit. These documents shall be identified by their associated Work Permit number.

5.3.4 ERP Work Procedures are maintained on the BNL network at U:\Field Work Packages\Work Procedures.

5.3.5 Non-ERP controlled support documentation such as Digging Permits, RWPs and Hot Work Permits, shall be prepared in accordance with SBMS requirements.

5.3.6 The Work Requestor, with assistance from the WCC, shall initiate a Work Permit form.

5.4 The Work Permit with associated work documentation attached shall be submitted to the ERP ABE for USID screening as required by ERP-OPM-3.3, "Unreviewed Safety Issue Determination."

5.5 The Work Permit with associated work documentation attached shall be submitted to the S&IH Manager for development of a JRA.

5.5.1 A JRA is required for all work performed within ERP. JRAs are maintained within the associated work permit folder.

5.5.2 If a current JRA is not on file, the S&IH Manager notifies the Work Requestor to submit a step-by-step breakdown of the work identifying the hazards associated with each step of the job and control measures to mitigate the hazard(s).

5.5.3 Using this information, the S&IH Manager, with assistance from SMEs, completes a JRA by performing a risk ranking of the work to verify adequate control measures are incorporated.

5.6 The Work Permit with the associated work documents attached is routed to the S&IH Manager, RPM, QMS Manager, ECR, Radioactive Waste Management Manager and the facility's Building Manager for preliminary review and screening.

5.6.1 Each discipline will review the work documents and identify radiation, safety, environmental, waste management and facility concerns.

5.6.2 Additionally, the review shall identify whether specific work control permit(s) (e.g., Confined Space Permit, Radiological Work Permit, Cutting/Welding Permit, etc.) are necessary.

5.6.3 Upon completion of the preliminary review, the Work Permit and associated work documents shall be returned to the WCC for compilation.

5.7 Using the feedback received from the preliminary review, the WCC completes Section 2 of the permit, identifies the Work Permit Primary Reviewer.

5.7.1 Using the guidance provided within SBMS Subject Area, "Work Planning and Control for Experiments and Operations" the WCC, with assistance from the WCM and S&IH Manager screens and categorizes the Work Permit (low, moderate or high hazard) based on the preliminary review feedback and their knowledge of S&IH issues, complexity of the task and work coordination.

5.7.2 The Work Permit Primary Reviewer assigns the Work Permit Review Team members based on the impact the work has on their respective discipline. At a minimum, the Work Permit Review Team will consist of the Work Requestor, the WCC, and the S&IH Manager.

5.8 The Primary Reviewer communicates the feedback received from the preliminary review back to Work Requester for resolution.

5.9 Upon resolving comments from the Work Permit Review Team the Work Requester submits the associated work documents to the Primary Reviewer for final review.

5.10 Upon receipt of the final Field Work Package the Primary Reviewer assembles the Work Permit Review Team for a final review. This may be accomplished as a team meeting or performed in series through independent reviews.

5.10.1 Each member of the Review Team must acknowledge the review by signing and dating the original copy of the Work Permit.

5.10.2 The signature of the Primary Reviewer on the Work Permit indicates that the hazards and risks that could impact ES&H have been adequately identified and will be controlled throughout the job in accordance with BNL requirements.

5.11 The Field Work Package must be reviewed and approved by the SRC.

5.12 Field Work Packages generated for routine maintenance performed within the scope of the facility specific S&M Manuals do not require SRC approval.

5.13 A Field Work Package pre-job briefing performed in accordance with ERP-OPM-3.4, "Field Activity Oversight" is required prior to the commencement of work. Annotate completion of this briefing by signing Section 4 of the Work Permit.

5.14 Following completion of the briefing, and when the resources and schedule allow, Section 5 is signed off by the FE (Job Supervisor) or WCC authorizing work to be performed.

NOTE 1: *The process by which a Work Permit is utilized and closed out is outlined in the Work Permit Use and Closeout Flow Chart (Attachment 5).*

NOTE 2: *When a change is made to a Field Work Package, the cognizant D&D Manager and/or the appropriate Work Package Manager shall review the change and determine whether the change is a Minor Change or Revision.*

5.15 Minor Changes shall be incorporated into a Field Work Package in accordance with the following:

- Changes shall be made to the affected Field Work Package document (e.g., Work Permit, Work Instruction, Digging Permit).
- A vertical bar shall be placed in the right or left margin of the document adjacent to the change.
- Hand markings shall be made in pen directly on the Working Copy of the document.
- Changes may bemade by the electronic generation of new page(s). If a new page is inserted, it shall be inserted into the procedure immediately following the original page(s) it revises. The original affected page shall be marked appropriately by "lining out" the portions that are superseded by the changed page.
- Both electronic and hand changes shall be initialed and dated by the Work Package Manager or cognizant D&D Manager.
- At a minimum, changes shall be reviewed by the individuals who performed the original Work Permit reviews (see 5.7.2) and the ABE. The review shall be documented on the Minor Change Review and Approval (Attachment 6).

- Upon completion of the review, the change shall be documented in the Minor Change and Revision Log (Attachment 7).

- Minor Changes to Field Work Packages can be approved and issued for use in the field without prior SRC approval. However, Minor Changes shall be provided to the SRC for review at the next scheduled meeting.

- The Minor Change and Revision Log shall be maintained in the original Field Work Package.

5.16 Field Work Package Revisions shall be issued when:

- Six or more Minor Changes are incorporated into the Work Permit, Work Instruction, or other controlled supporting documents in the Field Work Package; or

- The scope, intent, or purpose of a Field Work Package has changed.

5.17 When a Field Work Package revision is required, the original Work Permit shall be closed in accordance Step 5.23, and a new Work Permit initiated.

5.18 If during the performance of the task(s), new work scope, work methods or hazards are identified that were not addressed in the original Work Permit or associated work documents, then stop the activity and inform the FE or WPM. The job will stop until the Work Permit and associated work documentation is replanned as outlined in 5.3 through 5.14.

5.19 FEs shall promote worker feedback throughout the performance of the work.

5.19.1 Feedback received during the daily tailgate meeting or throughout the days work shall be recorded by the FE utilizing the Daily Field Report as required within ERP-OPM-3.4, “Field Activity Oversight.”

5.19.2 A copy of all Field Reports containing feedback on the effectiveness of safety, health environmental protection measures, efficiency, and quality of work processes shall be forwarded to the WCC for review and incorporation into future work documents.

5.20 Following completion of all work activities the FE shall compile all associated work documentation and submit the completed Field Work Package to the WCC for review.

5.21 Based upon the feedback received throughout the job or pre-planned post-job review requirements contained within the Field Work Package, the WCC, working with the FE or WPM will determine the need for a post job review.

5.21.1 If a post job review is deemed necessary, results of the review will be documented in report form and attached to the Work Permit prior to closeout.

5.21.2 Personnel involved in the post job review shall sign Section 6 of the Work Permit.

5.22 The WCC, with assistance from the FE shall complete Section 7 by reviewing worker feedback and verifying all feedback received throughout the job has been reviewed and evaluated for incorporation into future work.

5.22.1 If practical, each worker offering feedback throughout the job should be acknowledged and informed of the outcome of the feedback.

5.22.2 Documentation of feedback received and recourse shall be filed with the completed Field Work Package.

5.23 Upon final verification that all associated work documentation is present and complete and that the work area is returned to an acceptable condition Section 8 of the Work Permit is signed and the entire Field Work Package filed in accordance with ERP-OPM-2.6, "Records Management."(Reference 5) Completion of this step effectuates the closeout of the Field Work Package.

6.0 RECORDS

6.1 The WPM, FE, or WCC retains the original Work Permit and associated work documentation until the task is completed. After completion the entire Field Work Package is filed in accordance with ERP-OPM-2.6, "Records Management."

6.2 Permanent Work Permit files shall be created and archived within 45 days of job completion. Work permit files not archived within 45 days of completion will require entry of an action item within the ERP Family Assessment Tracking System (FATS) until such time the file is archived.

