Department of Energy
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MAY 19 1998

Mr. Andrew McNerney
Booster Application Facility (BAF) Project Manager
Brookhaven Science Associates. LLC
Brookhaven National Laboratory
Upton, NY 11973

Dear Mr. McNerney,

SUBJECT: APPROVED ENVIRONMENTAL ASSESSMENT (EA) AND FINDING OF NO SIGNIFICANT IMPACT (FONSI)

The Booster Application Facility Project Environmental Assessment, prepared by BNL, has been reviewed by New York State and the Long Island Regional Planning Board. The DOE review was coordinated by this office and included legal review as well as review by the DOE Chicago NEPA Compliance Officer. Additional support was provided by ER-80 at DOE-HQ. All comments have been incorporated in the final document and has resulted in a Finding Of No Significant Impact (FONSI). The final EA and FONSI are enclosed for your files.

Please feel free to contact me at extension 3430, for any additional information.

Sincerely,

Michael Butler
Booster Application Facility
Project Manager

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U.S. Department of Energy

Finding of No Significant Impact

Proposed Booster Applications Facility

at

Brookhaven National Laboratory, Upton, New York

AGENCY: U.S. Department of Energy

ACTION: Finding of No Significant Impact (FONSI)

SUMMARY: The Department of Energy (DOE) has prepared an Environmental Assessment (EA), DOE/EA-1232, evaluating alternatives for the proposed construction, operation, and eventual decommissioning of a Booster Applications Facility (BAF) at Brookhaven National Laboratory (BNL), Upton, New York that would meet national space radiation research needs involving the use of heavy ions. Simulation of space radiation requires the capability to produce protons and electrons at relatively low energies and heavy and light ions at energies up in the GeV per nucleon range. Availability of these particles is essential to calibrate spacecraft radiation detectors, establish a comprehensive understanding of radiobiology, assess radiation shielding needs for space missions, define the full impact of space radiation on sensitive electronic components, and other studies involving simulated space radiation environments. These low-energy protons and electrons can be delivered as beams in ground-based accelerators. No facility in the United States currently has the capabilities to meet national space radiation research needs for heavy ions.

Based upon the analyses in the EA, DOE has 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 is not required.

DESCRIPTION OF THE PROPOSED ACTION:

The proposed action (Preferred Alternative) would include construction and operation of a space radiation research facility north of the BNL Booster. This facility, identified as the BAF, would require the following construction activities:

- Upgrade the MP6 Tandem Van de Graaff accelerator and connect it into the Tandem to Booster (TTB) line;

- Install a beam line with diversion magnets off the northwest quadrant of the Booster;

- Construct a beam penetration that could direct beam to initially one and potentially up to three experimental facilities within the new BAF;

- Construct a new 250 square meter building and trailer area which would house a target area, laboratory facilities, shielding, power supplies, and a beam stop; and

- Construct a new paved roadway on the west side of the proposed facility to maintain the continuity of West Fifth Avenue.

Upgrade activities would include the installation or replacement of modernized or improved equipment comprising such items as power supplies and computer systems, and possibly the construction of two more target areas with trailer-size laboratory facilities. The connection of the MP6 Tandem Van de Graaff to the TTB would require the installation of approximately 70 meters of beam line in the existing enclosure and magnets to properly direct the beam. Beam line construction would consist of the manufacture and installation of vacuum systems, vacuum chambers, magnets, and power supplies.

Once the beam is diverted out of the Booster, it would travel through a 27 meter beam line and be diverted 20°. The beam would be redirected down a pathway 80 meters long and enter a 121.5 square meter experimental facility at the BAF. A new 250 square meter building connected to the experimental areas would provide the necessary support facilities for the experimental area, support laboratories, temporary biological specimen preparation areas, radiobiological laboratories, offices, a beam control room, a mechanical service equipment area and rooms for storage of radioactive materials and miscellaneous items. A separate 108 square meter power supply building would also be constructed at grade adjacent to the Booster. Once completed and operational, the BAF could receive enough low-energy protons and heavy ions from the Booster to support 1,500 hours per year of space radiation research.

