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 for the U.S. Department of Energy

# Memo

**Date:** April 5, 2011

**To:** N. Gmur

**From:** J. Higbie *Jennifer L. Higbie*

**Subject:** NEPA Review of Proposal – NEXT (NSLS-II Experimental Tools) Beamlines

I have reviewed the following proposal as required by 10 CFR 1021, DOE’s Rules for Implementing the National Environmental Policy Act.

- “NEXT (NSLS-II Experimental Tools) Beamlines”; BNL PI: N. Gmur.

The scope of the proposed action is the development of six insertion device beamlines for NSLS-II, beyond the initial six NSLS-II project beamlines. Development of these beamlines consists of specifying their source and front end requirements, design, engineering, fabrication/procurement, assembly, and installation on the NSLS-II experimental floor. Additional aspects include:

<input checked="" type="checkbox"/> Utilizes existing controls and procedures	<input type="checkbox"/> Continuation of existing experiment / program.	<input type="checkbox"/> Similar to research previously performed at BNL	<input type="checkbox"/> Utilizes existing facilities/equipment.
<input checked="" type="checkbox"/> BNL processes & procedures exist to manage waste generation/disposal	<input type="checkbox"/> Consists primarily of information gathering, data analysis, technical advice to organizations	<input type="checkbox"/> Bench-scale analysis of samples	Location(s): <input type="checkbox"/> Biology Department <input type="checkbox"/> Medical Department <input type="checkbox"/> Chemistry Department
<input type="checkbox"/> Utilizes standard biochemical and molecular biology procedures	<input type="checkbox"/> Utilizes approved Life Sciences protocols reviewed by appropriate committee: IBS, IACUC		<input checked="" type="checkbox"/> NSLS II <input type="checkbox"/> NSLS beamline <input type="checkbox"/> NSRL beamline <input type="checkbox"/> AGS beamline

The proposed action falls within the scope of the October 2006 Environmental Assessment for NSLS-II, DOE/EA-1558. This review has been coordinated with C. Polanish, NEPA Coordinator for the DOE Brookhaven Site Office. Please keep in mind that should the scope of a project change, it would need to be resubmitted for NEPA review. If you have questions about this review please do not hesitate to contact me at extension 5919.

cc: T. Green, D. Bauer, C. Polanish, (DOE-BHSO), M. Theisen, J. Remien, EC51ER.11

Brookhaven National laboratory

National Environmental Policy Act (NEPA)

ENVIRONMENTAL EVALUATION NOTIFICATION FORM

Project/Activity Title: NEXT (NSLS-II Experimental Tools) Beamlines

BNL Project Tracking No.: \_\_\_\_\_ DOE NEPA No.: \_\_\_\_\_

BNL Project Manager: Steven Hulbert Signature: \_\_\_\_\_ Date: \_\_\_\_\_

BNL NEPA Reviewer: Jennifer Higbie Signature: \_\_\_\_\_ Date: \_\_\_\_\_

I. Description of Proposed Action:

The goal of the NEXT beamline project is the development of six insertion device beamlines for NSLS-II, beyond the initial six NSLS-II project beamlines. The names and three-letter acronyms for the six NEXT beamlines are:

- ESM Photoemission-Microscopy Facility
FXI Full-field X-ray Imaging from Microns to Nanometers
ISR Integrated In-Situ and Resonant X-Ray Studies
ISS Inner Shell Spectroscopy
SIX Soft Inelastic X-ray Scattering
SMI Soft Matter Interfaces

Development of these beamlines consists of specifying their source and front end requirements, design, engineering, fabrication/procurement, assembly, and installation on the NSLS-II experimental floor.

Short Descriptions of Each of the Six NEXT beamlines

ESM Photoemission-Microscopy Facility

A high-resolution, high-flux, wide-energy range, micro-focused beamline to provide high-quality monochromatic radiation to three different electron microscopes for a) in-situ growth and structural, electronic, and chemical characterization of material surfaces at the nanometer scale; b) ultra-high energy- and angle-resolved physical studies of materials in ultra-high vacuum conditions; and c) real-time chemical analysis of samples in reactive environments up to atmospheric pressure. The microscopes will share a common sample preparation chamber allowing sample exchange between the three endstations.

FXI Full-field X-ray Imaging from Microns to Nanometers

The proposed beamline will house two complementary techniques: full-field, time-resolved imaging for large samples allowing tomography and 3D studies; and a 30 nanometer resolution, high speed transmission x-ray microscope (TXM) for samples demanding the highest resolution.

### **ISR Integrated In-Situ and Resonant X-Ray Studies**

An x-ray scattering beamline covering the 2.1 - 23 keV range that will enable the *in-situ* study of materials in a flexible range of environment chambers, providing a) polarization control with a 1  $\mu\text{m}$  vertical focus of the full intensity with 1.5 m working distance from the focusing optic; b) allow the entire beam intensity to be placed at grazing incidence on millimeter size horizontal samples for surface and interface studies providing a 1000 increase over what is currently possible at the leading NSLS beamline X21; c) for applications needing finer focus, optics for 100 nm vertical spot size will be available. The beamline will also support coherent x-ray scattering techniques such as x-ray photon correlation spectroscopy.

