ENVIRONMENTAL ASSESSMENT

CONSTRUCTION AND OPERATION OF AN IMPROVED
RADIATION CALIBRATION FACILITY

AT

BROOKHAVEN NATIONAL LABORATORY

U. S. DEPARTMENT OF ENERGY

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1.0 NEED FOR ACTION

Calibration of instruments used to detect and measure ionizing radiation has been conducted over the last 20 years at Brookhaven National Laboratory's (BNL) Radiation Calibration Facility, Building 348. Growth of research facilities, projects in progress, and more stringent Department of Energy (DOE) orders which involve exposure to nuclear radiation have placed substantial burdens on the existing radiation calibration facility. The facility currently does not meet the requirements of DOE Order 5480.4 or American National Standards Institute (ANSI) N323-1978, which establish calibration methods for portable radiation protection instruments used in the detection and measurement of levels of ionizing radiation fields or levels of radioactive surface contamination.¹ Failure to comply with this standard could mean instrumentation is not being calibrated to necessary levels of sensitivity. The Laboratory has also recently obtained a new neutron source and gamma beam irradiator which can not be made operational at existing facilities because of geometry and shielding inadequacies. These sources are needed to perform routine periodic calibrations of radiation detecting instruments used by scientific and technical personnel and to meet BNL's substantial increase in demand for radiation monitoring capabilities. To place these new sources into operation, it is proposed to construct an addition to the existing radiation calibration facility that would house all calibration sources and bring BNL calibration activities into compliance with DOE and ANSI standards. The purpose of this assessment is to identify potential significant environmental impacts associated with the construction and operation of an improved radiation calibration facility at BNL.

2.0 ALTERNATIVES

2.1 NO ACTION

The no-action-alternative would continue current operating conditions at the radiation calibration facility. The current facility conducts calibration operations using a 16 curie plutonium/beryllium source and a free air gamma calibration system. Additionally, instrument repair and upkeep operations are conducted at benchtop space and a small machine shop. Current radiation calibration activities generate hazardous waste from the use of small quantities of 1,1,1-trichloroethane and nickel cadmium batteries. Hazardous waste generation now amounts to less than 4.5 kilograms per year. The existing facility would continue to operate out of compliance with DOE and ANSI standards and would not be capable of handling the continually increasing demands for instrument calibration by the laboratory scientific and technical community.

2.2 PROPOSED ACTION

The proposed action would provide for the construction of a new 130 square meter building for the purpose of moving both existing and proposed new radiation sources into this new structure to conduct radiation calibration operations. Once all sources and associated calibration instrumentation are moved to the new facility, Building 348 would undergo minor interior modifications to consolidate radiation instrumentation testing and repair operations now conducted at various locations on the BNL campus. This new facility would be connected to the existing facility (Building 348) via a roof covered 30 meter walkway. The new

building would be constructed of structural steel frame and include 61 centimeter thick concrete shielding walls, heating, air conditioning, sprinkler systems, electric power, and lighting within a newly fenced area. The new building would be constructed in a northeast/southwest orientation with the walkway connecting the southwest corner of the new building to the northeast corner of Building 348. Chain link fencing around the existing building encloses about 0.16 hectares of woodlands and grasslands. With construction of the new facility, the fenced area would be roughly doubled to 0.32 hectares. This new building would be constructed in accordance with ANSI N323-1978. Site work would include the removal of 0.04 hectares of woodland habitat, excavation up to 1.6 meters below grade, back filling, and regrading. All utilities would be provided to this new building by connecting into existing site utilities. Useful life of this new facility is expected to be 40 years. The proposed facility is displayed in Figure 2-1.