ALTERNATIVES ANALYZED:

Alternatives to the proposed action discussed in the EA include the construction and operation of a space radiation research facility south of the BNL Booster and No-Action Alternative.

The South Alternative: The South Alternative would generally include the construction of all of the components of the proposed action. Additional actions needed for this alternative would be:

- Extension of the beam line across the 200 MeV linear accelerator (LINAC) injection tunnel to the AGS and the TTB;

- Construction of a retaining wall to protect the Radiation Effects Facility (REF);

- Installation of a beam line with diversion magnets off the southeast quadrant of the Booster; and

- Relocation of Michelson Avenue to the west side of the Neutral Beam Test Facility.

The exit point in the Booster for the beam would be in the southeast quadrant for this alternative. Once the beam is diverted out of the Booster, it would travel through 68.6 meters of beam line, crossing the Linac injection tunnel to the AGS and the TTB. At that point it would enter a pentagonal switchyard where the southwest traveling beam would be diverted in a more southerly direction and travel an additional 41.8 meters adjacent to the retaining wall constructed to protect the REF. The beam would enter the beam line for diversion into an experimental facility. Beyond this point the support facilities would be constructed the same as for the Preferred Alternative. The beam line and experimental facilities associated with this alternative for the BAF would be constructed upon previously disturbed sparsely vegetated sandy soils. Elevation of the new facilities would be 6.1 to 9.1 meters below the existing grade. Like the Preferred Alternative, only one of the proposed beam lines and associated experimental facilities would be initially constructed.

The No-Action Alternative: The No-Action alternative would not pursue new construction or modifications of current facilities at BNL to facilitate the space radiation research program. Only one facility world-wide generates the appropriate beams for space radiation research, the Schwerionen Synchrotron facility at Geselschaft fur Schwerionenforschung, Darmstadt,

Germany. This facility offers less than an ideal situation to the U.S. space radiation research program because it is heavily subscribed for other nuclear physics research. This Synchrotron facility cannot offer sufficient user time, consequently future use cannot be prioritized by the United States and the facility is unreliable.

ENVIRONMENTAL IMPACTS:

The potential environmental impacts from the proposed construction, operation, and decommissioning and decontamination of the BAF in the area immediately north of the BNL Booster as well as the cumulative effects from this and other BNL activities are evaluated in the EA. Areas of potential environmental impact evaluated in the EA are land use, resource commitments, water quality, air quality, noise, ecology, waste generation and management, cultural/historic resources, environmental justice, and radiation exposures.

Impacts of Facility Construction: The proposed BAF construction would entail new beam lines, power supplies, computer equipment, experimental facilities, biological specimen preparation facilities, and new structures to house operations. The BAF would require approximately 15,000 cubic meters of concrete and earthen cover. All of the resources required for construction and upgrades are readily available in local markets. Some specialized components such as magnets might be manufactured outside the existing area but this should not result in an impact on the availability of raw materials. Energy demands of construction equipment would not have a significant impact on available supplies.

Construction of the proposed BAF would be located where a partially paved roadway connects the 200 MeV LINAC facility to Alternating Gradient Synchrotron support facilities and forested area. The composition of vegetative species in the forested area, covering approximately 0.28 hectares, indicates that this parcel of land has been undisturbed for the last 15 to 20 years. No disturbance would occur to the adjacent stand of white pines which were planted in the 1930s. Because development is on a small parcel and is at least half cleared, with grasslands on earthen

shielding, no significant impacts to wildlife populations are anticipated. During construction the white-footed mouse and cottontail rabbit would be disturbed. Both are common at BNL and on Long Island. No federal or New York State listed or proposed threatened or endangered species exist within the project impact area.

No impacts to wetlands or watercourses are anticipated. The nearest wetland is approximately 75 meters to the north/northwest and construction is outside a 0.81 kilometer corridor surrounding the Peconic River, portions of which are protected under the New York State Wild, Scenic, and Recreational River Systems Act. Secondary impacts to local wetlands within BNL Recharge Basin HT (permitted outfall 006), could result from an increase in paved and semipervious habitat. Runoff discharging to storm water drains that feed HT would increase, possibly increasing discharges of sediments and pollutants common to semipervious and paved surfaces. Use of standard erosion control practices such as hydroseeding should minimize sediment discharges. The wetland habitat and surrounding areas have only minor variations in elevations so increase in wetland acreage could also occur from increased discharges. No facilities would be constructed in or have an impact on the 100-year floodplain as delineated by the Federal Emergency Management Agency's National Flood Insurance Program.

Noise, traffic, and visual effects would be minor at the BAF. Although 0.28 hectares of habitat would be replaced by several buildings and the BAF target areas would be constructed at grade and covered by 6 to 12 meters of earthen fill for shielding. this visual effect is already present at the adjacent Booster and AGS facilities. The area receives little public traffic and is shielded from the view of the general public by 1,200 meters of mature white pine forest. The rerouting of West Fifth Street would have little impact on traffic as alternative routes to this area are available with similar travel distances. All disturbed areas not paved during construction would be seeded to maintain grasslands on shielding soil or landscaped. Actual clearing of forested habitat would be limited to that necessary for construction and associated parking facilities. All site utilities are present in conduits which cross the site so no additional impacts would be

required to make utility connections. No resources or artifacts of archaeological importance are located within the project impact area.

Connection of the beam line and particle diversion system to the Booster would require approximately 3 to 6 months to complete. This action could be scheduled when the accelerator is shut down for routine annual maintenance activities. Under these conditions, no impacts to current operations would result.

Construction activities other than the breaching of the TTB transfer tunnel and the LINAC injection tunnel to the AGS would be carried out in a similar fashion. Routine activities for BAF construction would not generate radioactive wastes. Solvents and oils used for cleaning and lubricating would be kept in approved containers meeting the requirements of applicable federal, state, and local rules and regulations at each facility. Contractor operations involving these and other chemicals, such as soaps and paints, would be administratively controlled to ensure that wastes generated from these materials are handled and disposed of properly at offsite locations. Waste generation from routine construction activities is expected to be less than 10 cubic meters of material.

Impacts of Facility Operation: All fresh water available to BNL and surrounding communities comes from an EPA designated sole source aquifer system. Water consumption at the BAF would be minimized through the use of a closed-cycle heat removal system. It is estimated that the total water consumption of the BAF in cooling systems (in addition to current BNL usage at all existing/proposed facilities), would require 170 liters per minute (LPM) for cooling purposes, of which approximately 57 LPM would be consumed due to evaporation losses. In addition, BAF facilities would require approximately 5,700 liters per day (LPD) for domestic usage. This would represent a total increase in BNL pumpage of 1% and an actual increase in water usage of 0.7%, which is about 17,055 LPM withdrawn. Of the water withdrawn 8,530 LPM is returned through recharge basins and 2,000 LPM is returned via sewage treatment plant (STP) effluents.

This water would be drawn from up to ten process and/or supply wells, depending on operational constraints. As each operational well would be providing supply toward this increase, the production increase of each well would be within normal operating fluctuations and would produce imperceptible modifications to existing drawdown impacts in well capture zones. Based upon the 1991 Water Table Balance for BNL, BAF's actual requirements of 82,080 LPD represent only 0.5% of the Margin of Safe Yield volume of 17,055,000 LPD available to BNL. This increase would be well within past operating conditions which have decreased 10% since 1985 as a result of the implementation of various water conservation activities. Pumpage required by this project is well within permitted pumpage volumes for BNL supply wells.

The BAF is projected to require 0.5 MW of electrical power, which is 20% of the 2.5 MW required for operation of the Booster. Current peak electrical demand by BNL is 45 MW. Peak electric use is expected to increase to 80 MW when the RHIC becomes operational. The extra load due to the BAF would be essentially constant, with low variation at times of shutdown and start up. The New York Power Authority and the Long Island Lighting Company have indicated that they have adequate existing capacity and could supply additional BNL energy demands.

The BAF and support buildings to be constructed would increase the building occupied space at BNL by 0.2%. This small increase would have an imperceptible impact on use of fossil fuels and electricity to meet heating and air conditioning needs. Because the BAF facility would be covered with earthen shielding, the primary function required for building climate control would be dehumidification.

For BAF operations environmental concerns are associated water and air effluents. A secondary STP operated by BNL is authorized to treat 6.8 million LPD of sanitary discharge. The plant is currently operating at approximately 45% of capacity. Domestic sanitary waste is the only effluent expected to be discharged to sanitary lines on a routine basis from BAF. The volume of this discharge is not expected to exceed 5,700 LPD which is less than 0.1% of the current

authorized treatment plant limit. Connection to the sanitary system would be made for all BAF facilities. No radioactive isotopes would be discharged from any of the facilities connected to the sanitary system.

The BAF would be supported by maintenance facilities currently existing at BNL. These facilities have New York State Department of Environmental Conservation (NYSDEC) authorized air emission points associated with them for activities such as vapor degreasing, paint spraying, welding, sandblasting, baking, plating, and polishing. The BAF would also have laboratory facilities where fume hoods would discharge trace amounts of organic solvents, acids, bases, and other common laboratory chemical vapors. Pending the availability of detailed design for air emission points and the type and use of laboratory chemicals, air emissions from laboratories are generally regarded as insignificant and are exempt by the NYSDEC from obtaining authorization to construct and operate. Additional demands of BAF are not anticipated to require permit discharge limit modifications at existing facilities as operations should be well within the normal fluctuation of activities at BNL.

During BAF operations some beam line components could become activated. If any of these components were to fail, they would be removed from service and placed in indoor, shielded holding areas subject to controlled access. The items would be repaired, salvaged, or packaged and moved to BNL's hazardous waste storage facilities for secure storage and eventual shipment offsite as low level radioactive waste. Other hazardous or radioactive wastes generated during operations, such as from maintenance, would be handled in a similar manner.

Besides the packaging of wastes for disposal, BNL has instituted an aggressive waste minimization program which includes inventory control, material and process substitution, waste segregation, toxicity reduction, and recycling. Solid waste which is non-hazardous and non-radioactive would be disposed of through the services of an offsite vendor. For BNL, the BAF would increase the generation of solid waste approximately 7,200 kilograms per year or

approximately 0.5% of BNL's current solid waste stream of 1.35 million kilograms. Hazardous non-radioactive waste would be disposed of via the services of a group of firms presently under contract to BNL. Disposal services are typically comprised of incineration, landfilling and/or resource recovery, depending on the particular waste stream involved. These operations are performed at various permitted facilities around the United States. The BAF is expected to generate 450 kilograms per year of hazardous waste or less than 1% of the 70,000 kilograms generated by BNL in 1995. Low level radioactive waste would be shipped to and disposed of through burial at the Hanford site in the State of Washington. Initial handling and packaging of the waste would be accomplished on location by AGS Department personnel and then transferred to BNL's Hazardous Waste Management Facility (HWMF). Radioactive waste generated by BAF would total 1.5 cubic meters of material compared to current BNL operations which generate 450 cubic meters of material per year.

Building 919 would be the closest uncontrolled location to the proposed action with full-time worker occupancy, a distance of 150 meters. Non-radiation worker personnel are present in the building. Personnel in this building would be exposed to earth shine and skyshine radiation due to routine losses. To meet administration goals of BNL, which require dose rates to on-site non-radiation workers to be no more than 25 mrem/year and off-site individuals no more than 5 mrem/year, it has been calculated that no more than 330 mrem/hour could be allowed at the BAF outer shield surfaces during the running period. Given the size and thickness of shielding proposed for BAF, the calculated outer shield surface exposure would yield 0.002 mrem/hour. This translates into dose rates of 0.000027 mrem/year at the site boundary and 0.00013 mrem/year at Building 919, both of which are less than one ten thousandth of their respective administrative limits.

Secondary particles created by beam interactions would escape into the soil surrounding the BAF experimental area and beam stop. Some of the particles would interact with the silicon and oxygen atoms present in the soil to form possibly such radionuclides as tritium beryllium-7,

carbon-11, nitrogen-13, oxygen-15, and sodium-22. Once present in the soil they could be leached downward to the ground water by rain and then transported by the ground water to wells both onsite and offsite. Only the longer lived radioisotopes of tritium and sodium-22 would persist long enough to potentially impact ground water. Conservative estimates indicate that initial radionuclide contamination of soil water at the point of creation would be approximately 2,000 pCi/L. By the time this radionuclide containing soil water could be leached from beneath the BAF facilities, move into ground water, and migrate to any onsite or offsite potable water supply well, these radionuclides would be expected to have fully decayed and not be detectable above background concentrations.

The BAF would be expected to produce the following air activation products: tritium; beryllium-7; carbon-11; nitrogen-13; oxygen-14; oxygen-15; and argon-41. Under normal operating conditions, these radionuclides would not be exhausted from the target room and would decay to stable, non-radioactive atoms. Under abnormal operating conditions, expected to occur less than once per year, it may be necessary to vent the target hall causing a release of the generated radionuclides. Conservative estimates of the maximum dose to an individual onsite would be 0.002 mrem/year and the maximally impacted resident at the site boundary would receive approximately 0.00009 mrem/year as a result of these abnormal releases from BAF operations.

Activation products attributed to experimentation at the BAF could also be discharged through the incineration of disposed experimental materials. Incineration of other biological materials is conducted at an onsite unit currently permitted by the NYSDEC. The estimated dosimetric impact of operating the Booster, BAF, and the proposed RHIC would add an estimated 0.02 mrem at the site boundary and 0.009 person-rem for the collective dose. The total dosimetric impact due to air emissions from operating Booster and all other facilities including the projected operation of RHIC would be a maximum 0.2 mrem to an individual at the site boundary and a collective dose of 3.109 person-rem under 1995 operating conditions. Calculations to determine the total radiation dose to an individual residing at the BNL site boundary over a 10 year period

(10 years is the expected operating life of BAF) would be 0.0009 mrem from BAF. This dose would be nine orders of magnitude below respective background levels. Using the International Commission on Radiological Protection's and National Academy of Sciences' methods of risk prediction, the additional risk of a person residing at the site boundary to contract a fatal cancer would be less than one chance in a billion. Given this information, no radiation health effects are expected to occur.

Impacts of Decommissioning and Decontamination: During decommissioning and decontamination of the BAF, the only space radiation dedicated portion of the facility, radioactive items encountered would be limited to some experimental detectors, beam stops, transfer magnets and some vacuum equipment. These components would be categorized as low level waste and would be shipped for disposal offsite at existing federal facilities. Estimates of the amount of low level radioactive waste that would require disposal, assuming no components would be reusable, would amount to approximately 100 cubic meters. Construction debris from dismantling the BAF would include approximately 2,800 cubic meters of concrete, 55,000 kilograms of steel, 9,000 kilograms of copper, and 11,000 kilograms of miscellaneous materials. To access the BAF and beam transport lines would require the excavation of 15,000 cubic meters of earthen shielding which would be stockpiled and regraded following tunnel and component removal. After removal of soils containing tritium and sodium-22, included in the 100 cubic meters of low level radioactive material, the remaining soil would be regraded. Future site utilization would have no restrictions other than surrounding land uses.

Doses to site workers during decommissioning and dismantlement for either alternative would be expected to be of no concern since no components would become activated above a low level radiation hazard and decay of radioactive isotopes would occur from the time beam was last in the facility to the time when actual dismantlement would occur. Under current operations, actual dismantlement of this facility would be 5 to 10 years after shutdown.

DETERMINATION:

Based on the analyses in the EA, DOE has determined that the proposed construction, operation, and eventual decommissioning and decontamination of a Booster Applications Facility at BNL in the area described as north the BNL Booster does not constitute a major federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act of 1969. Therefore, an Environmental Impact Statement for the proposed action is not required.

PUBLIC AVAILABILITY: Copies of this EA (DOE/EA-1232) are available from:
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For further information regarding the DOE NEPA process, contact:

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Issued in Upton, NY, this 18 day of May 1998.

K. Dean Helms
Executive Manager