Department of Energy
Brookhaven Site Office
P.O. Box 5000
Upton, New York 11973

JUL 13 2012

Mr. Chek Beng Ng
New York State Department of
Environmental Conservation
Division of Hazardous Waste Remediation
625 Broadway - 11th Floor
Albany, New York 12233

RECEIVED
JUL 16 2012

Mr. Jessica Mollin
Federal Facilities Section
U.S. EPA – Region II
290 Broadway – 20th Floor
New York, New York 10007-1866

Dear Mr. Ng and Ms.Mollin:

SUBJECT: BROOKHAVEN NATIONAL LABORATORY (BNL): FINAL EXPLANATION OF SIGNIFICANT DIFFERENCES (ESD) FOR AREA OF CONCERN 9, BROOKHAVEN GRAPHITE RESEARCH REACTOR (BGRR)

Enclosed for your information please find two copies of the subject document which has been approved by the United States Department of Energy and the Environmental Protection Agency (EPA), and concurred on by the New York State Department of Environmental Conservation (NYSDEC).

This ESD, along with the EPA approval and NYSDEC concurrence letters will now be placed in the Administrative Record file for the BNL site. These documents will also be made available to the public via the BNL website at http://www.bnl.gov/gpg/reports.asp.

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

Sincerely,

Frank J. Crescenzo
Acting Site Manager

Enclosures
As Stated:

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BROOKHAVEN
NATIONAL LABORATORY

U.S. DEPARTMENT OF ENERGY
BROOKHAVEN NATIONAL LABORATORY
CERCLIS NUMBER NY7890008975

FINAL AREA OF CONCERN 9
BROOKHAVEN GRAPHITE RESEARCH REACTOR
EXPLANATION OF SIGNIFICANT DIFFERENCES

April 23, 2012

Prepared by:

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for

U.S. Department of Energy
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Brookhaven National Laboratory Site
Upton, New York

1.0 Introduction

The Brookhaven Graphite Research Reactor (BGRR) decommissioning decisions at Brookhaven National Laboratory (BNL), located in Upton, Suffolk County, New York, are documented in the *Final Record of Decision for Area of Concern 9, Brookhaven Graphite Research Reactor* (BGRR ROD), approved by the U.S. Department of Energy (DOE) and the U. S. Environmental Protection Agency (EPA), with the concurrence of the New York State Department of Environmental Conservation (NYSDEC). BNL was placed on the National Priorities List in 1989 and the BGRR ROD was approved in January, 2005 and placed in the Administrative Record.

The removal of the BGRR graphite pile and the biological shield is a selected remedial action activity described in the Final Record of Decision for Area of Concern 9, Brookhaven Graphite Research Reactor. The scope of removal of the BGRR biological shield is further detailed in the Remedial Design/Remedial Action (RD/RA) Work Plan. Additional information on differences in final project scope, including differences between the final project scope and the RD/RA Work Plan, are detailed in a Remedial Design Implementation Report submitted to EPA and NYSDEC on December 23, 2011.

Any significant changes to a ROD must be publicly noticed through an Explanation of Significant Differences (ESD), as required under Section 117(c) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, and pursuant to 40 Code of Federal Regulations (CFR) Section 300.435 (c)(2)(i) (Fed.Reg. Vol. 55, No. 46 [March 8, 1990]). A significant, but not fundamental, change is proposed to the final remedy described in the BGRR ROD for the BNL Site. This ESD has been prepared to describe the proposed changes to the scope of work for removal of the BGRR biological shield; specifically the removal of the outer steel walls, the inner steel walls, and the concrete between the inner and outer walls down to the existing floor level, rather than removing the approximately three vertical feet of biological shield embedded below the existing floor.

The lead agency for this ESD is the DOE. In addition to the DOE, EPA, NYSDEC, the New York State Department of Health (NYSDOH), and the Suffolk County Department of Health Services (SCDHS) oversee the BNL Site cleanup. EPA and NYSDEC have commented on this ESD. All regulatory agency comments have been incorporated in this document.

This ESD includes a brief summary of the remedy selected in the BGRR ROD, a summary of the project work completed as of December 2011, a description of the proposed change, and a description of why DOE and the regulators are proposing to make this change to the selected remedy.