Sources to be located in the new building include a Model 149-D20 Shepherd neutron calibration system, a free-air gamma calibration system, and a gamma beam irradiator. The Shepherd neutron calibration system would include a 100 microgram californium-252 neutron source. This source would be located near the center of the proposed facility. This Shepherd neutron calibration system would replace the existing neutron calibration system which would be disposed of. This new system would have higher neutron exposures available and coupled with improved exposure geometries, would permit calibrations to be completed in shorter time periods and with reduced scattering neutron contributions to the calibration exposures. The free-air gamma calibration system is presently in service in Building 348 and would be relocated to the new facility addition. This calibration system contains five sealed radiation sources: a 2 curie cesium-137 source; a 16 millicurie cobalt-60 source; a 48 millicurie cobalt-60 source; a 72 millicurie cobalt-60 source; and a 133 millicurie cobalt-60 source. The Laboratory does not possess a gamma beam irradiator at present but one would be purchased for use in the new building addition. This new gamma beam irradiator would be based on Model 81 Shepherd Beam Irradiator and possess a 3,000 curie cesium-137 source. The irradiator would permit the calibration of a large variety of radiation monitors over a broad range of exposures. Diagrams of each of these calibration systems are provided in Figures 2-2, 2-3, and 2-4, respectively. Information on the operation of these sources is provided in Section 4.2 and the preliminary safety analysis report developed on this facility which is included by reference.

2.3 CONSTRUCTION AT A DIFFERENT LOCATION AT BROOKHAVEN NATIONAL LABORATORY

The primary criterion for locating the new radiation calibration facility was to maintain a close proximity to Building 348 to take advantage of existing equipment and minimize the potential for increased radiation exposures at a different location. Alternative locations given primary consideration were located within the same general radius in which the proposed action is situated. The proposed action location was subsequently selected over all others because it provides the greatest minimization to the surrounding on site and off site public from radiation exposures.

Figure 2-1: Proposed radiation calibration building.

Figure 1-1: Diagram of the Californium-252 neutron source system.

Figure 2-11: Free-air gamma radiation source system.

Figure 1-1: Compressed Air Control System for the Gamma Irradiator.

The construction of a radiation calibration facility at a remote alternative location to the proposed action on the BNL facility would provide the necessary space for operations and meet DOE and ANSI standards. However, alternative locations would be situated farther from the existing facility which would defeat one purpose of the proposed action, to consolidate radiation instrument calibration and repair activities. Relocation of the entire facility would significantly increase the potential for environmental impact since the selected area would have to be located away from current operations, thus limiting alternatives to undisturbed areas of the site not already slated for development. This alternative was dropped from further consideration.

2.4 USE OF CONTRACT SERVICES

The use of outside contract services was also considered to meet BNL calibration needs. This alternative would produce none of the environmental disturbances at BNL associated with the proposed action. Magnitude of impacts off site would be largely determined by the location of the firm or firms providing BNL with the services required. Also, dependency on off-site contractors could pose a problem if equipment delays result because of ordering or stock problems. An on-site facility would be much less prone to logistic problems since needs could be better anticipated and a BNL facility is only concerned with servicing the Laboratory and its user community upon request. Because of these operational constraints and the determination that costs for services would be prohibitive (five times on site operations based upon calibration personnel calculations), this alternative was also dropped from further consideration.

3.0 SITE DESCRIPTION

3.1 GENERAL SITE

Brookhaven National Laboratory is a multi-disciplinary scientific research center located close to the geographical center of Suffolk County, New York approximately 97 kilometers east of New York City. For 1991 about 1.32 million persons resided in Suffolk County, about 0.41 million of them in Brookhaven Township, within which the Laboratory is situated. Approximately 8,000 persons resided within 0.5 kilometers of the Laboratory boundary.² Although much of the land area within a 16 kilometer radius remains either forested or cultivated, there has been continuing residential and commercial development near the Laboratory during recent years.

The BNL site is shown in Figure 3-1. It consists of 2,130 hectares of mostly wooded habitats except for a developed area of about 670 hectares. The site terrain is gently rolling, with elevations varying between 13.3 and 36.6 meters above sea level. The land lies on the western rim and headwaters of the Peconic River watershed. Freshwater wetlands in the north and east quadrants of the site remain in an area once part of a principal tributary to this river system.