6.3 All Work Permits must be maintained for 75 years in accordance with Occupational Health and Safety Assessment Series (OHSAS) 18001 - Health and Safety Record/Document Management Requirements.(Reference 6)

7.0 REFERENCES

7.1 BNL SBMS Subject Area, "Work Planning and Control for Experiments and Operations"

7.2 ERP-OPM-1.3, "Work Procedure Development and Requirements"

7.3 ERP-OPM-3.3, “Unreviewed Safety Issue Determination”

7.4 ERP-OPM-3.4, “Field Activity Oversight”

7.5 ERP-OPM-2.6, “Records Management”

7.6 OHSAS 18001 – Occupational Health and Safety Assessment Series

8.0 ATTACHMENTS

8.1 Attachment 1 – Work Instruction (Sample)

8.2 Attachment 2 – Designation of Work Permit Primary Reviewers and Review Team Members

8.3 Attachment 3 – Work Permit Development Flow Chart

8.4 Attachment 4 – Work Permit Additional Sign-on Sheet

8.5 Attachment 5 - Work Permit Use and Closeout Flow Chart

8.6 Attachment 6 – Minor Change Review and Approval

8.7 Attachment 7 – Minor Change and Revision Log

9.0 DEFINITIONS

9.1 Field Work Package. Work planning and implementation documents including but not limited to JRAs, approved USIDs and USID screening documents, primary work permits, adjunct work permits (e.g., RWPs, Hot Work Permits, Digging Permits, etc.), Work Procedures and Work Instructions.

Attachment 1

Work Instruction (Sample)

BGRR WORK INSTRUCTION	Work Permit No. # **DD-WP-302-013**	Date Effective 05/30/07
	Author: T. Doyle Reviewed/Date: T. Jernigan Approved/Date: T. Daniels	
Document Title: **Inspection and Weighing of Bldg. 701 10-ton Overhead Crane**		

1. PURPOSE

1.1 The purpose of this procedure is to provide directions to perform the prerequisite inspection to return the Bldg. 701 10-ton overhead crane to service for restricted use and to safely determine the weight of the Bldg. 701 10-ton overhead crane hoist.

2. SCOPE

2.1 The following activities will be performed:

- Inspection of the crane to return to service for restricted use.
- Positioning the hoist trolley to a position on the south end of the gantry beam.
- Lockout/Tagout (LOTO) of all power to the crane.
- Determining the weight of the hoist trolley using low-profile load cells.

2.2 This Work Instruction includes the following activities:

- Prerequisites
- Previous Lessons Learned
- References
- Safety Requirements
- Tools, Equipment and Special PPE
- Work Instructions
- Records

Work performed outside the scope of this Work Instruction must be pre-planned as outlined within ERP OPM 3.2, “Work Planning and Control”.

3. PREREQUISITES

3.1 Bldg. 701 10-ton Overhead Crane Inspection

NOTE: *The Bldg. 701 overhead crane has been placed "out of service" since 2005 due to lapse of the annual inspection requirements and several OSHA discrepancies. The following step prescribes the prerequisite inspection of the crane in order to return the crane to service to support its refurbishment in accordance with BSA Contract.*

3.1.1 Perform inspection of the Bldg. 701 overhead crane in accordance with SBMS requirements.

Plant Engineering (EP) Hoisting & Rigging Inspector:
Name (print): _____
Signature: _____ Date:_____

3.1.2 Upon completion of the crane inspection, post the following signs at the crane walkway entry and in the crane control cab:

NOTICE – RESTRICTED USE THE BLDG. 701 OVERHEAD CRANE USE IS RESTRICTED TO OPERATION AND MATERIAL HANDLING ACTIVITIES ASSOCIATED WITH THE REFURBISHEMENT OF THE CRANE

3.1.3 Bldg. 701 10-ton overhead crane inspected and ready for restricted use.

EP Hoisting & Rigging Inspector - Initial: _____ Date:_____
ER Field Engineer - Initial: _____ Date:_____

3.2 A Radiological Work Permit (RWP) has been issued for this work.

ER Field Engineer - Initial: _____ Date:_____

NOTE: *This prerequisite SHALL be completed after trolley has been located to its southernmost location, step 8.1.1.*

3.3 Post an area not less than 50' x 50' in size on elevation 110' directly beneath the work location of the Bldg. 701 10-ton overhead crane hoist trolley.

ER Field Engineer - Initial: _____ Date:_____

4. PREVIOUS LESSONS LEARNED

See Attachment 1.

5. REFERENCES

- Attachment 2, Load Cell Placement
- ERP-OPM-2.6, "Records Management"
- ERP OPM-3.2, "Work Planning and Control"
- ERP-OPM-3.4, "Field Activity Oversight"
- KoneCranes, Inc. "Accident Prevention Plan and Workplace Safety & Health Program", January 3, 2007.
- EP-ES&H-103, "Lockout/Tagout Requirements"
- ERP-OPM-2.8, "Lockout/Tagout"

6. SAFETY REQUIREMENTS

- Post area on elevation 110' beneath the work area "Danger – Overhead Work in Progress".
- EP personnel will perform all crane operation.
- CranePro personnel shall comply with KoneCranes, Inc. "Accident Prevention Plan and Workplace Safety & Health Program".
- Personnel not involved in the work shall keep clear of the work areas.
- The Job Risk Assessment shall be attached to this Work Instruction.

7. TOOLS, EQUIPMENT, and SPECIAL PPE

- Gloves, Safety Glasses, Safety Shoes, and other PPE as prescribed by the JRA.
- Three (3) Load cells, Transducer Technologies, Inc., model LPD-CT, 25K lb rating with digital readout and cables.
- Two (2) Porta-Power® lifting devices with pump, hose, and cylinder rated for 5-ton minimum capacity.
- Long-handled tool for placing east load cell (Note: Load cell location is approximately three feet (3') beyond the worker's extended arm).

8. WORK INSTRUCTIONS

NOTE 1: *The Bldg. 701 overhead crane hoist trolley will be determined by the use of three (3) load cells placed between the trolley frame and the crane bridge beam. The trolley will be required to be lifted less than ¼" from the rails to determine its weight.*

NOTE 2: *EP personnel will perform all crane operation.*

8.1 Weighing the Bldg. 701 10-ton Overhead Crane

8.1.1 Position the hoist trolley to its southernmost location on the crane bridge.

NOTE: *Lockout/Tagout shall be performed in accordance with EP-ES&H-103, "Lockout/Tagout Requirements" until such time as ERP-OPM-2.8, "Lockout/Tagout" is approved. Any Lockout/Tagout after this approval shall be performed under the ERP-OPM-2.8.*

8.1.2 At Bldg. 703 440V MCC, OPEN breaker 4A, "701 Crane", to isolate 440V power to building 701 overhead crane and apply LOTO to breaker.

LOTO applied – FE Initial: _____ Date: _____

8.1.3 Verify power to crane isolated by verifying zero voltage at the line side of crane disconnect located elev. 110', adjacent to the east rollup door.

_____ Volts - PE Electrician Initial: _____ Date: _____

NOTE: *Refer to Attachment 2 for load cell locations.*

WARNING 1: Personnel injury/fall hazard – All work shall be performed from the crane catwalks. Personnel shall not climb on the trolley or lean over catwalk handrail.

WARNING 2: Personnel injury/pinch hazard – Keep hands clear of trolley wheels when placing Porta-Power® cylinders and load cells.

8.1.4 Using a permanent marker, mark the location for each of the load cells at the following locations:

8.1.4.1 Two (2) load cells (north and south), each located between the west trolley frame member and the bridge beam, adjacent to the trolley rail, with south load cell located 6" – 8" north from the centerline of the south trolley axle and the north load cell located 6" – 8" south from the centerline of the north trolley axle.

8.1.4.2 One (1) load cell positioned on the east crane beam, each located between the east trolley frame member and the bridge beam, adjacent to the trolley rail equidistant between the two trolley axles (4'-10.5" ref. from centerline of either axle).

8.1.5 Using two (2) Porta-Power® cylinders placed adjacent to the locations marked above, SLOWLY lift the west side of the trolley 1/4" to 3/8" and insert one (1) load cell at each of the marked locations.

8.1.6 Release the pressure on the Porta-Power® cylinders to lower the trolley until the full weight is bearing on the each of the west load cells and remove one (1) the Porta-Power® devices.

8.1.7 Using (1) Porta-Power® cylinder placed adjacent to the location marked above, SLOWLY lift the east side of the trolley 1/4" to 3/8" and insert one (1) load cell at the marked location using the long-reach tool.

8.1.8 Release the pressure on the Porta-Power® cylinder to lower the trolley until the full weight is bearing on the east load cell; do not remove the Porta-Power® device.

8.1.9 Record the weight at each load cell and calculate total trolley weight.

a. East Load Cell: _____ lbs
b. West Load Cell (north): _____ lbs
c. West Load Cell (south): _____ lbs

Total Trolley Weight (a + b + c) = _____lbs
ER Field Engineer - Initial: _____ Date:_____

8.1.10 Using (1) Porta-Power® device placed adjacent to the location marked above, SLOWLY lift the east side of the trolley until there is approx. 1/8" clearance between the load cell and the trolley frame.

8.1.11 Remove the load cell, lower the trolley to the track and remove the Porta-Power cylinder.

8.1.12 Repeat steps 8.1.10 and 8.1.11 above to remove the two (2) Porta-Power® cylinders from beneath the west side of the trolley frame.

8.1.13 Remove all tools and equipment from the work area and perform housekeeping to remove any debris and trash and remove all work area postings.

8.1.14 All work steps complete:

ER Field Engineer - Initial: _____ Date:_____

9. RECORDS

- Upon completion of this activity, the work supervisor shall complete Sections 6 and 7 of the Work Permit and submit the form to the BGRR Work Controls Coordinator (WCC) for close-out as outlined in ERP-OPM-3.2, "Work Planning and Control".
- File the completed Field Work Package in accordance with ERP-OPM-2.6, "Records Management".

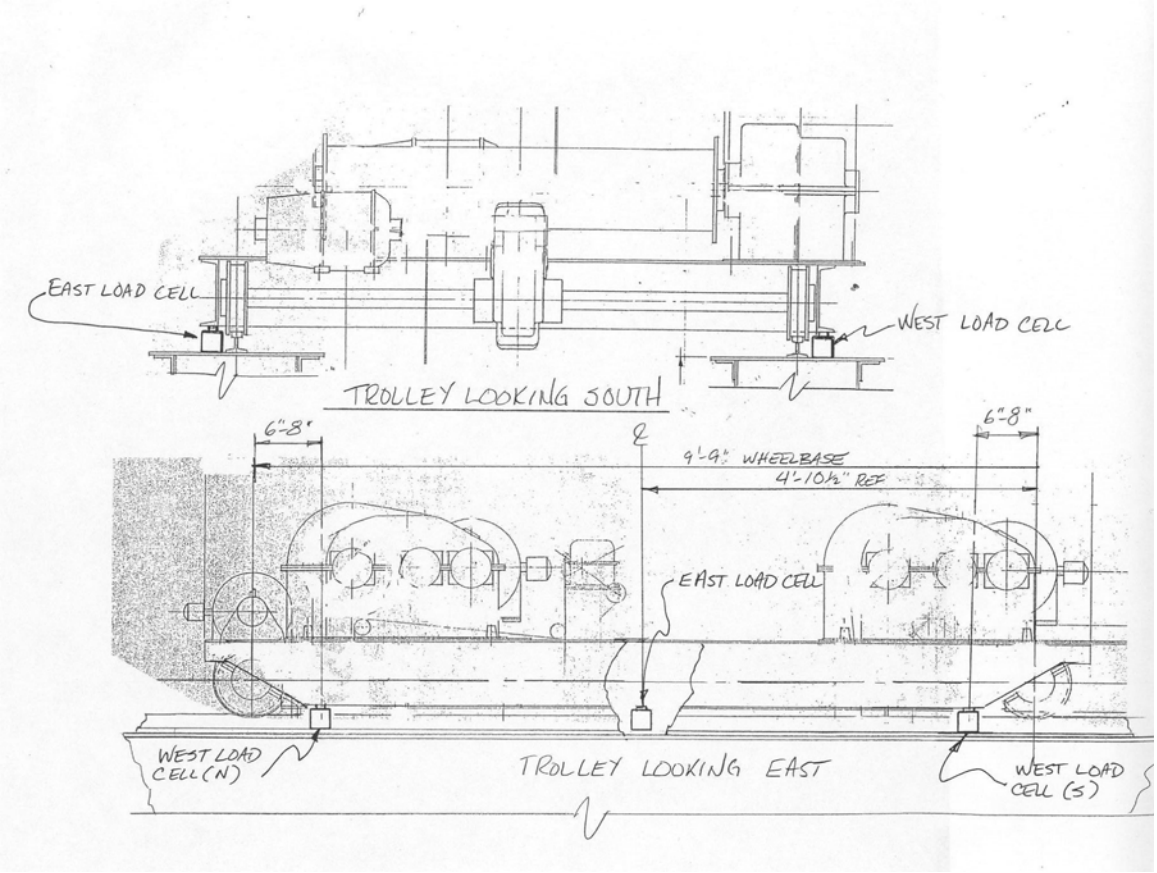
Attachment 1

Lessons Learned

(Insert appropriate Lessons Learned here – see SBMS Subject Area "Lessons Learned")

Attachment 2

Load Cell Placement



Attachment 2

Designation of Work Permit Primary Reviewers and Review Team Members

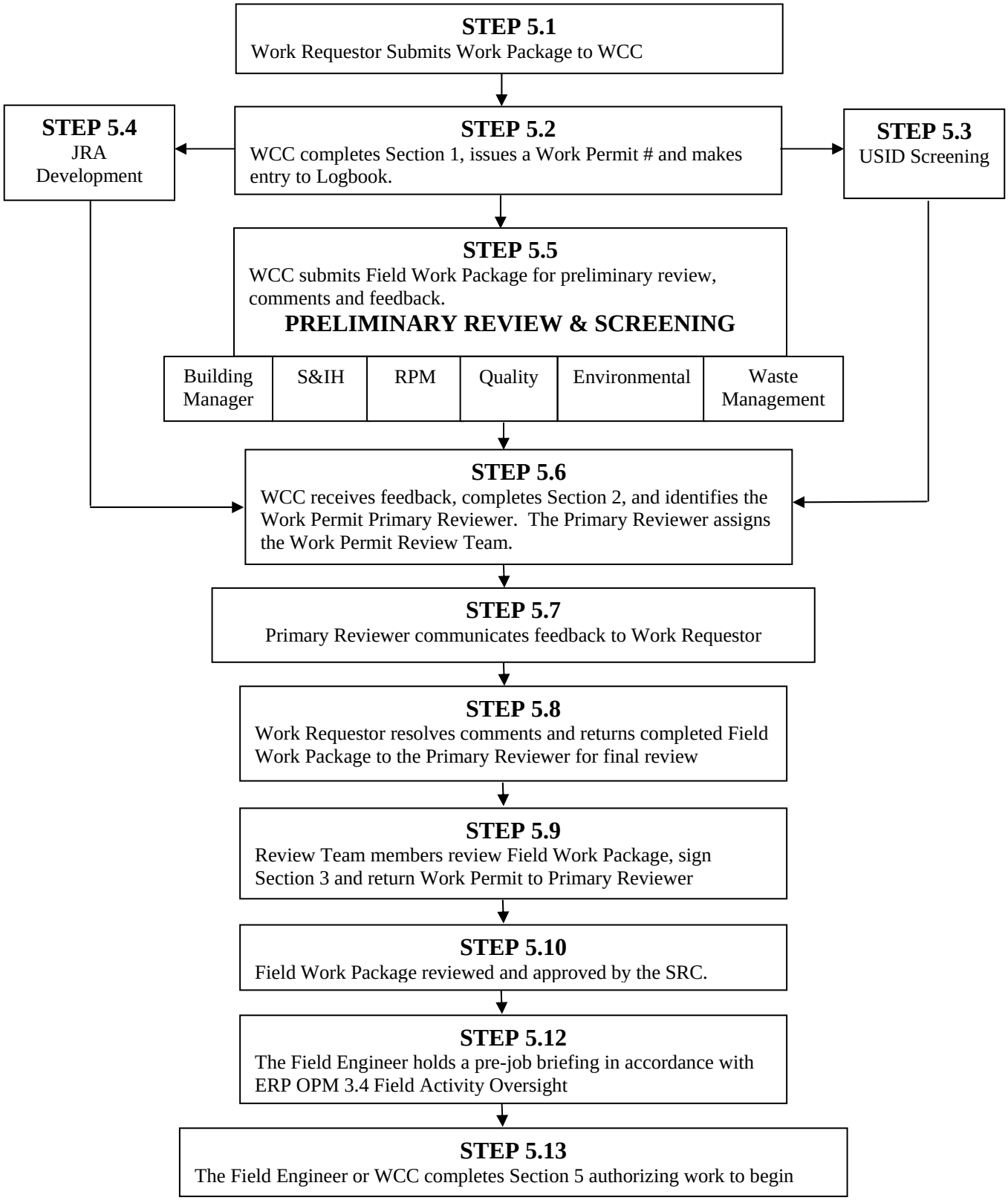
PRIMARY REVIEWERS

ERP Work Control Manager
ERP Work Control Coordinator
ERP D&D Operations, Manager
ERP D&D Support Manager
ERP Field Engineer
ERP Work Package Manager

WORK PERMIT REVIEW TEAM

*Work Permit Requestor
ERP Work Control Manager
ERP Work Control Coordinator
ERP S&IH Manager
ERP D&D Operations Manager
ERP D&D Support Manager
ERP Radiation Protection Manager
ERP Quality Management Services Manager
ERP Authorization Basis Engineer
ERP Environmental Compliance Representative
ERP Radioactive Waste Manager
*Must be part of team

Attachment 3
Work Permit Development Flow Chart



Attachment 4

Work Permit Additional Sign on Sheet

Work Permit Number _____

This is an extension of Work Permit Form Section 4. Job Site Personnel fills out this section.

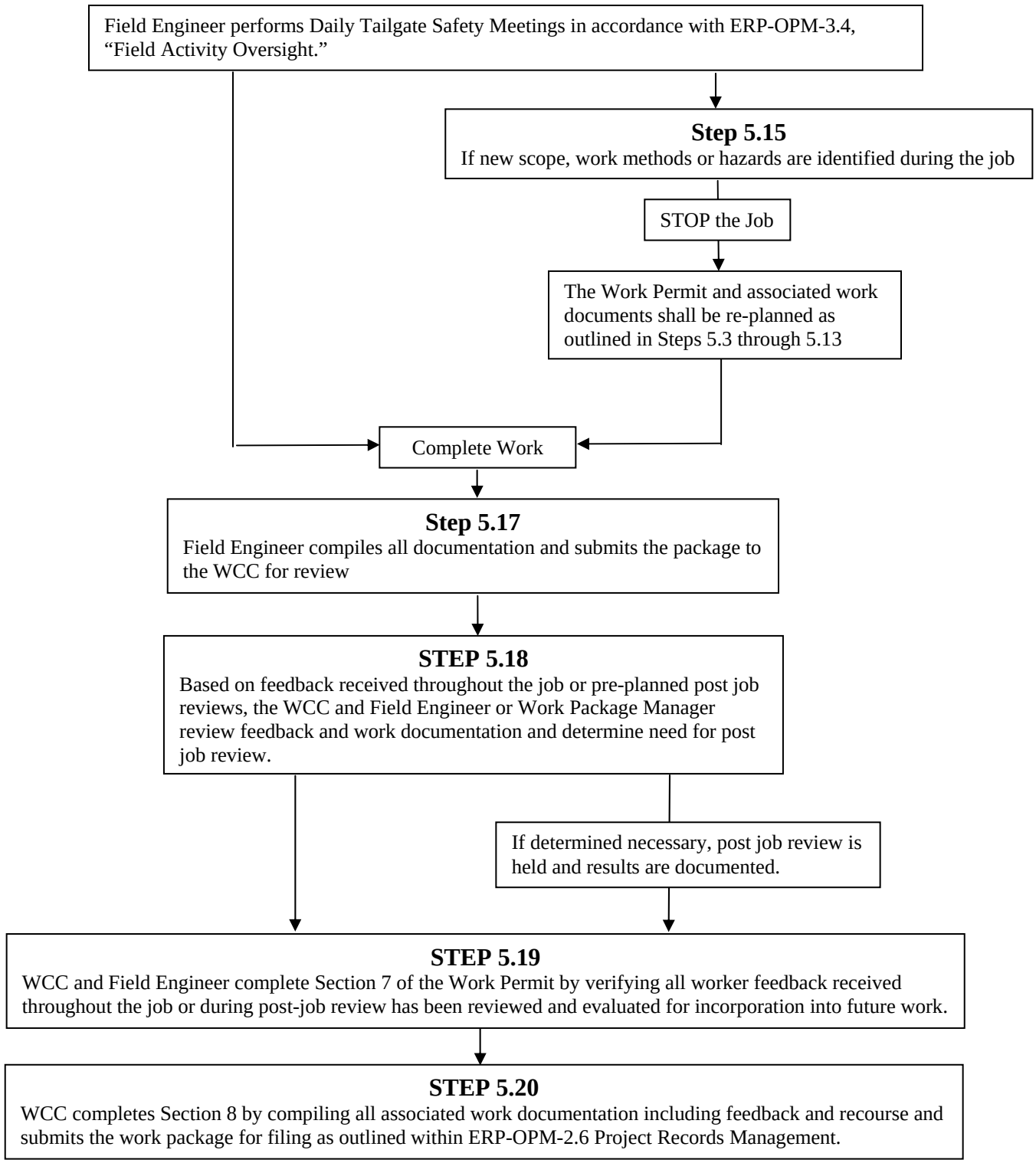
Note: Signature indicates personnel performing work have read and understand the hazards and permit requirements (including attached permits).

Workers	**Life #**

Workers are encouraged to provide feedback on ES&H concerns or on ideas for improved job work flow.

Attachment 5

Work Permit Use and Closeout Flow Chart



Attachment 6

Minor Change Review and Approval

Minor Change Number: _____ Date: _____

Reason for Change:

Affected Documents (list):

Document	Affected Page(s)	Comments

Work Permit Review Team Review:

Title	Name (print)	Signature	Date
Primary Reviewer			
ES&H Professional			
Other			
Other			
ABE			
Work Control Coordinator			
Service Provider			
Work Package Manager			
D&D Manager			

Attachment 7

Minor Change or Revision Log

SECTION	PAGE #	REV. #	DATE	REASON FOR MINOR CHANGE OR REVISION

PLEASE CLICK HERE TO SEND READING ACKNOWLEDGEMENT EMAIL

APPENDIX C

BGRR Local Emergency Plan

ERP Operations Procedures Manual

5.1 BGRR LOCAL EMERGENCY PLAN

Text Pages 1 - 13
Attachments - 4

Approved: _____ Date: 11/26/07

ERP Director
Les Hill

Preparer: R. Deschamps

ERP-OPM-5.1, Revision 1

REVISION LOG

SECTION	PAGE #	REV. #	DATE	REASON FOR REVISION
1.0	2	1	11/26/07	Defined training requirements for access.
2.0	2, 4	1	11/26/07	Removed Laboratory Emergency Supervisor and added the Crisis Manager. Also added the radiation Protection Manager and his responsibilities.
3.0	5, 6	1	11/26/07	Added additional information to the Facility Contents Section.
4.0	6, 7	1	11/26/07	Added additional information to the Radiation and Fire Hazard sections.
7.0	10	1	11/26/07	Added new Section, Emergency Response, and reference to the new Emergency Response OPM.
13.0	12, 13	1	11/26/07	Added additional information to the Training and Access section.
All	All	1	11/26/07	Editorial/format corrections throughout the procedure.

Table of Contents

5.1 BGRR LOCAL EMERGENCY PLAN

1.0 PURPOSE AND SCOPE

The purpose of this procedure is to provide guidance and direction to visitors, Environmental Restoration Projects (ERP) personnel, contractors, and workers for safe access and egress from the Brookhaven Graphite Research Reactor (BGRR) Complex structures during their visit or work activities. The BGRR Complex includes Buildings 701 - Reactor Building, Building 702 - Reactor Biological Shield and Building T-895 - Duct Service Building (DSB).

The scope of this procedure includes: access and unescorted access control, key or key card control, hazard survey, and emergency response, as they relate to BGRR building access and control.

Routine access/egress routes into Building 701 exist on the 110 ft. elevation east and west access doors. Corridors within the building route traffic to either the reactor highbay radiological control points, or the main stairwells or elevator to office space and conference areas on the 133 ft. and 143 ft. elevations. Unrestricted access to the non-radiological portions of Building 701 requires completion of the ERP General Employee Training (GET). Additional training, specific to the hazards and risks of the planned work, is required for access to the radiological areas within Building 701.

For the BGRR facility floor plans and evacuation routes see Attachments 1 through 4.

2.0 AUTHORITIES AND RESPONSIBILITY

2.1 Crisis Manager (CM)

2.1.1 Shall supervise and coordinate actions during an operational emergency (OE).

2.2 Incident Commander (IC)

2.2.1 Shall act as the person in charge of the incident scene and the one who assumes overall responsibility for the emergency response until an OE is declared and the CM takes responsibility. All personnel at the scene of the incident report to and are responsible to the IC.

2.2.2 Shall establish the Command Post in a safe location.

2.3 ERP Director

2.3.1 Shall ensure the overall implementation of this procedure.

2.3.2 Shall assign a Local Emergency Coordinator (LEC) and an alternate LEC for ERP.

2.4 LEC

2.4.1 Shall prepare and update the Local Emergency Plan (LEP).

2.4.2 Shall review and update the Fire Response Run Card at least annually.

2.4.3 Shall coordinate emergency management issues with all other co-tenants within ERP.

2.4.4 Shall conduct an annual building fire/evacuation drill, as needed, and conduct critiques of the drills and implement corrective actions as necessary.

2.4.5 Shall identify and maintain emergency equipment.

2.4.6 Shall identify, procure, and arrange maintenance of required emergency equipment. Shall ensure routine monthly walkdowns are conducted to verify all equipment is at location and properly maintained. Shall keep the Building Manger advised of any discrepancies.

2.4.7 Shall establish an accountability process and ensure that building accountability is performed following a building evacuation and reports these results to the IC.

2.4.8 Shall identify and maintain a listing of staff in their assigned building (s) that may require assistance during an emergency and provides for assistance in safely exiting the building in an emergency.

2.4.9 Shall question personnel to determine the status of any equipment that may have been left in an energized or unsafe condition.

2.4.10 Shall ensure that emergency forces have been summoned and building alarms are sounded as required.

2.4.11 Shall maintain command and control of the scene until relieved by the IC.

2.4.12 Shall identify him/herself to the IC, and assists him/her as required in mitigating the emergency.

2.4.13 Shall ensure that the tone alert radio assigned to the building is operational and that it is brought to the assembly area, shelter-in-place area, or evacuation area as required.

2.4.14 Shall ensure that the Safety and Industrial Health (S&IH) Manager is informed of any event requiring the activation of this plan.

2.4.15 Shall revise this LEP to incorporate Lessons Learned (LL) from any ERP or Brookhaven National Laboratory (BNL) emergency or other relevant LL which would improve this procedure with regard to all ERP facilities.

2.5 BGRR Building Manager

2.5.1 Shall act as the single point of contact for coordinating all non-programmatic surveillance, maintenance, operations and project-related issues affecting the building/facility as a whole.

2.5.2 Shall assume the duties of the LEC if the LEC and alternate LEC are not present.

2.5.3 Responsible to authorize unrestricted access to the non-radiological areas of Building 701 once minimum training requirements have been completed and verified through the issuance of keys or key cards.

2.6 ERP Radiological Protection Manager (RPM)

2.6.1 Is responsible for ensuring the LEC is provided current radiological conditions to update the ERP facility Emergency Pre-plan Response Cards by completing a quarterly review.

2.7 ERP Project Administrative Manager

2.7.1 As authorized by the Decontamination and Decommissioning (D&D) Support Manager, shall order and issue keys, locks and/or key cards as required to support the Project once minimum training requirements have been completed and verified.

2.7.2 Shall maintain and administer the key or key card logbook.

2.8 ERP Training Services Manager (TSM)

2.8.1 Shall verify that the minimum training requirements have been completed prior to the authorization of unescorted access to the BGRR areas.

NOTE: *The definition of staff includes personnel who visit for administrative meetings.*

2.9 ERP Staff

2.9.1 Individual staff members in the building are responsible for activating alarms if they are aware of an emergency and for responding to alarms in a timely and orderly manner. If a building occupant is aware of an emergency in the building he/she should:

- Pull the nearest fire alarm box, **Call 2222 or 911** from an on-site phone or **631-344-2222** from an off-site phone, and briefly describe the nature and extent of the emergency.

- Warn others in the vicinity.

- Alert the Building Manager as to the nature of the emergency.

2.9.2 Shall be aware of the shelter-in-place, outdoor and indoor assembly area location for each ERP facility.

3.0 DESCRIPTION OF FACILITY ACTIVITIES

3.1 Location
The facility is located on Rutherford Drive and normally houses 35 people.

3.2 Work Performed
The work performed here consists of surveillance and maintenance (S&M) and D&D preparatory activities.

3.3 Classified Material
There is no classified material contained in this building.

3.4 Facility Contents

3.4.1 Building 701 Reactor Building houses Building 702 the biological shield and graphite pile. Building 701 also contains administrative offices and provides support to equipment and systems. It contains three floor levels plus the canal level below the main floor.

- Building 701 contains radioactive and hazardous materials and material handling equipment such as overhead cranes and fork trucks. In addition the building houses industrial equipment, elevators, heating, ventilation and air-conditioning (HVAC), office equipment, and systems such as steam, domestic water, sanitary and electrical systems.

3.4.2 The DSB is a 2200 square feet temporary structure made of corrugated metal. It is used for material storage in support of decommissioning activities.

- The DSB contains radioactive materials and material handling equipment such as overhead cranes and fork trucks.

3.4.3 The below ground ducts exhausted cooling air from the graphite pile. The remaining portion of the ducts are sealed shut but can be accessed through the opening located at the point which the ducts transition to above ground elevation.

3.4.4 The yard area outside Buildings 701 consists of asphalt-paved and dirt areas to the east, south, and west of Building 701.

3.5 Building Access

Building access is controlled for property and personnel protection. There are to be no unauthorized guests. A BNL issued key or key card is needed for access.

4.0 DESCRIPTION OF HAZARDS

4.1 Radiological Hazards

4.1.1 Building 701

- Posted Contamination, Radiation, and Radioactive Material Areas exist throughout.
- Hot Particle Areas and High Radiation Areas may be posted based on the active work.
- Radioactive contamination includes fission and activation products as well as transuranic radionuclides.

4.1.2 Building 702 (BGRR graphite pile and biological shield)

- Contains approximately 877 curies of loose and fixed activation products, fission products and transuranic radionuclides.
- Contents consisting of:
  - Graphite Pile - 775.8 Curies
  - Biological Shield – 81.3 Curies
  - Pile Base Plate – 11.2 Curies
  - Below Ground Duct (under Bldg 701) – 7.3 Curies
  - Deep Pit and fuel canal – 0.167 Curies
  - Bldg 701 interior – 1 Curie
- Shield plugs prohibit access to Building 702. Plugs are removed when graphite pile and bioshield removal activities commence.

4.2 Chemical Hazards

4.2.1 Bulk chemical inventories have been removed from the BGRR.

4.2.2 The following hazards potentially exist within the complex:

- Asbestos: Transite wall coverings, asbestos covered piping, electrical wire insulation and ducting.
- Lead: Shielding (lead shot, brick, and sheet) and lead-based paint.
- Polychlorinated Biphenyls (PCBs): PCBs exist in the facility primarily as an inherent element within aged electrical components, and paints.

Additionally, small amounts of other chemical hazards could be encountered in BGRR Facilities.

4.3 Fire Hazard

4.3.1 Building 701 is constructed using steel frame, poured concrete and brick. The roof of both the reactor bay and office complex is four-ply asphalt based roofing construction. Building 702 and T-895 are constructed of non-combustible materials.

4.3.2 The fire exposure hazard in the BGRR consists of transient flammable/combustible materials associated with performing routine maintenance or decommissioning activities. Controls are in place to limit the use and presence of flammable/combustible materials in Building 701 and 702.

4.4 Physical Hazards

4.4.1 Industrial: The BGRR is a shutdown facility, with the offices of BGRR personnel currently housed in the 701 Building. All areas of the facility are entered on a routine basis for S&M inspections.

- There is rigging equipment in the facility. This equipment shall not be placed in service until certified for use, reviewed for its intended use, and tagged accordingly.

WARNING: Personnel fall hazard, fall from heights - Access to the roof of Building 701 is restricted to prevent falls. Personnel must maintain a distance of at least 6 feet from the edge of the roof parapet unless authorization is granted via an ERP Work Permit or as part of preventive maintenance specified within the BGRR S&M Manual.

4.4.2 Falls: The absence of guardrails on the buildings' multilevel flat roofs presents a potential fall hazard.

- The Reactor bay roof was replaced in 2005 and is in excellent condition. The roof structure over the office area is in fair condition. However, visual inspection of the roof surface will not always indicate structural integrity, and some cracked roofing panels have been noted.

4.4.3 Confined Spaces: There are numerous confined spaces in and around structures at the BGRR. Confined spaces shall only be entered in accordance with a Work Permit.

WARNING: Personnel shock hazard - Do not touch any electrical wiring or transfer equipment unless specifically addressed in an assigned work package.

4.4.4 Energy Sources: The facility is powered by a single 480-volt electrical feed with dry-type step-down transformers for lighting distribution. The switchgear is aged and must be operated with extra caution. Written authorization and work instructions are required for all 480-volt switchgear operations. All electrical lines should be considered energized until proven otherwise. The transformer station outside of Building 701, at the southwest corner, was permanently de-energized in January 2000.

- There are some missing conduit enclosures, light bulbs, and fixture covers on items that may contain energized wires.

5.0 NOTIFICATIONS

5.1 LEC
Bruce Lein
BNL Ext. 2188; Home Phone # 631-588-8512; Cell Phone # 631-922-5911

5.2 Alternate LEC
Fred Sauerbrun
BNL Ext. 2760; Home Phone # 631-886-1285; Cell Phone # 631-484-0194

5.3 Environmental, Safety and Health (ES&H) Coordinator
Brian Heneveld
BNL Ext. 4721; Home Phone # 516-799-7555; Cell Phone # 631-774-6615

5.4 S&IH Manager
Brian Heneveld
BNL Ext. 4721; Home Phone # 516-799-7555; Cell Phone # 631-774-6615

5.5 Radiation Protection Manager
Robert Deschamps
BNL Ext. 4714; Cell Phone # 845-797-9551

5.6 D&D Support Manager
Fred Petschauer
BNL Ext. 7498; Home Phone # 631-929-5996, Cell Phone # 631-484-0190

5.7 D&D Operations Manager
Tom Daniels
BNL Ext. 4752; Home Phone # 631-281-5488; Cell Phone #631-831-7662

5.8 BGRR Building Manager
Dean Atchison
BNL Ext. 7854, Home Phone # 631-929-8398, Cell Phone # 631-831-0159

5.9 ERP Director
Les Hill
BNL Ext. 8631, Home Phone # 631-474-3209, Cell Phone # 631-834-3936

6.0 EMERGENCY SIGNALS

6.1 Laboratory Emergency Signals
The sounding of the site sirens indicates the existence of a site emergency.

6.1.1 Warning Signal - This consists of the continuous sounding of the site sirens for five minutes. Proceed immediately to the Indoor Assembly Area (mail box area, 143' level) and await instructions.

6.1.2 Evacuation Signal - This consists of the intermittent sounding of the site sirens for five minutes. Evacuate the site immediately in accordance with the Laboratory Emergency Plan.

NOTE: *The Tone Alert Radio must be placed in an area that is constantly manned or in an area that is accessible to occupants of the buildings.*

6.1.3 Tone Alert Radio

- Location: Elevation 143 ft. of Building 701, Office 2A near window.
- Responsible Individual: Project Administrative Manager.

6.1.4 Telephone Numbers for Emergency Communications

- Indoor Assembly Area – Near the mailboxes on elevation 143 ft. in Building 701 – ext. 4432.
- Shelter In Place – The conference room on elevation 143 ft. in Building 701 – ext. 8273.

6.2 Building Emergency Signals

The building alarms consist of ringing of the fire alarm bells. Ringing of the bells is activated automatically by a network of heat detectors or by pulling the red fire alarm pull-boxes located throughout the building.

6.2.1 Upon hearing the building alarm, all persons shall immediately evacuate the building and proceed to the Outdoor Assembly Area (West Laydown Area). The LEC shall meet the emergency response personnel at the Command Post. There are no hearing impaired personnel identified in the building.

6.3 Emergency Telephone: **Ext. 2222 or 911**

Any individual may call the Laboratory Emergency Number. Anyone who does so should:

- State the nature and extent of the emergency.
- Give the location including building and room.
- Give your name and a call back number.

7.0 EMERGENCY RESPONSE

7.1 ERP-OPM-5.6, "Emergency Response Procedure" (Reference 1) provides immediate response actions and required interface with the BNL site Emergency Response Organization (ERO) including Emergency Services, Police, Medical and Radiological Controls in responding to incidents, emergencies and off-normal occurrences at the ERP projects.

7.2 ERP-OPM-5.6 describes the required actions for emergency or an incident at ERP projects including the following:

- Medical Emergencies
- Fire
- Spill
- Radiological events – building evacuation due to airborne radioactivity, contamination spread and/or elevated radiation levels

8.0 INDOOR ASSEMBLY AREA

8.1 The Indoor Assembly Area (see Attachment 1) is located near the project staff mailboxes on elevation 143 ft. of Building 701. Gather in this area for personnel accountability and to await further instructions.

8.2 The LEC will assign someone to operate the telephone and take attendance for accountability.

9.0 OUTDOOR ASSEMBLY AREA

9.1 The Outdoor Assembly Area (see Attachment 4) is located at the West Laydown Area just outside the entrance of Building 701. Personnel will meet there for accountability and to await further instructions.

9.2 In case of inclement weather, the Alternate Outdoor Assembly Area will be the Main Lobby of Building 703.

10.0 SHELTER IN PLACE

10.1 In the event of a hazardous materials release where assembly and evacuation is not the preferred protective action, personnel will be directed to seek shelter. The shelter area is selected so that it affords maximum protection for personnel.

10.2 The Shelter In Place Area (see Attachment 1) is the Building 701 conference room on 143 ft. level. The LEC shall ensure that the Tone Alert Radio is brought to the conference room.

11.0 ACCOUNTABILITY FOR PERSONNEL

11.1 In the event of a building evacuation of the BGRR, the LEC will use the BGRR occupancy list, project work documentation provided by project construction/field engineers, and cell phones to account for all personnel.

11.2 Accountability will include inquiries about repair/maintenance staff, contractor, and visitors. Field Engineers shall account for their personnel and report their results to the LEC.

11.3 Personnel shall remain in the assembly area until they have been accounted for and instructed to return to work by the IC. The LEC will report results of accountability to the IC and the ERP Director.

11.4 Handicapped and Hearing-impaired Individuals must notify their immediate supervisor prior to working in this facility. The supervisor is responsible for notifying this individual in the event of an emergency. The supervisor should then notify the LEC or Alternate in the event of an emergency that all individuals are or are not accounted for.

12.0 BUILDING EMERGENCY EQUIPMENT

12.1 There are fire extinguishers and fire alarm pull boxes located on every elevation in Building 701.

12.2 There are radiation detection equipment check sources and decontamination materials located on the 110 ft. elevation.

13.0 TRAINING AND ACCESS

13.1 Training Requirements

13.1.1 In addition to job-specific training for Project work, the Laboratory requires a minimum set of required ES&H training modules for all personnel. Training requirements for unrestricted access to the non-radiological areas of the BGRR is completion of ERP GET.

13.2 Building Access

13.2.1 Employees, contractors, guests, or any person requiring unrestricted access into non-radiological areas of the BGRR Facility, shall complete ERP Generic GET and be issued a key/key card for access.

13.2.2 All untrained personnel shall be escorted while within areas other than non-radiological.

13.2.3 Hard hats, safety glasses with side shields, and safety shoes are required for access to posted work areas within the BGRR.

13.2.4 Casual visitors should not be given access by ERP personnel that may be coincidentally leaving the building at the time the visitor arrives. All visitors must receive authorization from a specific ERP point of contact to enter Building 701.

13.2.5 All personnel entering BGRR Complex buildings shall obey all signs and postings.

13.2.6 All BGRR buildings are locked. Access to any of the buildings is by use of a key or key card. Access doors shall be secure at all times. In the event that a door(s) must remain open for an extended period of time to facilitate work efforts, it is the responsibility of the work package Field Engineer to ensure proper personnel building access and egress during that time, and that the door(s) are again locked when work is complete.

13.3 Key and or Key Card Control

13.3.1 The D&D Support Manager, Building Manager, and Administrative Staff are the ERP representatives authorized to request a key and or key card.

13.3.2 The D&D Support Manager and the Project Administrative Manager shall authorize Administrative Staff, or designee, to issue keys and or key cards to individuals once minimum training requirements have been verified.

13.3.3 The ERP TSM shall verify the minimum training requirements are completed prior to authorization of issuance of keys and or key cards.

13.3.4 The ERP Administrative staff assigns a key and/or key card to qualified personnel and maintains a log of the assignments.

13.3.5 When access is no longer needed, required, or denied, the key and/or key card shall be surrendered to Administrative Services or designee.

13.3.6 Fire-Rescue maintains a key to gain entry to the building.

14.0 DRILLS

14.1 Emergency drills shall be conducted annually and as determined necessary by the LEC. Critiques of the drill should be conducted within 30 days of the drill.

15.0 RE-ENTRY

15.1 In the case of an incident, re-entry into affected areas shall be at the discretion of the IC, CM (as applicable), Radiological Controls Division Facility Support Representative and the LEC.

15.2 In the case of a declared OE, termination of emergency shall come from the Emergency Operations Center (EOC) and the CM.

16.0 REVIEW AND UPDATE

16.1 This plan shall be reviewed annually and updated as necessary by the LEC. Reviews are required but not limited to:

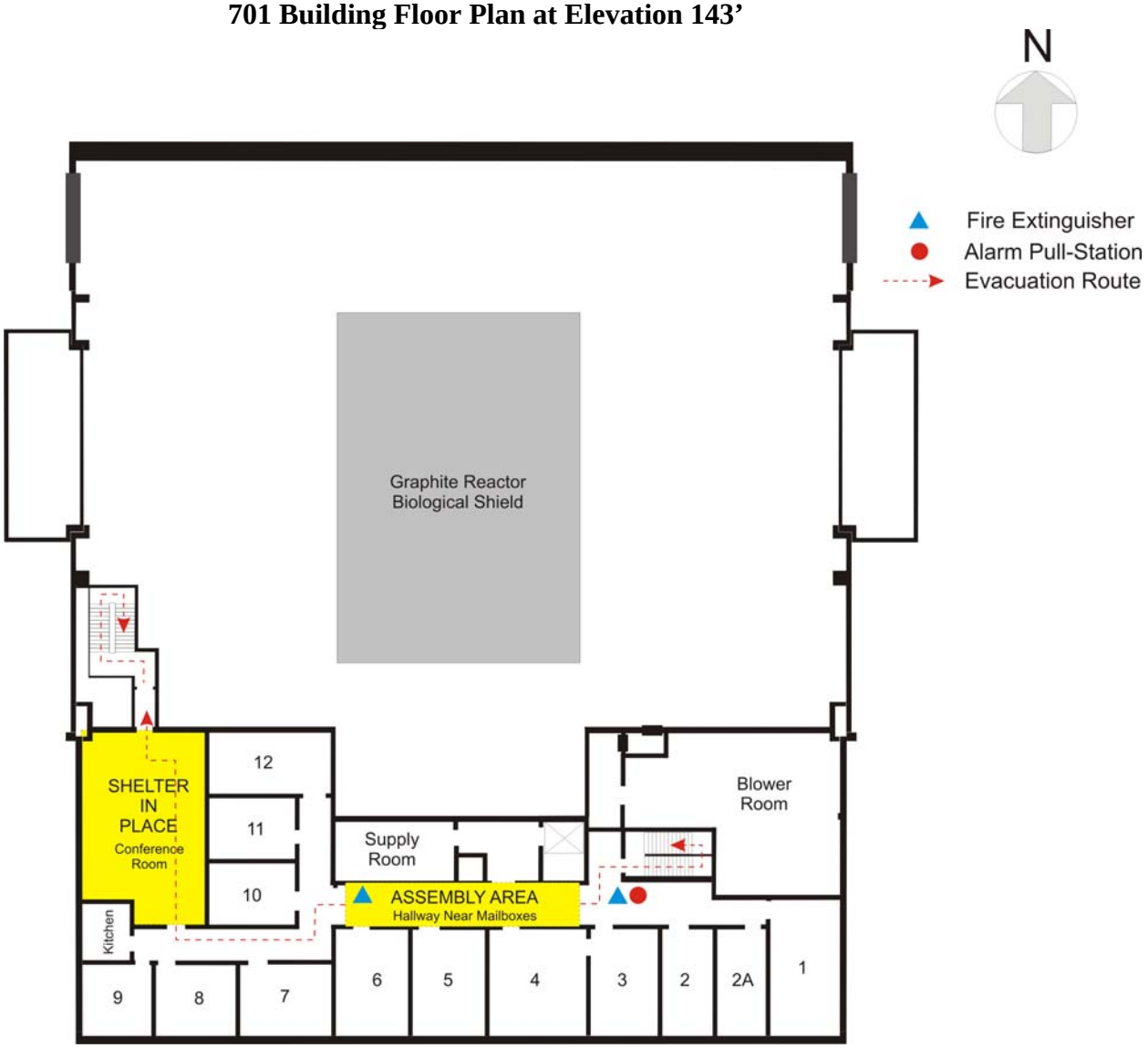
- After an actual event or incident.
- When the building is physically modified.

17.0 REFERENCES

17.1 ERP-OPM-5.6, “Emergency Response Procedure”

Attachment 1

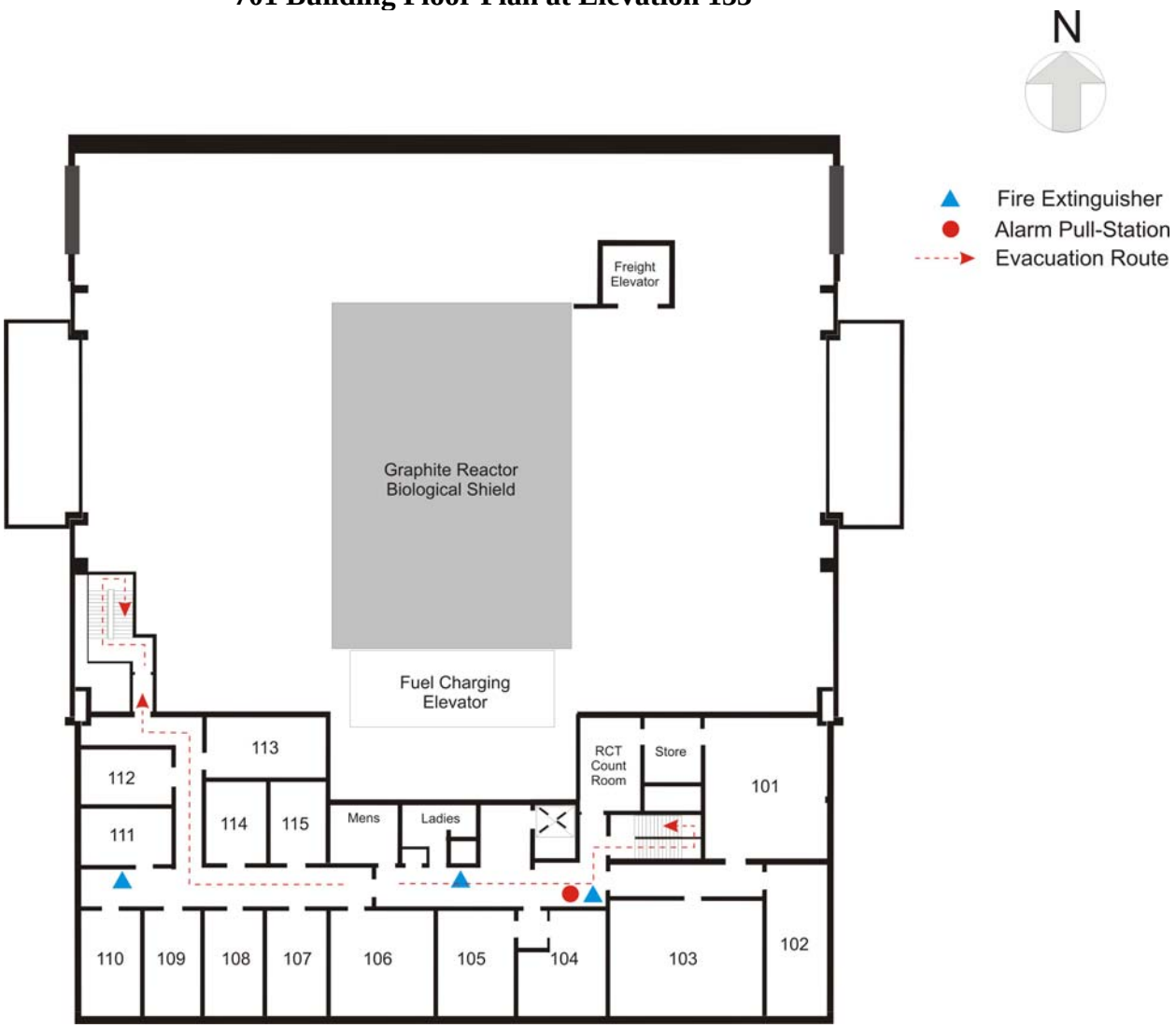
701 Building Floor Plan at Elevation 143’



