



**U.S. DEPARTMENT OF ENERGY  
BROOKHAVEN NATIONAL LABORATORY  
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**FINAL OPERABLE UNIT III  
EXPLANATION OF SIGNIFICANT DIFFERENCES  
FOR  
AREA OF CONCERN 32  
BUILDING 452 FREON-11 SOURCE AREA AND  
GROUNDWATER PLUME**

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FINAL OU III Explanation of Significant Differences  
For Area of Concern 32  
Building 452 Freon-11 Source Area and Groundwater Plume

Brookhaven National Laboratory Site  
Upton, New York

**Introduction**

The groundwater cleanup decisions at Brookhaven National Laboratory (BNL), located in Upton, Suffolk County, New York, are documented in the Operable Unit III Record of Decision (OU III ROD) which has been approved by US Department of Energy (DOE) and the US 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 OU III ROD was approved and placed into the Administrative Record in June 2000.

Following the 2011 discovery and characterization of a Trichlorofluoromethane (known by the trade name Freon-11) groundwater plume in the vicinity of BNL Building 452, the DOE, EPA and the NYSDEC have determined that the proposed remedial actions will be documented as an Explanation of Significant Differences (ESD) under the OU III ROD (DOE 2011). In accordance with Section X.D of the BNL Interagency Agreement, the Building 452 Freon-11 Source Area and Groundwater Plume have been designated Area of Concern (AOC) 32.

Any significant changes to the OU III ROD must be publicly noticed through an 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) (Federal Register Vol. 55, No. 46 [March 8, 1990]), an ESD is required because a significant, but not fundamental change is proposed to the final remedy described in the OU III ROD. This ESD has been prepared to describe the proposed treatment of the Building 452 Freon-11 Source Area and Groundwater Plume, which is located entirely within OU III. This action will enable BNL to achieve the OU III ROD cleanup objective of meeting drinking water standards for volatile organic compounds (VOCs) within the Upper Glacial aquifer by 2030 and to prevent or minimize further migration of VOCs in groundwater.

The lead regulatory 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 clean up and 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 OU III ROD, a description of the proposed change, and a description of why DOE and the regulatory agencies are proposing to make this change to the selected remedy.

This ESD was prepared for DOE by Brookhaven Science Associates, LLC (BSA) according to EPA guidelines (EPA, 1999b). While 40 CFR Section 300.435(c)(2)(i) does not require a public comment period for an ESD, DOE has informed the public about the change described in this ESD, including presentations to the Brookhaven Executive Roundtable (BER) on September 28, 2011, and the BNL Community Advisory Council (CAC) on October 13, 2011 and January 12, 2012. 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, such as the OU III Area of Concern 32 Building 452 Freon Plume Remediation System Project Work Plan and Design Report (BNL, 2012), will become part of the Administrative Record file for the BNL site. Further information on the site description and history can be found in the OU III ROD (DOE, 2000), the 2005 ESD that addressed a remedy for the Magothy aquifer, changes to the strontium-90 remedies and the closeout of the Building 96 geophysical anomalies (DOE, 2005), and the 2009 ESD that addressed soil remediation at Building 96 (DOE, 2009). A notice will also 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, 18<sup>th</sup> 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

## **Remedy Selected in the OU III 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 then entered into a Federal Facilities Agreement (FFA) that became effective in May 1992 that 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 FFA, has historically been and continues to be involved with cleanup work at BNL. To effectively manage remediation of the BNL site, the identified AOCs were divided into discrete groups called Operable Units (OUs). The BNL site is divided into six OUs. OU III was developed to address groundwater contamination in the central and southern portion of the site and in the areas beyond the BNL property line where groundwater contamination has migrated. In 2011, the Building 452 Freon-11 Source Area and Groundwater Plume were designated as AOC 32.

The 1999 Remedial Investigation and Feasibility Study for OU III identified groundwater contaminated with VOCs on BNL property and outside the BNL property. The OU III ROD establishes the cleanup decisions for several groundwater contamination plumes at BNL. The cleanup objectives included in the OU III ROD to address the VOC contamination are:

- Meet the drinking water standards in groundwater in the Upper Glacial aquifer for VOCs in 30 years (by 2030) or less, and
- Prevent or minimize further migration of VOCs in groundwater.

The OU III ROD specifies the use of source controls and several different groundwater pump and treat technologies (air stripping, in-well air stripping, granulated activated carbon, etc.) in combination with monitored natural attenuation to achieve the cleanup objectives. The remedy being proposed for the Freon-11 plume does not alter the scope of the original OU III remedy.