Ground water in the vicinity of BNL moves predominantly in a southerly direction towards the Great South Bay, although the flow becomes somewhat easterly within the Peconic River watershed. Percolation occurs rapidly into the sandy sediments of the uppermost Pleistocene deposits underlying the Laboratory. The estimated rate of ground water velocity is 30 to 45 centimeters per day. About half of

Figure 3-1: Overview of Brookhaven National Laboratory Environmentally Sensitive Areas

Long Island's annual precipitation percolates through the soil to recharge ground water. The other half returns to the atmosphere via evaporation and evapotranspiration. Precipitation for 1991 totalled 115 centimeters, about 9 centimeters below Long Island's previous 40 year annual average.² A variety of fish and wildlife habitats can be found at BNL because of its relative lack of development and its location within a river corridor. The predominant oak/pine forest community offers excellent feeding, resting, and nesting opportunities for many species of migratory songbirds. Small mammals common to the northeast can be found in the grasslands and forest edges. Despite the Laboratory's relatively pristine environment, no New York State or Federally listed or proposed threatened or endangered species occur on site according to representatives of the New York State Department of Environmental Conservation and the U.S. Fish and Wildlife Service (see Section 10.0).^{3,4}

When assessing the impact of radioactive releases, wind rose information is especially useful. The BNL site is considered well ventilated as a result of its location on the eastern seaboard. Winds are predominately from the southwest during the summer, northwest during the winter, and equally from each of these directions in the spring and fall. Inclement weather is generally accompanied by winds from the northeast.

3.2 AREA OF PROPOSED ACTION

The proposed facility would be constructed adjacent to the existing radiation calibration facility. This location is on the western fringe of the core development of BNL. Beyond the fenced area to be erected would be vacant forested land to the immediate north and west; Building 348, a small office building housing approximately 25 employees (Building 51), and a woodworking shop (Building 405) to the immediate south; and the BNL Fire/Rescue Station, with up to 20 employees present at any one time, to the immediate east. Employees found in all adjacent facilities except Building 348 are considered to be non-radiation workers. The location of the proposed action is shown in Figure 3-2.

The proposed facility would be constructed on an open grassland field. A 15 meter band of forested habitat separates the current facility from the proposed facility. The site terrain is generally flat with elevations ranging from 25 to 28 meters above sea level. No wetlands or other environmentally sensitive habitats are located in the project impact area. Depth to ground water in the area is approximately 14 meters. Ground water flow is generally toward the south but bends to the southeast during the operations of BNL Potable Wells 4, 6, and 7.⁵

The forested habitats and open grasslands of the project area host most of the wildlife common to the BNL site. White-tailed deer are routinely spotted feeding in the open grassland. The forested and forest/grassland edge areas are attractive to common songbirds. No barriers to wildlife movement in and out of the project area exist.

4.0 ENVIRONMENTAL IMPACTS OF PROPOSED ACTION AND ALTERNATIVES

Environmental impact is an important criterion used in the alternatives selection process. Environmental concerns associated with this project fall within the categories of potential impacts to archaeological resources, loss of natural habitats, and radiation exposures to workers and the general public.

4.1 IMPACTS FROM CONSTRUCTION

No construction is proposed under the no-action-alternative. The sections below focus on the proposed action. Impacts associated with operations under the no-action-alternative are discussed in Section 4.2.

4.1.1 Land Use and Ecology

The proposed action building area has received only limited disturbance since the occupation of Camp Upton by the U.S. Army in 1947. Grasslands are managed on part of the land to provide proper clearance surrounding a radio tower used to receive weather information by the Department of Applied Science. The remainder of the property is forested, although the monotypic speciation would indicate this area was planted rather than vegetated through natural succession.