Page Break

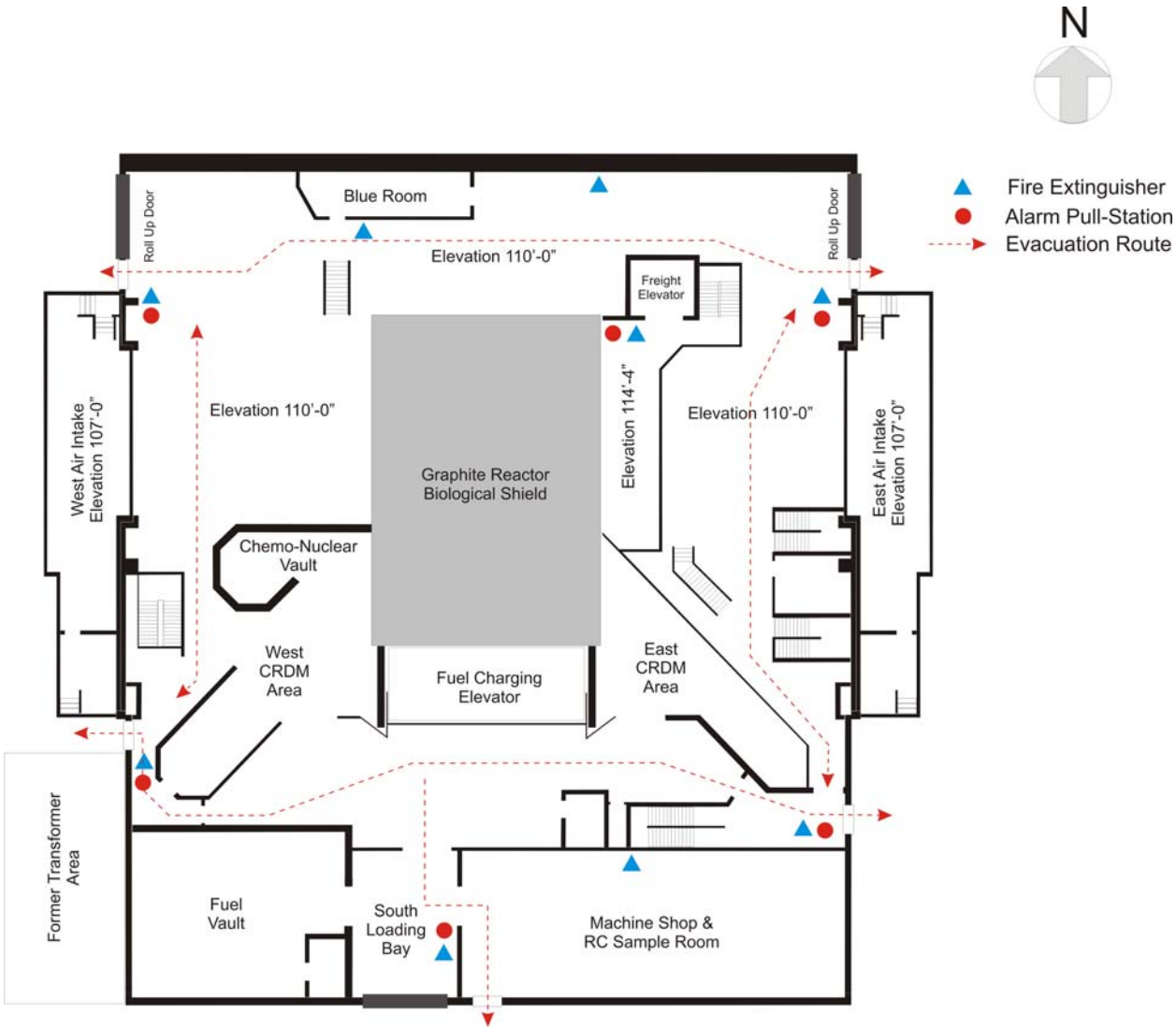
Attachment 2

701 Building Floor Plan at Elevation 133’



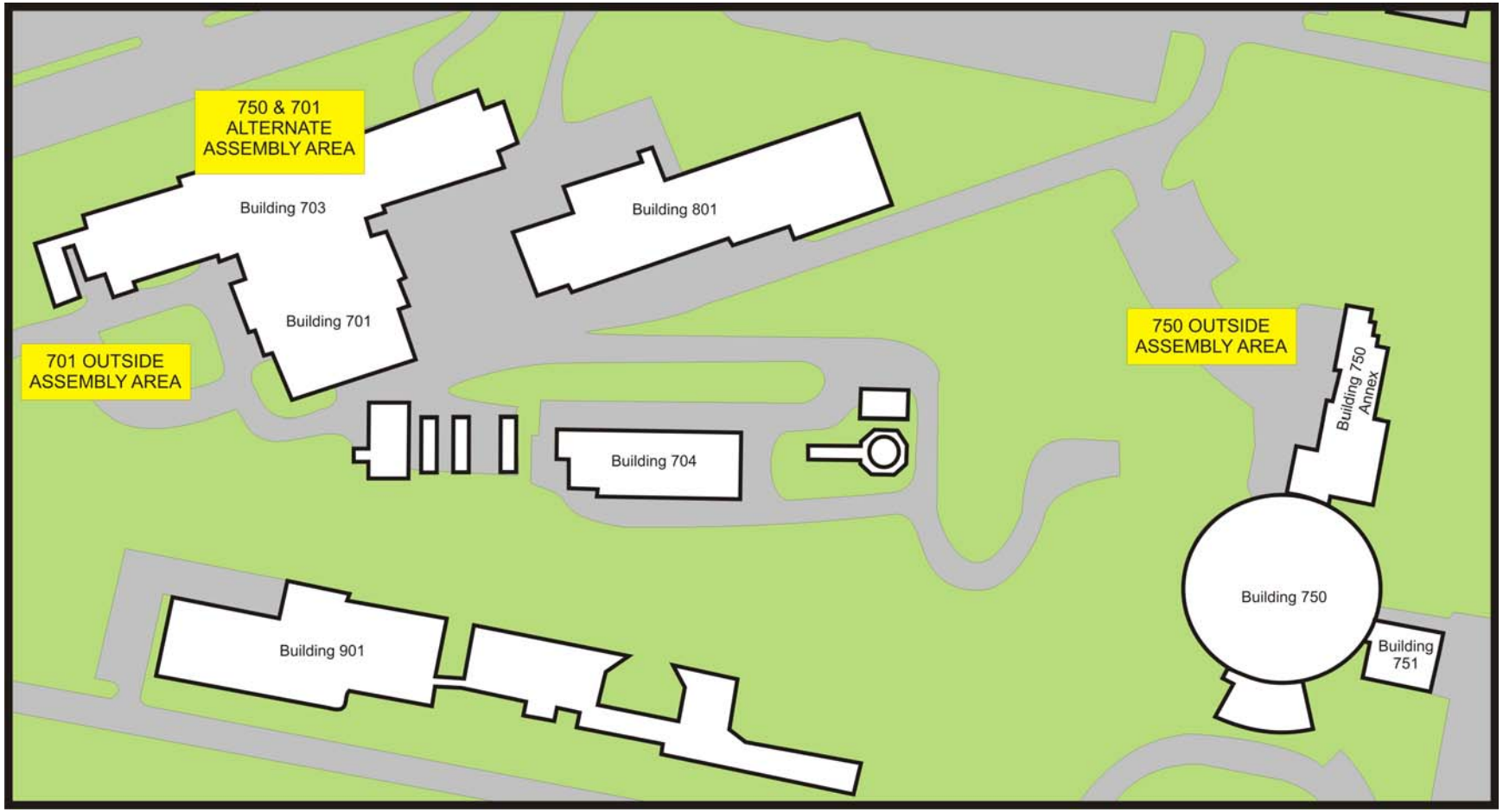
Attachment 3

701 Building Floor Plan at Elevation 110'



Attachment 4

BGRR/HFBR Outdoor Assembly Areas



ONLINE COPY – ER OPERATIONS PROCEDURES MANUAL

PLEASE CLICK HERE TO SEND READING ACKNOWLEDGEMENT EMAIL