## **Description of the Significant Differences and the Basis for the Differences**

The Freon-11 detected in the groundwater near Building 452, a site maintenance facility, was released to the environment after the OU III ROD was finalized in 2000. To date, the highest concentration of Freon-11 detected in the plume was 38,000 micrograms per liter ( $\mu\text{g/L}$ ). The New York State Ambient Water Quality Standard for Freon-11 is 5  $\mu\text{g/L}$ . Low levels ( $<10 \mu\text{g/L}$ ) of Freon-11 are also detected in extraction well RTW-1, which is used to remediate the northern portion of the former Building 96 Tetrachloroethylene (PCE) plume (AOC 26B). The physical location of the Freon-11 plume is between the Building 96 plume and the former location of the Carbon Tetrachloride plume and is fully contained within the boundaries of OU III. The Carbon

Tetrachloride Treatment System recently underwent decommissioning after completing its cleanup objective.

Due to the high levels of Freon-11 detected in groundwater and the extent of the plume, active remediation of the plume is required to ensure that the OU III ROD cleanup objectives are met. To achieve the cleanup objectives, operation of newly installed extraction well EW-18 and the use of existing Building 96 Groundwater Treatment System extraction well RTW-1 will be needed to maintain hydraulic control and remediate the plume (DOE, 2012a). The high concentration segments of the Freon-11 plume will be captured by extraction well EW-18, while the lower concentration, downgradient segments of the plume will be captured by RTW-1. The treatment system began start-up testing in March 2012. Groundwater from extraction well EW-18 is treated using an air stripper tray system located in a new treatment building located adjacent to the existing treatment building for RTW-1 (**Figure 1**). Groundwater from extraction well RTW-1 is also treated using a tray air stripper system. The treated water from both groundwater treatment systems is discharged to a nearby stormwater culvert which leads to BNL recharge basin HS, where the water is recharged back into the Upper Glacial aquifer (**Figure 2**). The discharge from the Building 96 treatment system is regulated under a NYSDEC State Pollutant Discharge Elimination System (SPDES) equivalency permit. This permit has been modified to include Freon-11 as a discharge monitoring parameter (NYSDEC, 2012a). The discharge from the new Freon-11 treatment system is regulated under a separate SPDES equivalency permit (NYSDEC, 2012a). Review of the potential atmospheric emissions following the New York State air emissions modeling (DAR-1) process shows that the release of Freon-11 from this system will not pose short-term or long-term impacts (DOE, 2012b; DOE, 2012c). The atmospheric discharges are regulated under a NYSDEC air equivalency permit. In addition to operating the groundwater remediation system, DOE will evaluate the extent of residual Freon-11 contamination in the vadose (unsaturated) zone soils above the water table in the Building 452 source area, as well as continue to monitor the wells immediately downgradient of the source area. This ESD will include source controls/remediation, if they are deemed necessary to meet the cleanup objectives.

Groundwater modeling indicates that the Building 452 Freon-11 plume can be successfully remediated in approximately 2-5 years from system start-up. This timeframe is based upon the assumption that there is no longer a significant continuing release of Freon-11 into the groundwater at the Building 452 source area. Based upon this timeframe, neither the existing OU III treatment goals nor performance period in the OU III ROD would be modified by this ESD. A Freon-11 capture goal of 50 µg/L will be the basis for determining shutdown of extraction wells EW-18 and RTW-1.<sup>1</sup> Shutdown determinations will be based upon the Freon-11 concentrations detected in individual monitoring wells at the source area and within the capture zone of each extraction well, as well as Freon-11 concentrations detected in the extraction wells. Active treatment becomes increasingly less efficient as the level of contaminants diminish. The 50 µg/L capture goal is consistent with the operation and maintenance manual exit strategy

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<sup>1</sup> The decision to shutdown extraction well RTW-1 will also be based upon meeting the cleanup objectives defined in the Building 96 O&M Manual (BNL, 2009).

criteria of 50 µg/L total volatile organic compound (TVOC) concentrations used for most of the other groundwater treatment systems at BNL. A petition for shut down of the treatment system will be submitted to the regulatory agencies for approval. Following the period of active treatment, reduction in Freon-11 concentrations to less than the 5 µg/L maximum contaminant level (MCL) will be accomplished by monitored natural attenuation. The primary natural attenuation mechanism for the remaining Freon-11 would be dispersion in the aquifer. The Freon-11 plume will continue to be monitored until the MCL is met, and there are no indications of a rebound in Freon-11 concentrations near the source area. The use of monitored natural attenuation as a follow-up to active remediation is consistent with EPA directives (EPA, 1999a). Additional measures will be taken, in conjunction with the regulatory agencies, if monitoring results indicate that Freon-11 concentrations in groundwater could exceed the 5 µg/L MCL beyond the BNL site boundary. Implementation of these measures, if necessary, is included in the scope of this ESD. Groundwater data will be evaluated and reported annually in the Groundwater Status Report and during CERCLA Five-Year Reviews, both of which are made available to the public.

Because of the high levels of Freon-11 detected in groundwater, in May 2011 air samples were collected inside Building 452 and several exterior areas. Freon-11 was not detected in any of the air samples. Additional soil vapor intrusion evaluations will be conducted upon change of use of the building, if another building is constructed where Building 542 is currently located, or if a building is constructed at a location within the footprint of the Freon-11 groundwater plume. This is consistent with the groundwater controls identified in the BNL Land Use Controls Management Plan.

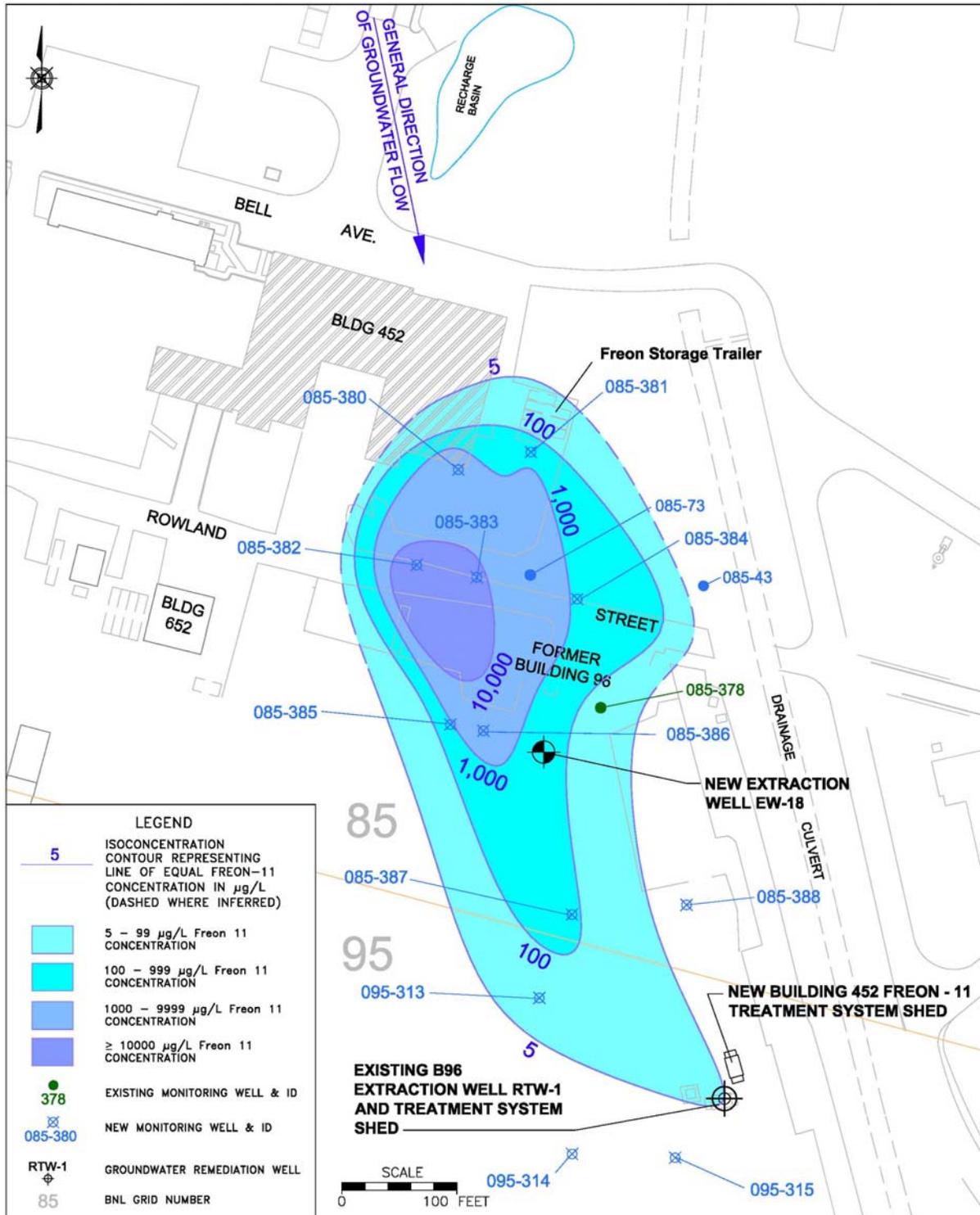
**Table 1** below provides a summary of the proposed changes described in this ESD to the remedies defined in the OU III ROD.

**Table 1. Significant Differences between Current and Proposed OU III Remedy**

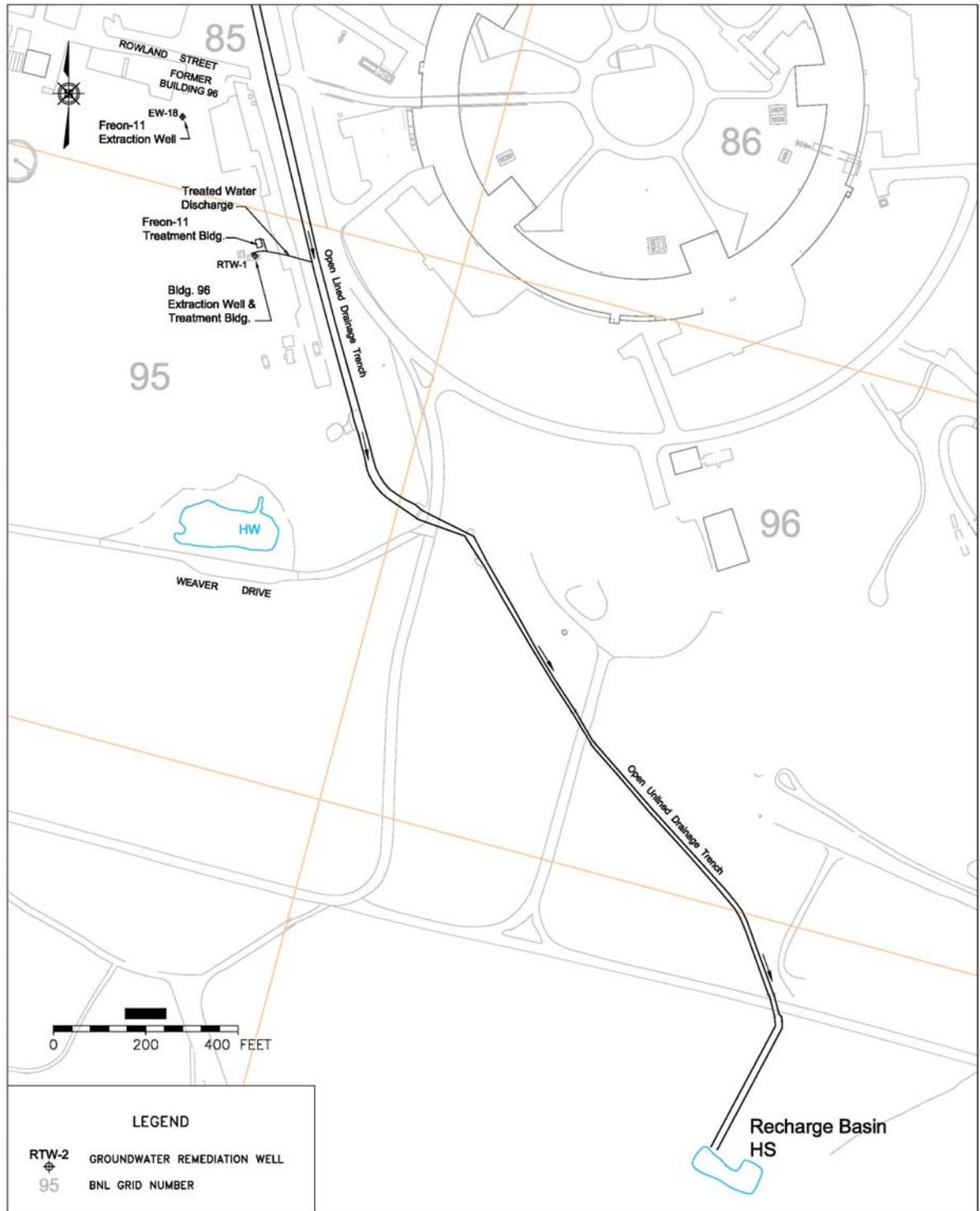
<b>Item</b>	<b>Current (2000 ROD)</b>	<b>Proposed (ESD)</b>
Scope	Pump and treat using extraction wells, air stripping, and activated carbon filtration for VOCs.	Pump and treat using one new extraction well (EW-18) and air stripping system, and the continued use of Building 96 extraction well RTW-1 and treatment system. Source control, if necessary.
Performance	Identification of Freon-11 contamination does not meet OU III cleanup objectives.	OU III cleanup objectives would be met with the new Freon-11 treatment system.
Cost	The capital cost in the OU III ROD for the selected VOC remedy is \$10.5M*	Additional \$300K to construct a new groundwater treatment system, and \$125K in annual operating costs.

\* \$10.5M capital cost identified in the ROD for the entire OU III VOC treatment remedy.

**Figure 1. Location of Building 452 Freon-11 Groundwater Plume During 2011, Monitoring Wells and Extraction Wells.**



**Figure 2. Flow Schematic for Treated Water Discharges.**



## **Public Participation and Regulatory Agency Comments**

The EPA and NYSDEC reviewed and provided comments on the draft ESD (EPA, 2012; NYSDEC, 2012b). Responses to all regulatory agency comments have been incorporated into this final document.

While 40 CFR Section 300.435(c)(2)(i) does not require a public comment period for an ESD, BNL/DOE briefed the BER (a forum for frequent, routine, and executive level communications about BNL) on September 28, 2011 and the CAC (a group who advises the Laboratory Director on environment, health, and safety issues that are important to the community) on October 13, 2011 and January 12, 2012. Furthermore, DOE did not recommend a public comment period because: 1) the Building 452 Freon-11 plume is located entirely within the central portion of the BNL site; 2) there is no direct exposure risk to the public; 3) the plume can be hydraulically controlled with the new treatment system; and 4) neither the existing OU III cleanup objectives nor performance period would be modified by this ESD.

A notice will be published in *Newsday* that briefly summarizes the Building 452 Freon-11 Groundwater Plume ESD. The ESD will be made available on the BNL website at <http://www.bnl.gov/gpg/reports.asp>. The ESD and other relevant documents such as the OU III Area of Concern 32 Building 452 Freon Plume Remediation System Project Work Plan and Design Report (BNL, 2012) will become part of the Administrative Record file for the BNL site. The Administrative Record includes, among other things, the ROD and technical documents. These documents are available for review at the BNL Research Library, EPA Region II Administrative Records Room, and the Stony Brook University Library.

## **Affirmation of Statutory Determinations**

Considering the new information that has been developed, DOE, EPA, and NYSDEC have determined that the remedy selected for the Building 452 Freon-11 Groundwater Plume is 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 and alternative treatment technologies to the maximum extent practicable for this site.

DOE, EPA, and NYSDEC believe that a change in the scope of the remedy has occurred in which a determination was made for the need for active remediation of the Building 452 Freon-11 Groundwater Plume. Nevertheless, the agencies believe that this change does not fundamentally alter the remedy selected in the OU III ROD or its appropriateness.

The State of New York concurs with the ESD.



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New York State Department of Environmental Conservation (2012a). Letter from C.B. Ng to M.D. Holland titled: *Brookhaven National Laboratory (BNL) Request for a Renewal/Application of the State Pollutant Discharge Elimination System (SPDES) Equivalency Permit for Building 96 Groundwater Treatment Well RTW-1, Building 452 Freon-11 Groundwater Treatment System and Air Equivalency Permit Application for Building 452 Freon-11 Groundwater Treatment System.* March 21, 2012.

New York State Department of Environmental Conservation (2012b). Letter from C.B. Ng to M.D. Holland titled: *Brookhaven National Laboratory, Site ID: 152009 Operable Unit III Draft Explanation of Significant Differences (ESD) for Building 452 Freon-11 Source Area and Groundwater Plume.* April 19, 2012.

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U.S. Department of Energy (2012c). Letter from M. Holland (DOE) to M. Genece (NYSDEC) titled: *Brookhaven National Laboratory Operable Unit III Air Equivalency Permit Application for the Building 452 Freon-11 Groundwater Treatment System.* January 24, 2012.