This ESD was prepared by Brookhaven Science Associates (BSA) according to EPA guidance (EPA, 1999). While 40 CFR Section 300.435(c)(2)(i) does not require a public comment period for an ESD, DOE presented the change described in this ESD to the Community Advisory Council (CAC) and the Brookhaven Executive Roundtable (BER) for the BNL site on January 12, 2012 and January 25, 2012, respectively. The CAC and BER will continue to be informed of the status of this project through completion. In addition, the approved ESD will be made available to the public via the BNL website at http://www.bnl.gov/gpg/reports.asp. The ESD and other relevant documents will become part of the Administrative Record for the BNL site. Further information on the site description and history can be found in the BGRR ROD (DOE, 2005). A notice will be published in *Newsday* that briefly summarizes this ESD.

The Administrative Record for BNL is available for review at the following locations:

Brookhaven National Laboratory Research Library
Information Services Division
Building 477A
Upton, NY 11973
Phone: (631) 344-3483

U. S. EPA – Region II Administrative Records Room
290 Broadway, 18th floor
New York, NY 10007
Phone: (212) 637-4308

Stony Brook University
Melville Library
Special Collections and University Archives
Room E-2320
Stony Brook, NY 11794
Phone: (631) 632-7119

2.0 Remedy Selected in the BGRR ROD

In 1989, the BNL site was included on EPA's National Priorities List because of soil and groundwater contamination that resulted from past operations. The DOE, EPA, and NYSDEC entered into a Federal Facilities Agreement (FFA) that became effective in May 1992, and which set the framework for the cleanup activities. The FFA is also referred to as an Interagency Agreement (IAG). The lead agency for remedial action at BNL is DOE. In addition, the SCDHS, while not a signatory to the IAG, has historically been and continues to be involved with cleanup work at BNL. To effectively manage remediation of the BNL site, 32 Areas of Concern (AOCs) were identified and divided into discrete groups called Operable Units (OUs). The BGRR was designated as AOC 9.

The BGRR biological shield and associated components are the structures that shielded personnel from radiation during the reactor's operation, and provided physical support and an airtight membrane around the BGRR graphite pile. The biological shield, which is constructed of steel and high density concrete, surrounded the graphite pile and air plenum chambers. The biological shield is 55'-0" long by 37'-6" wide by 33'-7"high. An isometric cutaway view of the BGRR biological shield is provided in Figure 1.

The biological shield wall foundations are set 3'-3" lower than the surrounding building floor. The thickness of the biological shield walls varies by location from 4'-3" to 5'-6". The outer walls are 3" thick steel plate. The east and west inner steel plates are 6" thick in the area immediately adjacent to the graphite pile location and 3" thick elsewhere. Other components of the biological shield wall include the two 3" thick steel neutron shields, the thermal shielding, and binding plates in the exhaust plenums. The estimated weight of the biological shield is 9,422,000 lbs, which is made up of 2,022,000 lbs of steel and 7,400,000 lbs of high density concrete.

Extensive characterization of the BGRR complex to determine the nature and extent of radiological and non-radiological contamination was conducted prior to beginning of demolition. The characterization included direct sampling for hazardous and radiological contaminants and isotopic analyses of activated components, contaminated surfaces and debris. Characterization results relative to the biological shield are documented in the following reports:

- *Characterization Report for Building 701/702 Below-ground Structures, Pile and Remaining Soils* (BSA, January 2003); and

- *Characterization Report for Building 701 Above-ground Surfaces, Systems and Structures* (BSA, November, 2002).

As reflected in the ROD, characterization results from these two studies indicated that the biological shield contained approximately 4,805 Curies (Ci) of radioactivity. The structural materials of the biological shield were volumetrically activated at varying levels based on their relative position to the neutron flux generated within the reactor. Characterization results indicated that almost the entire radiological inventory was confined to the inner one-third of the steel-encased biological shield walls. The isotopic inventory within the biological shield consists of Nickel-63 (1,945 Ci), Hydrogen-3 (tritium; 1,648 Ci), Cobalt-60 (871 Ci), Iron-55 (189 Ci), Calcium-41 (108 Ci), Carbon-14 (31 Ci), and Nickel-59 (13 Ci). Although later characterization suggested a lower radiological inventory, these were the figures which were documented in the ROD.