Woodlands would be cleared to accommodate the construction of the new facility. No wetlands, environmentally sensitive habitats, or areas within a 100 year floodplain would be impacted by construction. The net result would be the loss of approximately 0.04 hectares of woodland habitat and about 20 linear meters of woodland/grassland edge. All areas disturbed but not impacted by structural modification would be graded, seeded, and mulched to maintain a lawn area. The tiger salamander (Ambystoma tigrinum), a New York State endangered species is known to occur at BNL. However, no habitat is proposed to be disturbed by the alternatives under consideration are known to support tiger salamander populations. Assuming the habitats at BNL are at their optimal carrying capacity, individual organisms would be lost as a result of construction. These losses would be expected to be minimal given the small area of disturbance, maintenance of existing wildlife corridors, and the existence of similar habitats throughout the Laboratory.

The New York State Historic Preservation Officer (SHPO) has reviewed the proposed action in accordance with the National Historic Preservation Act and issued a determination dated February 27, 1991 which states that the project will have no effect/impact on those characteristics of the property which would qualify it for inclusion in the National Register of Historic Places (see Section 10.0).⁶ Since the proposed action requires excavation to 1.6 meters below grade, the contractor would be required to stop work immediately if any artifacts of possible historic significance are uncovered until the artifact and surrounding area could be examined further. This occurrence is expected to be remote given the historic use and previous disturbances at this location.

4.1.2 Emissions and Effluents

Construction of the proposed action would require the use of heavy equipment for earthwork and general construction. Operation of heavy equipment could generate noise sufficient to disrupt operations at Buildings 51, 348, and 599. Building 51 provides office space for BNL's Office of Environmental Restoration, Safety and Environmental Protection Division's emergency planning operations, and the Department of Applied Science's Meteorology Group; Building 348 houses current activities in radiation instrument calibration; and Building 599 is BNL's Fire House. A vegetative buffer zone of forested habitat approximately 8 meters wide should attenuate most noise and visual impacts from Buildings 51 and 348. The Fire House has no vegetative screening to attenuate noise but is 220 meters from the construction zone so noise would attenuate over this distance. In addition, all construction equipment would be required to be operated in good repair including functional mufflers. Noise levels in all facilities are not expected to exceed 45 decibels. This level is satisfactory for telephone conversations, normal voice discussions at distances of 3 to 9 meters, and operation of a quiet office.⁷ Proper muffling equipment would also control exhaust emissions.

During excavation to accommodate building construction topsoil would be stockpiled until construction is completed and then regraded, seeded, and mulched to promote revegetation. During excavation and storage, dry and windy weather conditions could result in eolian erosion of sediments and a localized increase in airborne particulates. To control wind erosion, denuded areas and stockpiled materials would be watered as necessary to prevent localized dust problems. Soils would be expected to remain in stockpiles for a maximum of six months. Piles would not exceed three meters in height since visibility reductions could effect safe operation of construction machinery.

4.2 IMPACTS FROM OPERATIONS

4.2.1 Emissions and Effluents

No impacts to water quality are anticipated for the no-action and proposed-action alternatives. Other than generation of domestic wastes, no processes exist which discharge to BNL's sanitary system or recharge basins. For the proposed action, a slight increase in condensate and domestic waste may be contributed to sanitary lines. Such increases are expected to be imperceptible at BNL's Sewage Treatment Plant operation which currently operates during maximum flow at approximately 60% of its permitted discharge of 1.8 million gallons per day.² Increased input related to the proposed action directed to the sanitary system would be less than 0.1% of current BNL volume.

Calibration of radiation instruments requires operation of sources and monitoring equipment. This activity generates no elevated noise levels. Operations until 1992 included spray painting of some components within Building 348. This action was conducted in a spray paint booth exhausted to the outdoors. On the average, approximately one liter of aerosol paint per month was utilized. Spray painting has been discontinued and is not proposed to be incorporated into the proposed action. No air emissions would therefore occur for the no-action or proposed-action alternatives.

4.2.2 Hazardous and Domestic Wastes

Current radiation calibration activities generate hazardous waste from the use of small quantities of 1,1,1-trichloroethane and nickel cadmium batteries. Hazardous waste generation now amounts to less than 4.5 kilograms per year. Operation of the proposed action would have no effect on the amount of hazardous waste generated annually. