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

Mr. Doug Pocze
Federal Facilities Section
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U.S. EPA - Region II
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New York, New York 10007-1866

Mr. Chek Beng Ng
New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway -11th Floor
Albany, New York 12233-7015

Dear Mr. Pocze and Mr. Ng:

SUBJECT: BROOKHAVEN NATIONAL LABORATORY (BNL) HIGH FLUX BEAM REACTOR (HFBR) DRAFT ACTION MEMORANDUM: REMOVAL AND DISPOSAL OF CONTROL ROD BLADES AND BEAM PLUGS

Attached for your information are two copies of the HFBR Action Memorandum: Removal and Disposal of Control Rod Blades and Beam Plugs. This Action Memorandum was developed in accordance with the Department of Energy (DOE) Office of Policy and Assistance guidance on Non-Time-Critical (NTC) Removal Actions. The guidance on NTC Removal Actions requires Brookhaven to perform a site evaluation, engineering evaluation/cost analysis, removal action and a closeout. The HFBR Project has extensive site characterizations which have been shared with the regulators during Core Team meetings and documented in a Focused Feasibility Study (FFS). The FFS included detailed information regarding engineering evaluations and cost analyses for the four proposed alternatives identified in the Proposed Remedial Action Plan and the draft Record of Decision (ROD). A Remedial Action Remedial Design Work Plan will be developed for your review after the ROD has been approved. A completion report for the activities specified in the Action Memorandum will be generated and submitted to the regulators.

If you have any questions please contact George Cava or Lloyd Nelson of my staff at (631) 344-3429 and (631) 344-5225, respectively.

Sincerely,

Donald A. Pfister, P.E.
Federal Project Director
Office of Environmental Management

Enclosures:
As Stated

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ACTION MEMORANDUM

HIGH FLUX BEAM REACTOR REMOVAL ACTION FOR CONTROL ROD BLADES AND BEAM PLUGS

July 2008

Prepared by:
Brookhaven National Laboratory
Brookhaven Science Associates

Prepared for:
U.S. Department of Energy
Brookhaven Site Office
Upton, New York 11973

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ACRONYMS, ABBREVIATIONS, AND UNITS OF MEASURE

ALARA	As Low As Reasonably Achievable
ARAR	Applicable or Relevant and Appropriate Requirements
BNL	Brookhaven National Laboratory
BP	Beam Plug
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act.
CFR	Code of Federal Regulations
CRB	Control Rod Blade
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
HWMF	Hazardous Waste Management Facility
NEPA	National Environmental Policy Act
NTS	Nevada Test Site
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PRAP	Proposed Remedial Action Plan
RDIP	Remedial Design Implementation Plan
ROD	Record of Decision
SCDHS	Suffolk County Department of Health Services
S&M	Surveillance and Maintenance
WLA	Waste Loading Area

I. PURPOSE

The purpose of this Action Memorandum is to document the decision by the U.S. Department of Energy (DOE) to complete the removal and disposal of the High Flux Beam Reactor (HFBR) control rod blades (CRBs) and beam plugs (BPs).

In consultation with the U.S. Environmental Protection Agency (EPA), New York State Department of Environmental Conservation (NYSDEC), New York State Department of Health (NYSDOH), and Suffolk County Department of Health Services (SCDHS), DOE developed a Proposed Remedial Action Plan (PRAP) for the HFBR Complex that summarized the evaluation of four remedial alternatives. The public comment period for the PRAP began on January 10 and concluded on March 17, 2008. DOE addressed the comments received, and a draft Record of Decision (ROD) including a responsiveness summary is being prepared for review by the regulators.

Given the considerable regulatory and community support for DOE's preferred remedial alternative (Alternative C, Phased Decontamination and Dismantlement with Near-Term CRB Removal), DOE has decided to expedite the removal and disposal of the CRBs and BPs (containing 35 percent of the current HFBR radioactive material inventory) by exercising its removal action authority. Accordingly, the decision to proceed with the removal and disposal of the CRBs and BPs is being documented in this Action Memorandum.

Expediting this action will allow DOE to take advantage of the availability of shipping casks and disposal sites. Certified casks have been purchased at discounted prices because their licenses (Certificates of Compliance) are set to expire on October 1, 2008. As these casks are equipped with robust shielding, only two shipments of CRBs will be required. The shipping casks with the CRBs will be disposed of at DOE's Nevada Test Site (NTS), greatly simplifying cask handling and disposal operations at NTS.

II. SITE CONDITIONS AND BACKGROUND

A. Site Description and History

BNL is owned by the U.S. Department of Energy, one of the 17 DOE national laboratories. BNL conducts research in the physical, biomedical, and environmental sciences, as well as in energy technologies and national security. The Laboratory also builds and operates major scientific facilities available to university, industry, and government researchers.

BNL is located in Suffolk County on Long Island, about 60 miles east of New York City. Approximately 1.4 million people reside in Suffolk County and approximately 450,000

reside in Brookhaven Township, within which BNL is situated. The BNL site covers almost 5,300 acres, much of which is wooded. BNL has operated since 1947 as a research facility for national science and technology programs, and is expected to continue this mission for the foreseeable future.

Most BNL facilities are located near the center of the site in a developed portion that covers about 1,700 acres. The HFBR Complex is within this central portion of the BNL property. The complex covers about 13 acres, which is less than one-hundredth of the overall BNL site.

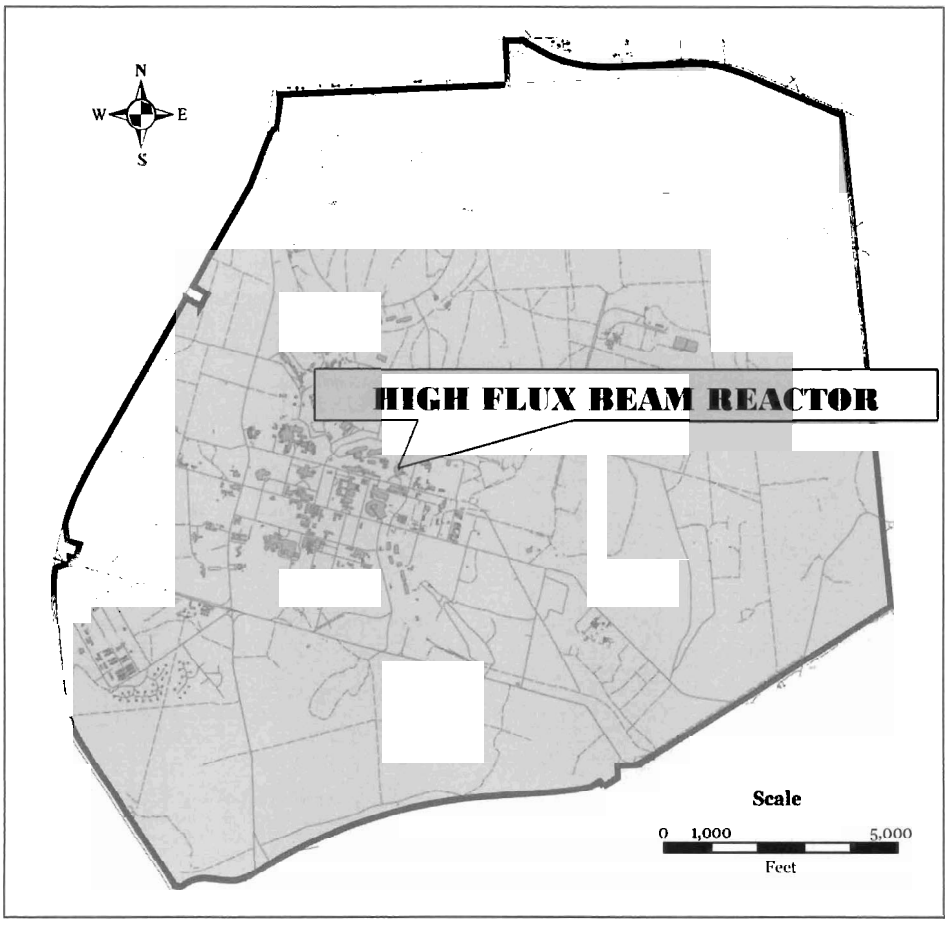

Figure 1. Location of High Flux Beam Reactor on BNL Property

The HFBR operated from 1965 to 1996 and was used solely for scientific research, providing neutrons for materials science, chemistry, biology, and physics experiments. During a routine maintenance shutdown in 1996, tritium from the spent fuel canal was found in groundwater south of the reactor. Investigations revealed that the source of the tritium was a small leak in the ceramic tile-lined concrete pool where spent nuclear fuel was stored. Operations at the HFBR were suspended and the DOE considered what to do. All of the spent fuel was removed and sent to DOE's Savannah River Site in 1998. The pool was drained and a freestanding, double-walled, stainless steel liner with an instrumented low-point sump was installed to eliminate the potential for leakage to the environment. In November 1999, DOE announced it was permanently closing

the reactor. The HFBR has been continuously maintained under a surveillance and maintenance (S&M) program from its initial operation in 1965.

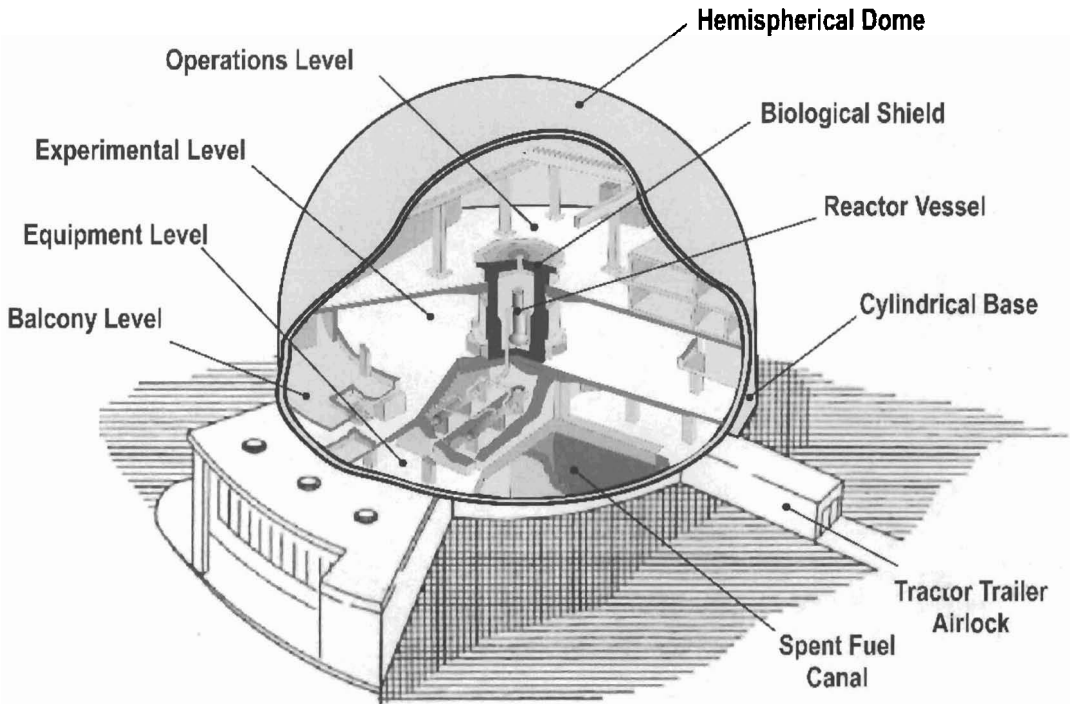

Figure 2. -- Cutaway View of the HFBR Confinement Building

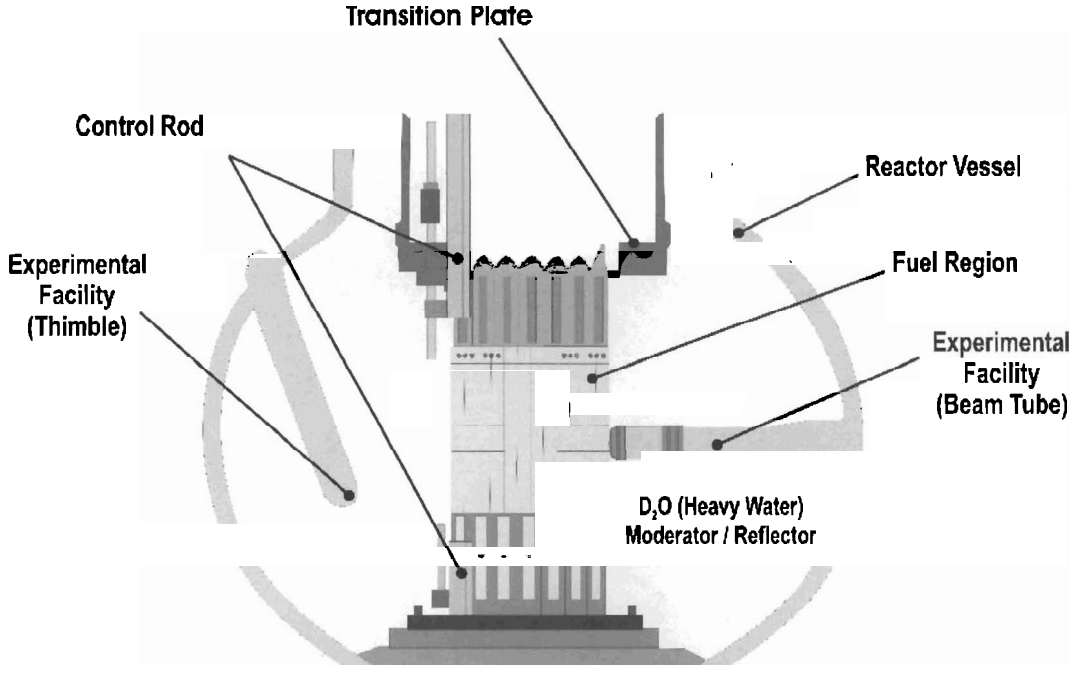

Figure 3. – Cutaway View of the Reactor

B. Actions to Date

1. Previous Actions

A number of actions have been taken to remove contaminated structures, systems, and components from the HFBR Complex. The completed interim actions are summarized below:

- The HFBR fuel was removed and sent to an off-site facility.
- The primary coolant was drained and sent to an off-site facility.
- Scientific equipment was removed and is being reused.
- Shielding and chemicals were removed and are being reused at BNL and other facilities.
- The cooling tower superstructure was dismantled and disposed.
- The confinement structure and spent fuel canal were modified to meet Suffolk County Article 12 requirements.
- The Stack Monitoring Facility was dismantled and disposed.
- The Cooling Tower Basin and Pump/Switchgear House was dismantled and disposed.
- The Water Treatment House was dismantled and disposed.
- The Cold Neutron Facility contaminated systems were removed and the clean building has been transferred to another organization for re-use.
- The Guard House was dismantled and disposed.

2. Current Actions

The cleanup of the WLA is currently in progress, authorized by the *Action Memorandum, High Flux Beam Reactor, Removal Action for Waste Loading Area*. It is being performed as a non -time-critical removal action.

The Waste Loading Area (WLA) is an area (about 2 acres) along the eastern boundary of the Former Hazardous Waste Management Facility (HWMF). The cleanup of the WLA was transferred to the HFBR scope of work in September 2005 through a modification to the Remedial Design Implementation Plan (RDIP) for the Former HWMF.

3. Planned Actions

The public comment period for the HFBR PRAP concluded on March 17, 2008. DOE addressed the comments received, and a draft ROD including a responsiveness summary is being prepared for review by the regulators. This removal action is consistent with the selected remedy and will be documented in the HFBR ROD.

C. National Priorities List Status

Brookhaven National Laboratory was added to the National Priorities List in 1989.

III. THREATS TO PUBLIC HEALTH OR WELFARE AND THE ENVIRONMENT/ STATUTORY AND REGULATORY AUTHORITIES

This action is being undertaken as a removal action under the Interagency Agreement among the DOE, EPA, and NYSDEC.

The appropriateness of the removal action is based on the following:

Factors listed in 40 Code of Federal Regulations (CFR) 300.415 (b) (2) of the regulations implementing the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA), including:

- Actual or potential exposure of human populations, animals, or the food chain to hazardous substances or pollutants or contaminants.

- Preferred alternative for the HFBR described in the HFBR PRAP

IV. IDENTIFICATION OF REMOVAL ACTION OBJECTIVE

The removal action objective is consistent with the following remedial objective for the HFBR activated components stated in the HFBR Feasibility Study and PRAP:

Control, minimize, or eliminate all routes of future human and/or environmental exposure to radiologically contaminated facilities or materials

V. PROPOSED ACTION AND ESTIMATED COSTS

A. Proposed Action

This Action Memorandum addresses the removal and disposal of the HFBR CRBs and BPs.

There are 16 CRBs in the reactor vessel, separated into main and auxiliary groups, each containing eight CRBs. The proposed action includes the removal of the CRBs from the reactor vessel, transfer to the fuel canal, loading into two disposable shipping casks, and shipment by truck to NTS for disposal.

Nine activated beam plugs are currently stored at the HFBR complex (on the experimental level of the Confinement Building). The proposed action includes the removal of the BPs (including three collimators), loading into disposable casks/containers, and shipment to DOE's Nevada Test Site and Energy Solutions' Clive Operations facility in Utah for disposal.