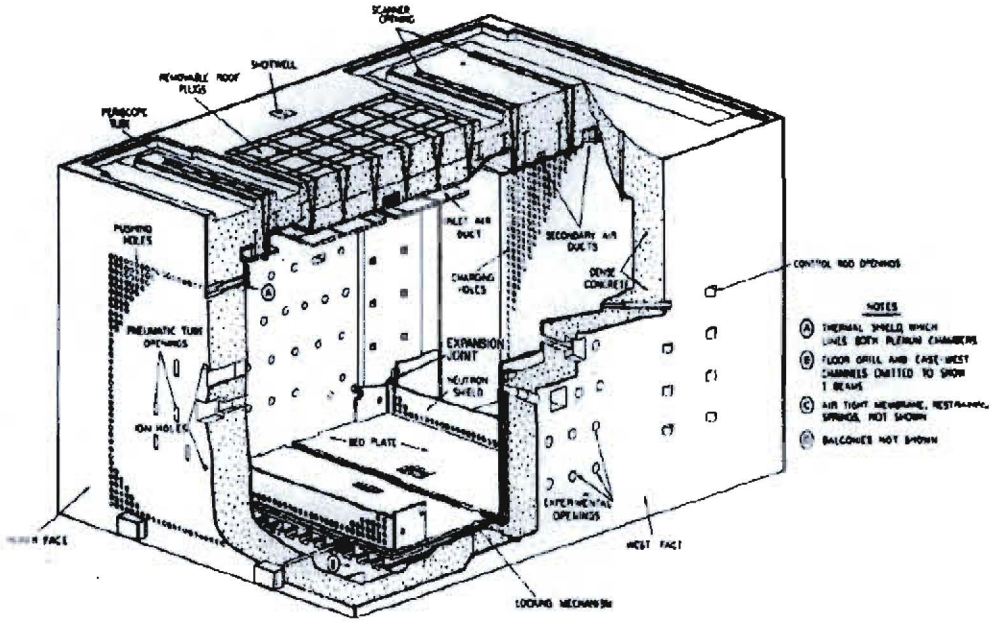

Figure 1

BGRR Biological Shield Isometric Cutaway View

3.0 Project-to-Date Summary

In preparation for removal of the graphite pile, the east and west reactor cooling air intake plenums and the void space beneath the lower graphite pile bedplates were filled with a concrete grout to prevent the graphite blocks and debris from falling into these inaccessible areas. Placement of this grout was topped at the bottom surface of the lower pile bedplates (Figure 2). BSA completed the removal of the graphite pile in 2010, and immediately commenced preparations for the removal of the biological shield.
In preparation for the removal of the biological shield, 3-inch thick steel plates were placed over the upper pile bedplates to reduce the radiological dose to the workers who would be exposed during the setup and operation of the torch-cutting and concrete breaking equipment. These steel plates were secured in place with a concrete grout similar to that used in grouting the intake plenums.

During initial phases of the biological shield removal project, a remote-operated, rail-mounted excavator with a hydraulic breaker hammer was utilized to break the concrete on the roof and sidewalls. Once the roof had been removed, and removal of the sidewalls was in progress, it became evident that this excavator/hammer unit lacked sufficient force to break the high-density concrete effectively enough to support the project schedule. The decision was made to deploy a larger excavator/hammer unit which would be capable of breaking the concrete in the walls at a higher rate. Once the new unit was selected, it was determined the building floor as well as the floor area within the footprint of the biological shield required reinforcement to support the machine, which weighed over 35 tons. To accomplish this, the void areas beneath the Building 701 high bay area outside of the biological shield footprint were filled with cementious grout, and steel plates were placed atop this floor surface to evenly spread the load of the new excavator/hammer unit. To strengthen the floor area within the

biological shield footprint, the north and south outlet air plenums were filled with reinforced concrete. This configuration not only provided a solid, void-free surface on which to operate the new excavator, it provided additional shielding which allowed workers (including the excavator operator) to enter the interior of the biological shield for the first time in the project to perform tasks that had previously been inefficiently accomplished by remote means.