### **ISS Inner Shell Spectroscopy**

A wiggler-based beamline dedicated to inner shell spectroscopies. The exceptional flux provided by a wiggler enables measurement of absorber concentrations in short time frames (thus reducing damage to samples) at environmentally or technologically relevant levels impractical to measure at dipole beamlines.

### **SIX Soft Inelastic X-ray Scattering**

This soft x-ray scattering undulator beamline and very high resolution emission spectrometer will provide a world-leading overall energy resolution at two end stations: a) <10 milli-electron volts up to 1 keV and continuously tunable momentum transfer; and b) the second endstation will feature ~200 meV resolution at 1 keV and will reside on the experimental floor. This resolution is a factor of 10 better than anything in operation today and will revolutionize studies in condensed matter, energy storage, catalysis and environmental science. The optics to achieve this ultimate resolution require that this long beamline endstation be outside the experimental hall.

### **SMI Soft Matter Interfaces**

Soft matter encompasses polymers, liquids, liquid crystals, granular materials, gels, biomolecular materials, all of which lack the three-dimensional crystallinity characteristic of conventional hard-matter systems. These soft materials are increasingly called upon to address national needs in energy, health, and environment. High resolution scattering measurements under a wide range of sample environments are an essential tool for understanding structural aspects of the interfacial properties, a necessary step to developing improved materials. SMI is an x-ray scattering beamline dedicated to interface scattering in the tender x-ray (2-5 keV) region and micron-sized beams for liquid surface studies, and world-class capabilities for fast reflectivity and high-resolution x-ray scattering measurements at solid/vapor, solid/liquid, liquid/liquid, and liquid/vapor interfaces.

## II. Description of Affected Environment:

Five of the six NEXT beamlines will occupy their assigned space on the existing NSLS-II experimental floor. The SIX (Soft Inelastic X-ray Scattering) beamline will require a separate building adjacent to the NSLS-II Ring Building. The construction of the SIX building will involve disturbance of soils in areas previously disturbed due to the original construction of the NSLS-II buildings (no new, undisturbed areas impacted).

The SIX building will be:

1. Built on a concrete slab,
2. Adjacent to the main Ring Building, and
3. Dimensions ~25 meters x ~40 meters.

III. **Potential Environmental Effects:** (In Section IV, document an explanation for each "yes" and "no" response if additional information is available and could be significant in the decision-making process.)

**A. Sensitive Resources: Will the proposed action result in changes and/or disturbances to any of the following resources?**

	Yes/N
1. Threatened/Endangered Species and/or Critical Habitats	No
2. Other Protected Species (e.g., Burros, Migratory Birds)	Yes
3. Wetlands	No
4. Archaeological/Historic Resources	No
5. Prime, Unique, or Important Farmland	No
6. Non-Attainment Areas	Yes
7. Class I Air Quality Control Region	Yes
8. Climate Change (e.g., greenhouse gases)	Yes
9. Special Sources of Groundwater (e.g., Sole Source Aquifer)	No
10. Navigable Air Space	No
11. Coastal Zones	No
12. Areas with Special National Designation (e.g., National Forests, Parks, Trails)	No
13. Floodplain	No

**B. Regulated Substances/Activities: Will the proposed action involve any of the following regulated substances or activities?**

	Yes/N
14. Clearing or Excavation	Yes
15. Dredge or Fill (under Clean Water Act section 404; indicate if greater than 10 acres)	No
16. Noise (in excess of regulations)	No
17. Asbestos Removal	No
18. PCBs	No
19. Import, Manufacture, or Processing of Toxic Substances	Yes
20. Chemical Storage/Use	Yes
21. Pesticide Use	No
22. Hazardous, Toxic, or Criteria Pollutant Air Emissions	Yes
23. Liquid Effluent	Yes
24. Underground Injection	No
25. Hazardous Waste	Yes
26. Underground Storage Tanks	No
27. Radioactive (AEA) Mixed Waste	Yes
28. Radioactive Waste	Yes
29. Radiation Exposures	Yes
30. Surface Water Protection	No
31. Ozone Depleting Substances	No

**C. Other Relevant Disclosures. Will the proposed action involve the following?**

	Yes/N
32. A threatened violation of ES&H regulations/permit requirements	No
33. Siting/Construction/Major Modification of Waste Recovery, or TSD Facilities	No
34. Disturbance of Pre-existing Contamination	No
35. New or Modified Federal/State Permits	No
36. Public controversy (e.g., Environmental Justice Executive Order 12898 consideration and other related public issues)	No

37.	Action/involvement of Another Federal Agency (e.g., license, funding, approval)	No
38.	Action of a State Agency in a State with NEPA-type law. (Does the State Environmental Quality Review Act Apply?)	No
39.	Public Utilities/Services	No
40.	Depletion of a Non-Renewable Resource	No
41.	Adverse visual impacts	No
42.	Targets for Intentional Destructive Acts	No
43.	Opportunity for environmental sustainability (energy usage, green buildings, native vegetation, etc.)	Yes
44.	Connected Action (To other actions with significant effects)	No
45.	Extraordinary Circumstances (affecting significance of environmental effects)	No

**IV. Additional Information:**

A2 (Other Protected Species e.g., Burros, Migratory Birds). The NSLS-II area is used by killdeer (migratory bird) and Canada geese for nesting in the spring. Efforts would be made to eliminate or limit impacts of construction on these species. Should it be necessary the USDA-APHIS-WS would be consulted on conflict issues.

