DOE/EA-1321

U.S. Department of Energy

Finding of No Significant Impact

Proposed Upgrade and Improvement of The National Synchrotron Light Source Complex

At

Brookhaven National Laboratory
Upton, New York

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AGENCY: U.S. Department of Energy

ACTION: Finding of No Significant Impact (FONSI)

SUMMARY: This Environmental Assessment (DOE/EA-1321) addresses the proposed action by the U.S. Department of Energy (DOE) to upgrade the facilities of the National Synchrotron Light Source Complex; namely, the National Synchrotron Light Source (NSLS), the Accelerator Test Facility (ATF) and the Source Development Laboratory (SDL) at Brookhaven National Laboratory (BNL). The potential environmental effects of the No-Action Alternative as well as the Proposed Action are evaluated in the EA.

The No-Action or Continued Maintenance Alternative would not involve any upgrades and would keep the NSLS Complex operating in its existing configuration, repairing and replacing components involving only in-kind (non-upgrade) equipment.

The Proposed Action includes upgrades to accelerators and research beamlines that would improve their operating characteristics and, consequently, meet the demands of the increasingly large and diverse scientific user community. Construction of additional spaces onto existing structures to accommodate new accelerator components and offices also would be included in the Proposed Action.

This EA describes the current and anticipated operations. The NSLS has operated successfully since the early 1980s but needs a variety of upgrades to maintain its leading scientific capability among U.S. synchrotron light sources. Most of these upgrades would take place over several years and would occur within existing buildings. Current beam line and accelerator components would be replaced with improved state-of-the-art

devices. Typical devices that would be upgraded include monochromators and mirrors which guide synchrotron light beams, and radio frequency cavities which provide power to the electron beams. The approach taken in this EA is to evaluate the overall impact of the anticipated upgrades, rather than providing a NEPA review for each upgrade individually. The EA includes a general description of the environment of BNL, and the environmental impacts due to current operations and anticipated operations due to the proposed upgrades.

Based on the analyses in the EA, DOE determined that the proposed action does not constitute a major federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act (NEPA) of 1969. Therefore, the preparation of an Environmental Impact Statement (EIS) is not required.

DESCRIPTION OF THE PROPOSED ACTION:

The Proposed Action would upgrade the operating and research capabilities of the NSLS Complex. The accelerators and their components would be improved and state-of-the-art upgrades made to the beamlines (e.g., optics, detectors, controls, and analytical equipment). The proposed upgrades to buildings would include increasing the office and research space for the NSLS and SDL facilities. The majority of equipment upgrades would require replacing an existing component or system with an improved one. Other items represent installing new systems (including new construction) within the NSLS Complex. The items listed in the EA constitute all reasonably foreseeable actions that could take place within the NSLS Complex over the next five to ten years; they are major capital and operating budget items. Any such list of upgrades should not be regarded as inclusive as factors beyond current planning, such as new scientific or technical breakthroughs or unforeseen failures of components could require similar items that are not specified in this list. If any new breakthroughs involve environmental impacts not foreseen and addressed in the scope of this EA, separate NEPA reviews would be conducted.

The resident NSLS staff of some 176, plus additional beamline staff of ~100, supported 2416 users in FY99. This is the largest group of research users at BNL. They represented 380 institutions from 80 countries worldwide, with the majority (84%) affiliated with institutions based in the United States.

The NSLS, located in Building 725, began operations in 1982. It consists of a Linear Accelerator (Linac), a Booster Ring and two synchrotron storage rings, the Vacuum Ultraviolet Ring (VUV) and the X-ray Ring which store and circulate bunches of electrons close to the speed of light. There are 100 experimental beamlines, 85 of which may be operating at any one time. As the electrons are accelerated, synchrotron radiation (SR) is produced and directed down the beamlines to the research stations. SR is a very high-intensity, broad-spectrum form of electromagnetic radiation with infrared, visible, ultraviolet, and x-ray energies. It is a powerful research tool and is used by researchers in a wide variety of scientific areas including chemical sciences, materials sciences, life

sciences and medicine, geosciences and ecology, applied sciences and engineering, and optical/nuclear and general physics. Life sciences represent the most rapidly growing component. Most experiments use the techniques of spectroscopy, scattering, diffraction, and imaging. The NSLS operates 24 hours a day, 7 days a week. One thousand and thirteen experiments were conducted in FY99, ranging in duration from a few days to the entire year. In FY99, the VUV Ring delivered ~5900 hours of beam to users and the X-ray Ring delivered ~5600 hours. The proposed addition to the NSLS Building 725 (~9300 square feet) would match the steel frame and wall construction of the existing building's second floor. While a small amount of excavation would be necessary for installation of footings to support the second story addition, major changes to the actual footprint of this building would not be anticipated. The additional space would be used for offices, meeting rooms and mailrooms and would also result in increased equipment set-up and storage space. Beamline and accelerator upgrades would be performed within this building.

The Accelerator Test Facility (ATF), located in Building 820, began operations in 1990, and is dedicated to research and development in the physics of beams. It consists of a Linear Accelerator that accelerates bunches of electrons to higher energies. The electrons and high peak power laser beams are directed to any one of four research beamlines where more than one experiment may be running at once. Its users carry out research and development in advanced accelerator physics, studying the interactions of high power electromagnetic radiation and electron beams, including laser acceleration of electrons and free-electron lasers. Other topics include the development of high brightness electron beams, high-power laser beams, electron injectors, beam diagnostics, and computer controls. The ATF conducted eight long-term experiments in 1999, and delivered ~1000 hours of beam to users. The Proposed Action would include upgrades to the accelerator, beamlines and lasers within the existing facility. While the Proposed Action does not anticipate any additions to the ATF building, ATF programs may expand into existing space within Building 820 in order to improve/increase laboratory space, machine shops, equipment set-up and storage. These activities would primarily involve minor facility improvements and relocating equipment into the newly acquired areas.

The Source Development Laboratory (SDL), located in Building 729, would begin operations in 2001. It was founded, in part, on the advances made at the ATF. It consists of an electron Linac plus associated accelerator components, and would act as a test bed accelerator and laser facility for producing an intense ultraviolet beam delivered in extremely short, trillionth of a second pulse lengths. In addition to accelerator development, the beams would be applied to a variety of basic and applied research experiments, analogous to those conducted at the NSLS. The SDL was originally covered by the National Environment Protection Act Environmental Assessment #0602 [NEPA EA-0602]. The proposed ~3600 square foot extension on the west side of Building 729 would accommodate upgrades to the accelerator and beamlines. This extension would continue the existing slab and steel frame/metal wall construction, and would be built mostly over an existing driveway. Some additional impervious surfaces (driveway/parking lot) would also be created.

Several aspects would be common to implementing a majority of the proposed scientific actions. Implementing the upgrades would involve disassembling existing systems and components and installing replacements. Most of the items removed would either be excessed or disposed of as scrap material. Some of the old components would be stored as potential spares, even though they are not the latest technology, due to the high cost of the replacement items. Certain components may be purchased as off-the-shelf items, while others would be designed, engineered and assembled by BNL personnel. Installation would involve mounting and rewiring the various components and associated power supplies. Transport of any heavy equipment would require the use of installed overhead cranes/hoists or hydraulic lift devices by trained personnel. Most of the identified activities would not require work on contaminated or activated systems. Those systems and components that have been identified as being potentially activated are required to be surveyed prior to removal and disposal. Disposal of any activated/contaminated material would follow established approved BNL/DOE protocols. Beam line preparation and equipment installation occur within Controlled Areas, areas controlled for radiological purposes. Such work could involve some low-level radiation exposure to workers. All appropriate training and worker safety protocols would be in place prior to initiation of the work to minimize exposure using As Low As Reasonably Achievable (ALARA) principles. Some experiments may produce small quantities of biohazardous and radioactive material wastes. These materials would be handled by personnel trained in the proper handling requirements and would be processed according to approved BNL and regulatory protocols.

ALTERNATIVES ANALYZED:

The alternative to the Proposed Action in the EA consists of the No-Action or Continued Maintenance Alternative.

The No-Action Alternative (Continued Maintenance):

The No-Action Alternative would continue operations at the NSLS Complex at their present levels for the foreseeable future. These operations would include preventive maintenance, repair, and lifetime replacement of operating components. Repairs and replacements would be limited to in-kind, i.e. non-upgrade, capabilities. These continued maintenance activities also are encompassed in the Proposed Action.

ENVIRONMENTAL IMPACTS:

The potential environmental impacts from the continued operation, construction and upgrades of the NSLS Complex are evaluated in the EA as well as the cumulative impacts from this and the other BNL activities. The areas of potential environmental impact evaluated are the commitment of resources, soils, water resources, air resources, cultural resources, transportation, human health effects, accidents and natural hazards, waste management, environmental justice, cumulative and long-term impacts.

Impacts of Continued Operation with Upgrades:

COMMITMENT OF RESOURCES: The Commitment of Resources for the Proposed Action builds on the conditions of the No-Action Alternative. The bullets below summarize the anticipated utilities usage in 5 years for the NSLS Complex:

- 205 MW hour increase in electrical usage is anticipated for new office spaces (e.g., lighting and computers), along with a 6,485.3 MW hour increase for upgrades to the beamlines and accelerators (total usage $\cong$ 42,289 MW hours/year);
- ~6% increase in the usage of high-pressure steam is anticipated due to the construction and heating needs of new office and research spaces (total usage $\cong$ 19.5 million pounds/year);
- ~17.7% increase in chilled water usage is anticipated (total usage $\cong$ 41,189 x 10^6 BTUs).

SOILS: The impact on soils from construction would be minimized using standard erosion-control practices (e.g., hay bales) when necessary. Upon completion, all areas would be restored to the pre-construction state by regrading and seeding. Constructing the 3600 square foot addition to Building 729 would create some additional impervious surfaces. While exact dimensions are not available at this time, the size of any new impervious area is anticipated to exceed that of the existing driveway by about 80%. The resulting additional runoff would be minimal from these surfaces. The remaining impacts to soil would be comparable to the No-Action Alternative and expected to be minimal.

WATER RESOURCES: An estimated 5% increase in staff (total $\cong$ 185), users (total $\cong$ 2537) and the number of experiments (total $\cong$ 1064) may, correspondingly, increase the effluent discharge to the sanitary waste stream. The increased discharge to the sanitary system would slightly increase the total Laboratory discharge rate of 700,000 gallons/day. However, it would be well within the 3 million gallon/day capacity of the plant and would not have a significant impact. The Work Planning, Experimental Review and Tier I Safety Inspection controls would continue to ensure that hazardous wastes are segregated from the sanitary system. The expansion of impervious surfaces described in "Soils" would slightly increase surface water discharge to recharge basin HS by approximately 6000 gallons for a typical 2-inch rainfall. This volume would be considered a minimal increase to the total discharge to basin HS.

AIR RESOURCES: There would be a temporary increase in emissions due to construction (e.g. vehicles and other equipment). There also would be some increased emissions due to increases in the use of steam, chilled water and electricity by the proposed upgrades and construction. All other impacts to air resources are identical to those described in the No-Action Alternative and expected to be minimal.

CULTURAL RESOURCES: The buildings associated with the NSLS, ATF, and SDL were constructed in 1981, 1957, and 1982, respectively, and are currently not eligible for inclusion in the National Register. None of the proposed actions are located in proximity to any of the eligible properties identified by BNL. There would be no impact to cultural resources.

TRANSPORTATION: The proposed construction would temporarily increase the deliveries of materials to the NSLS Complex. The proposed upgrades (including staff and users) would generate an expected increase in deliveries and the use of private vehicles by approximately 5%. The consequences of these are expected to be minimal.

HUMAN HEALTH EFFECTS: Monitoring individual worker exposures, through the use of thermoluminescent dosimeters (TLD), control TLDs and real-time monitors set up in various locations throughout the facilities, indicate that the dose from operations is maintained ALARA. In CY99, 7082 TLDs were issued to individuals in the NSLS Complex. The average whole body dose (gamma plus neutron) was 0.02 mrem/yr and the maximum whole body dose recorded for one individual was 20 mrem/yr. The control TLDs did not have any recordable dose in CY99 indicating that the operational and administrative controls were very effective. The human health effects of the Proposed Action are not expected to change from those identified in the No-Action Alternative due to the strict maintenance of administrative, operational, shielding, and machine safeguards. The improvements and efficiencies gained from component upgrades could possibly result in reduced corrective and preventive maintenance. Shielding upgrades and installation of new radiation monitors would subsequently reduce personnel dose. Because the measured radiation levels within the NSLS Complex have been historically low, the dose contribution from the NSLS Complex to the environment and the public is non-existent. There would be no anticipated increase in off-site dose to the public as a result of NSLS Complex operations. Impacts, therefore, are expected to be minimal and even slightly less than the No-Action Alternative.

ACCIDENTS AND NATURAL HAZARDS: Occurrences, non-conformances and injuries are not expected to increase under the Proposed Action. The goal of the NSLS Complex would be to maintain existing levels, or lower them, by continuing to implement Work Planning Controls, Experimental Reviews, Tier I Safety Inspections and Training. Upgrades to the NSLS Complex are expected to reduce the potential for occurrence of accidents, as well as the potential for their consequences. The potential for natural hazards would remain the same under the Proposed Action Alternative.

WASTE MANAGEMENT: The Proposed Action would result in the one-time generation of waste from building construction (e.g., excavated soils, cement, metals and wood). The engineers in charge of the various projects would manage this waste, and the materials would be disposed of properly. The Proposed Action also includes equipment upgrades that would slightly increase (~5%) waste generation. These increases would be within the year-to-year variation that is now experienced. Another possible source would be in chemical (hazardous) wastes generated by a ~5% increase in the number of experiments [CDR, 1999]. There would probably be an increase in discarded metals during the upgrades as old equipment is replaced by newer equipment. For larger

objects, such as beam pipes and chambers, an effort always is made to reuse them and save costs. Much of the remainder would be evaluated for recycling before disposal. Any accelerator components determined to be radiologically activated would be transported to BNL's Waste Management Facility for disposition at an off-site DOE-managed or approved facility. The slight increase in waste expected to be generated initially under the proposed action would not create a significant impact. The improvements and efficiencies gained from component upgrades could possibly result in reduced corrective and preventive maintenance that would subsequently reduce waste generation.

ENVIRONMENTAL JUSTICE: None of the alternatives would have environmental justice impacts because there would be no anticipated economic or health impacts to any potentially affected population. Therefore, there would be no disproportionate adverse impacts to either low-income or minority populations.

CUMULATIVE AND LONG-TERM IMPACTS: The cumulative impacts are based on current BNL operations, current and future Relativistic Heavy Ion Collider (RHIC) and Booster Applications Facility (BAF) operations, and those for the NSLS Complex Proposed Action. Impacts due to the NSLS Complex No-Action Alternative would remain the same.

Based on dose information from personal dosimeters and area monitors, the external dose contribution from the NSLS Complex appears non-existent to the environment and the public. Due to the strict maintenance of administrative, operational, shielding and machine safeguards, this is not expected to change for the Proposed Action.

The increases in the usage of electricity, steam and chilled water by the NSLS over the next five years are within the projected capabilities of BNL and would not create a cumulative impact to the environment.

The NSLS contribution to waste may increase by up to 5% due to more staff, users and the number of experiments. However, the improvements and efficiencies gained from component upgrades could possibly result in reduced corrective and preventive maintenance that would subsequently reduce waste generation. The NSLS Complex and BNL at-large consistently endeavor to identify pollution prevention opportunities that likely would result in a net reduction in waste. Such a projection indicates a minimal additional cumulative impact to the environment.

DECOMMISSIONING: A discussion of decommissioning would be reserved for a separate NEPA document to be prepared near decommissioning when detailed data would be available.

Impacts of Construction:
The commitment of resources for the proposed action upgrades and construction (9300 square foot addition to NSLS Building 725 and 3600 square foot addition to SDL Building 729) would include the resources listed above, as well as additional research and

support staff; construction personnel, equipment, materials and utilities such as electrical, petroleum, and water. Metals, concrete, masonry, wood, plastics, thermal and moisture protection materials, doors and windows, finishes, mechanical and electrical systems would be used to construct the building's proposed additions. Construction may generate dust and noise, but the impact of such work would be limited in time and kept to a minimum. Spraying water would control the dust. The noise from excavation equipment would be significant locally (it may disturb office workers near the construction-site), but not away from the immediate area. Fossil fuels and water would be used to operate construction machinery. Construction contractors would be trained and instructed to notify the BNL spill-response team in the event of a spill, and are required to have Material Safety Data Sheets for any chemicals they use. The resources required for much of the construction and upgrades are readily available in local markets. Some specialized components might be manufactured outside the BNL area but this should not impact the availability of raw materials. The energy demands of the construction equipment would have a negligible effect on available supplies. The new facilities would be tied into existing climate controls with electronically controlled systems for heating, ventilation, and air-conditioning linked to BNL's site-wide Energy Management Control System.

DETERMINATION:
Based on the analyses in the EA, DOE has determined that the continued operation, construction and upgrades of the NSLS Complex at BNL do not constitute a major federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act (NEPA) of 1969. Therefore, the preparation of an Environmental Impact Statement (EIS) is not required.

PUBLIC AVAILABILITY: copies of this EA (DOE/EA-1321) are available from:
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