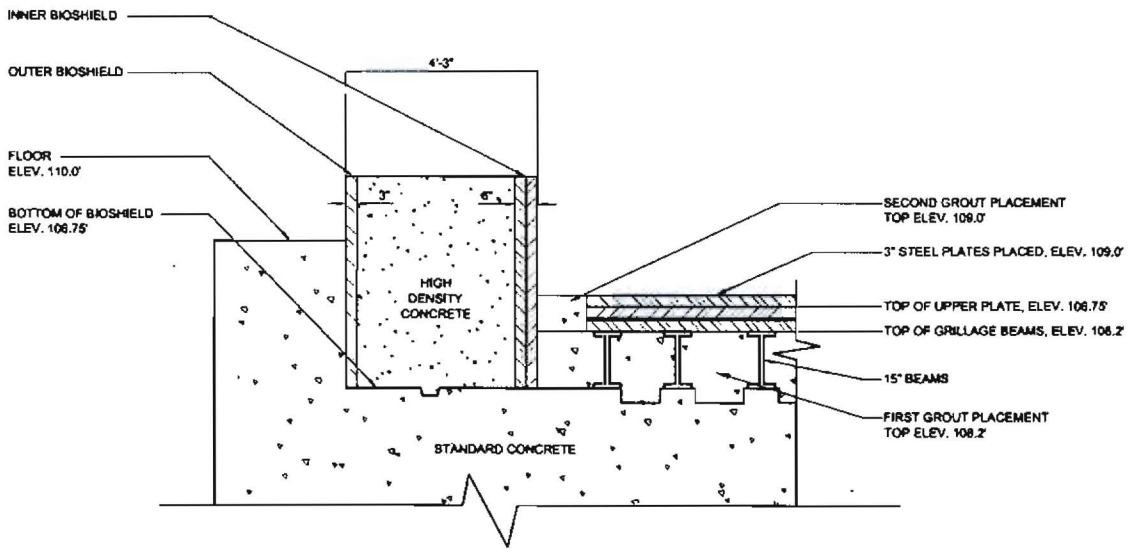

Figure 2

Section View of Biological Shield During Removal Activities (Typical for North, West & South Walls - Similar for East Wall)

4.0 Description of the Significant Difference and the Basis for the Difference

The BGRR ROD, Section 10, Selected Remedy, states "Removal of the biological shield will include the removal of the neutron shields and the steel-encased concrete walls." As stated above, the steel-encased concrete walls have a height of 33'-7" and their foundations are seated at 3'-3" below the building floor level.

DOE proposes a completed end state which is different than that described in the Selected Remedy. Removal of the biological shield inner steel wall and concrete structure will take place at least to the existing Building 701 floor level. This change would leave approximately 650,000 lbs of concrete (approximately 8.8% of the biological shield concrete by weight) and 80,000 lbs of activated steel (approximately 4.0% by weight) in the foundation of the walls, with a total residual activity of approximately 1.1 Curies. In addition, one of the two remaining steel bed plates that supported graphite pile and was planned to be removed will remain in place containing approximately 9.8 Curies. This remaining activity is additional to the amount specified in ROD (2005) for the end state of selected remedy. Approximately 80 – 90% of this additional activity is attributed to Ni-63 decay with the remainder due to the decay of Am-241, Co-60, Fe-55 and other radionuclides. The outer steel walls, which are free of radiological activation, will also be removed to the existing floor level, leaving the foundation below the floor. The portion of the biological shield foundation remaining below the building floor will be protected beneath a reinforced concrete cover. The steel plates that were placed over

the pile bedplates and cementious grout installed during the removal activities will also remain in place beneath the reinforced concrete cover. This will provide for a structurally stable long-term configuration, with no void spaces, no pathway to groundwater for radioactive contaminants, and radiological dose rates less than 0.1 milliRem per hour (mR/hr). This change in end state does not affect the planned long-term surveillance and maintenance activities for Building 701.

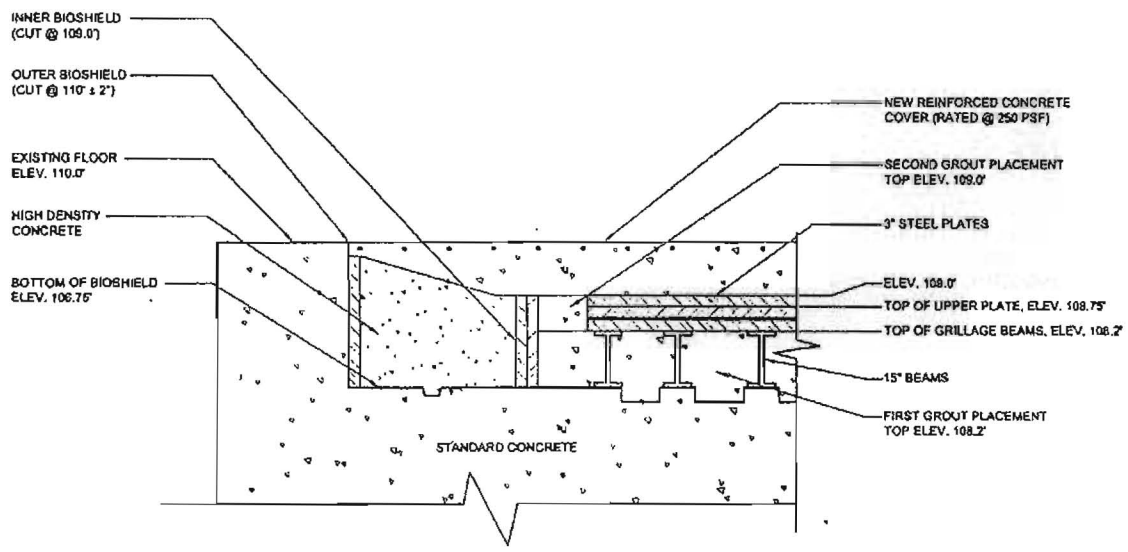

Figure 3

Section View of Proposed End State
(Typical for North, West & South Walls)