A6, A7, and A8 (Non-Attainment Areas, Class I Air Quality Control Region, and Climate Change). Long Island has been classified as a non-attainment area by the US EPA. The use of greenhouse gases in the research conducted on the NEXT beamlines is anticipated to be minimal, but possible. Each beamline experiment is reviewed by department Environment, Safety and Health staff. Where greenhouse gas use is anticipated, the quantity would be minimized to the extent possible, exhaust needs would be examined and controlled, and if possible, substitute gases would be used to minimize any environmental impact. Construction activities utilizing mechanize equipment would be temporary in nature.

B14 (Clearing or Excavation). Five of the beamlines will be constructed on the already existing NSLS-II Ring building experimental floor. The proposed building for the SIX beamline would require a footprint of ~1000 square meters (~10,760 square feet). All drainage from the building would be connected to the site storm water system. Standard erosion controls would be utilized during construction phases.

B19 (Import, Manufacture, or Processing of Toxic Substances). Regulated toxic substances may be used in beamline experiments in which case their use would be fully reviewed, and the appropriate controls implemented as needed in accordance with BNL Standards Based Management System (SBMS) guidance.

B20 (Chemical Storage/Use). A wide variety of chemicals would be used in the beamline experiments. Such use would involve review, minimization when possible, and substitution for less hazardous chemicals when possible. Established BNL review processes would be employed to evaluate these processes.

B22 (Hazardous, Toxic, or Criteria Pollutant Air Emissions). An evaluation of the listed beamlines for compliance with federal and state regulations regarding criteria and hazardous air pollutants would be initiated, as needed, during experiment review in accordance with the SBMS Subject Area *Non-Radioactive Airborne Emissions*.

B23 (Liquid Effluent). Liquid effluents from the new beamlines would typically be limited to domestic water usage. Any discharges associated with experiments would be evaluated and conducted in accordance with the BNL SBMS Subject Areas. Since occupancy would involve both a relocation of personnel and a transient scientific community, minimal increases in domestic sewage would be anticipated.

B25 (Hazardous Waste). Experiments, machining and maintenance activities would generate small quantities of hazardous waste. The quantity of hazardous wastes generated from operations by these beamlines would not be expected to substantially differ from the current experiment volumes generated by the NSLS. Existing processes for handling and disposing of Hazardous Wastes would be followed.

B27 (Radioactive (AEA) Mixed Waste). Research efforts at these beamlines could potentially result in the generation of mixed wastes. Efforts would be made to either minimize or eliminate such waste using techniques such as "decay in storage". Existing processes for handling and disposing of Mixed Wastes would be followed.

B28 (Radioactive Waste). For example, in a typical year, the existing NSLS generates less than 5 cubic feet of radioactive waste. Efforts would be made to either minimize or eliminate such waste using techniques such as "decay in storage". Existing processes for handling and disposing of Radioactive Wastes would be followed. It is typical for institutions conducting research with radioactive samples that they have brought from their home facilities to return these samples to the home facilities, thus no waste is generated.

B29 (Radiation Exposures). NSLS-II is a radiological facility with a Controlled Area within which will be higher radiation posting areas as well as activation areas. The NEXT beamlines would be located within the Controlled Area. Radiation exposures would be possible. Shielding would be designed to maintain personnel radiation exposures As Low As Reasonably Achievable (ALARA). Radiation protection interlocks would also be used to protect personnel, along with additional established protocols and procedures. An evaluation of the listed for compliance with federal and state regulations regarding radioactive air pollutants would be initiated, as needed, in accordance with the SBMS Subject Area *Radioactive Airborne Emissions*.

C43 (Opportunity for environmental sustainability (energy usage, green buildings, native vegetation, etc.)). Five of the NEXT beamlines would be assembled on the existing NSLS-II experimental floor of the Ring Building. The Ring Building meets the requirements for LEED certification. The design of the SIX beamline building would meet LEED requirements.

**NOTE:** DOE BHSO will utilize the information provided in this EENF to make a NEPA determination. The separate determination document, provided by DOE, is to be appended to this NEPA review.

**V. Other NSLS-II documents available:**

- a. NSLS-II EENF submission by BNL to DOE/BHSO - January 2006
- b. DOE/BHSO review of NSLS-II EENF and requirement for a NSLS-II Environmental Assessment - February 2006
- c. Environmental Assessment for NSLS-II, DOE/EA-1558 - October 2006
- d. U.S. DOE Finding of No Significant Impact Construction and Operation of NSLS-II - September 2006
- e. A Stage I Archaeological Survey for the Proposed National Synchrotron Light Source (NSLS-II) - January 2007
- f. Comparison of NSLS-II EA 2006 and 2008 Title II Design - July 2008