The removal and disposal activities also include:

- Detailed planning
- Preparation of the Confinement Building for CRB and BP removal
- Procurement of shipping casks/containers
- Secondary waste processing, shipment and disposal

B. Contribution to the Remedial Performance

This removal action will contribute to the overall reduction in the radioactive material inventory at the HFBR complex. This action will be documented in the HFBR ROD.

C. Description of Alternative Technologies

No new or alternative technologies are required for the implementation of this action.

D. Applicable or Relevant and Appropriate Requirements

The *National Contingency Plan*, Section 40CFR300.430 (f)(1)(ii)(B), requires compliance with federal and state applicable or relevant and appropriate requirements (ARARs) unless a waiver is invoked. The ARARs are listed below:

1. *Chemical-Specific ARARs*
   a. *6 NYCRR Part 380, Rules and Regulations for Prevention and Control of Environmental Pollution by Radioactive Materials:* These regulations are the relevant and appropriate regulations for controlling radioactive emissions and liquid releases to the environment while completing the remedial action. Potential radioactive surface contamination release, airborne radioactivity generation and release, or radioactive liquid release will be controlled to eliminate emissions that would affect human health or the environment.

b. *U.S. Department of Transportation Requirements for the Transportation of Hazardous Materials (49CFR Parts 100 to 170):* These regulations will apply to any wastes that are transported off site.

2. *Location-Specific ARARs*

None

3. *Action-Specific ARARs*

a. *Occupational Radiation Protection (10CFR835):* These rules establish radiation protection standards for all DOE activities. Remedial actions and safe storage will be performed in accordance with the requirements of a DOE-approved radiation protection program and dosimetry program, and appropriate procedures will be established to ensure compliance with this regulation.

b. *Nuclear Safety Management (10CFR830):* These rules establish the minimum acceptable quality assurance and nuclear safety controls for all applicable DOE activities. All remedial action will be performed in accordance with the requirements of a DOE-approved quality assurance and nuclear safety control program and appropriate procedures will be established to ensure compliance with this regulation.

c. *49CFR Sections 173.4-173.471, Packaging and Transportation of Radioactive Material:* These rules apply to the proper packaging and transportation of hazardous material, specifically Class 7, radioactive material. Packaging and transportation of all DOE generated waste will be performed in accordance with this regulation.

4. *"To Be Considered" Guidance*

a. *DOE Order 451.1B, National Environmental Policy Act Compliance Program:* This order requires that CERCLA actions address National Environmental Policy Act (NEPA) values.

b. *DOE Order 5400.5, Radiation Protection of the Public and the Environment, including As Low As Reasonably Achievable (ALARA) Approach:* This order establishes the standards and requirements for protecting members of the public and the environment against undue risk from radiation. As with 10CFR835, remedial action will be performed in accordance with appropriate procedures that will be established to ensure continued protection of the public and the environment. ALARA is the practical approach to radiation protection used to manage and control exposures (both individual and collective of the work force and the general public) and keep releases of radioactive material to the environment as low as is reasonable, taking into account social, technical, economic, practical, and public policy considerations. Technologies and techniques will be incorporated into this remedy so that radioactive waste is

minimized and direct exposure to radiation sources is reduced to as low as is reasonably achievable.

c. *DOE Order 435.1, Radioactive Waste Management:* This order provides guidance and requirements for managing and disposing of radioactive waste generated at DOE facilities.

d. *40CFR300.440, Off-Site Rule (52FR49200):* The purpose of this rule is to avoid having wastes generated from response actions that are authorized or funded under CERCLA contribute to present or future environmental problems. This is accomplished by directing the waste to management units that have been determined to be environmentally sound. The rule establishes compliance and release criteria, and establishes a process for determining whether facilities are acceptable based on those criteria. The rule also establishes procedures for notifying waste management units of their unacceptability, for reconsidering unacceptability determinations, and for re-evaluating unacceptability determinations. In accordance with this rule, HFBR wastes will only be sent to off-site facilities that meet EPA acceptability criteria.

e. *Suffolk County Sanitary Code – Article 12, Toxic and Hazardous Materials Storage and Handling Controls:* This code requires the use of all available practical methods of preventing and controlling water pollution from toxic and hazardous materials. For the Article 12 registered components remaining at the HFBR, detailed surveillance and maintenance actions will be included in the S&M program.

f. *DOE Order 460.1B, Packaging and Transportation Safety:* This order establishes safety requirements for the proper packaging, transfer, and transportation of hazardous materials.

g. *DOE Order 460.2A, Departmental Materials Transportation and Packaging Management:* This order establishes requirements for management to ensure safe, secure, efficient packaging and transportation of materials, both hazardous and non-hazardous.

E. Project Schedule

Detailed planning for this action is currently in progress. This removal action is expected to be completed by October 2008.

F. Estimated Cost

This removal action will cost approximately $3,330,000.

VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

The proposed action (near-term removal and disposal of the CRBs and BPs) offers many advantages. This is particularly so in the case of CRBs because of a combination of unique circumstances.

Certified casks have been purchased at discounted prices because their licenses (Certificates of Compliance) are set to expire on October 1, 2008. As these casks are equipped with robust shielding, only two shipments of CRBs will be required. The shipping casks with the CRBs will be disposed of at DOE's NTS, greatly simplifying cask handling and disposal operations at NTS.

If the action is delayed, it would be necessary to rent alternate casks. An assessment of the use of available alternate casks shows that it is likely to result in the following adverse impacts:

- Higher cost
  Increased number of shipments because of reduced shielding
  Unloading of the shipping casks at NTS (for reuse) resulting in increased complexity of operations at NTS
- Higher radiation exposure to operators at NTS

(Note: It may be possible to mitigate these impacts by DOE making arrangements to self certify these casks and give authorization for limited use for one final shipment to the disposal site following the current expiration date.)

In addition to the above, people with extensive knowledge and experience in handling the CRBs and BPs and disposal sites are currently available to implement the removal action. It is uncertain if such expertise and disposal sites will be available in the future.

VII. PUBLIC PARTICIPATION

A. BNL Community Relations

The BNL Community Involvement Plan was published April 15, 1999. It is supplemented by project-specific plans. In the case of the HFBR, a Communications Plan for the Regulatory Decision-Making Process for Decommissioning the High Flux Beam Reactor was developed. In accordance with these two plans and CERCLA Sections 113 (k)(2)(B)(i-v) and 117, the Community Relations Program focuses on informing and involving the public in the decision-making process to ensure that the

views of the internal and external stakeholder communities are considered. A variety of activities are used to provide information and to seek public participation, including distribution of materials to a stakeholders' mailing list; holding community meetings, information sessions, tours, and workshops; and preparing and distributing fact sheets.

The Administrative Record, which documents the basis for removal and remedial actions, was established and is maintained at the libraries listed below:

Brookhaven National Laboratory
Research Library, Bldg. 477A
Upton, NY 11973
631-344-3483 or
631-344-3489

U.S. EPA - Region II
Records Room
290 Broadway, 18th Floor
New York, New York 10007-1866
212-637-4308

B. Community Involvement Related to the Removal of Control Rod Blades and Beam Plugs

The community involvement activities conducted for the remedy selection process for the HFBR included a formal public review of the HFBR PRAP. The public comment period began January 10 and ended on March 17, 2008. Two information sessions and a public meeting were held during the public comment period. Public comments received indicate that here is considerable community support for DOE's preferred remedial alternative identified in the PRAP (Alternative C, Phased Decontamination and Dismantlement with Near-Term CRB Removal). DOE's responses to public comments and concerns will be included in the HFBR ROD Responsiveness Summary.

VIII. OUTSTANDING POLICY ISSUES

There are no outstanding policy issues identified for this removal action.

IX. ENFORCEMENT

DOE owns BNL and DOE will fund this removal action. The removal action will be conducted in accordance with CERCLA and National Contingency Plan requirements, the Interagency Agreement, and applicable New York State regulations.

X. RECOMMENDATION

This Action Memorandum recommends a non-time-critical removal action for the removal and disposal of the HFBR CRBs and BPs. This decision document was developed in accordance with CERCLA, as amended, and is consistent with the National Contingency Plan.

XI. REFERENCES

BNL, 2007a. *Feasibility Study, Brookhaven High Flux Beam Reactor, Decommissioning Project*, prepared by Brookhaven Science Associates for the U.S. Department of Energy, September 2007

BNL, 2007b. *Action Memorandum, High Flux Beam Reactor, Removal Action for Waste Loading Area*, prepared by Brookhaven Science Associates for the U.S. Department of Energy, October 26, 2007

BNL, 2008. *The Proposed Remedial Action Plan for the High Flux Beam Reactor at Brookhaven National Laboratory,* prepared by Brookhaven Science Associates for the U.S. Department of Energy, January 2008

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.