With regard to the BGRR's radiological end state, the ROD, Section 11.1, Protection of Human Health and the Environment, states, "This remedy removes over 99 percent of the radioactive material at the BGRR complex." The total Curie content of the BGRR as stated in the ROD was 8093 Ci: 3239 Ci in the graphite pile, which has been completely removed, 4805 Ci in the biological shield, and 49 Ci in miscellaneous other features of the facility, including contaminated soils. The proposed change will leave 1.11Ci in the below-grade foundation of the biological shield and 11.2 Ci in the graphite pile bedplates. Overall, the proposed remedy will remove over 99.8% of the radioactive material at the BGRR complex.

The change in the removal scope for the BGRR biological shield does not affect the desired end state for the BGRR. The intent of Alternative C in the BGRR ROD is met; and the radiological end points will be achieved. Implementation of the change described in this ESD will result in reduced project cost, reductions in radioactive waste volumes requiring off-site disposal, and reductions in radiation doses to workers who would otherwise be removing the lowermost section of the biological shield.

5.0 Public Participation and Regulatory Agency Comments

In a February 8, 2012 e-mail, the NYSDEC indicated that they had no comment on the Draft ESD. EPA provided verbal and email comments on the Draft ESD January 25, 2012 and February 9, 2012, respectively. Responses to comments were provided to the regulators as well as a Draft Final ESD. All regulatory comments have been incorporated into this final document.

Per EPA's CERCLA guidance, a formal public comment period is not required as part of the submission of an ESD for regulator review and approval. However, BSA did brief the Community Advisory Council on January 12, 2012. The Community Advisory Council (CAC) represents a diverse range of interests and values of individuals and groups who are interested in or affected by the actions of the Laboratory. The CAC consists of representatives from 25 local business, civic, education, activist, environment, employee, emergency, and health organizations. DOE briefed the Brookhaven Executive Roundtable (BER) on January 25, 2012. The BER was formed in 1997 to provide a forum for ongoing executive-level communication about Brookhaven National Laboratory (BNL). The BER membership represents the major stakeholders associated with BNL, including:

- The owner, the U.S. Department of Energy
- The management-and-operations contractor, Brookhaven Science Associates
- Jurisdictional, regulatory, oversight, community and elected interests

The CAC and BER will continue to be updated on the project status.
A notice will be published in *Newsday* that briefly summarizes the BGRR ESD. The ESD will be made available on the BNL website at http://www.bnl.gov/gpg/reports.asp. In addition, the ESD and other relevant documents will become part of the Administrative Record for the BNL site. These documents are available for review at the BNL Research, EPA Region II, and the Stony Brook University libraries.

6.0 Affirmation of Statutory Determinations

Considering the new information that has been developed, DOE, EPA, and NYSDEC have determined that the remedy selected for the BGRR remains protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to this remedial action, and is cost-effective. In addition, this remedy utilizes permanent solutions to the maximum extent practicable for this site.

DOE, EPA, and NYSDEC believe that a change in the scope of the remedy has occurred, as specified in Section 4.0 of this ESD. Nevertheless, the agencies believe that this change does not fundamentally alter the remedy selected in the BGRR ROD or its appropriateness.

The State of New York concurs with the ESD.

AUTHORIZING SIGNATURES

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Michael D. Holland, Site Manager
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Brookhaven Site Office
Office of Science

04/20/12
Date

Jack Craig, Director
U.S. Department of Energy
EM Consolidated Business Center
Office of Environmental Management

4/23/12
Date

Walter E. Mugdan, Director
Emergency and Remedial Response Division
U.S. Environmental Protection Agency – Region 2

6.21.12
Date

7.0 References

BSA, 2002

Characterization Report for Building 701 Above-ground Surfaces, Systems and Structures, November 2002.

BSA, 2003

Characterization Report for Building 701/702 Below-ground Structures, Pile and Remaining Soils, January 2003.

DOE, 2005

Final Record of Decision for Area of Concern 9, Brookhaven Graphite Research Reactor (BGRR), January 31, 2005.

BSA, 2008

Remedial Design/Remedial Action Work Plan for the Biological Shield Removal, March 28, 2008.

BSA, 2011

Environmental Restoration Projects Remedial Design Implementation Report, December 21, 2011.

USEPA, 1999

A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents, July, 1999.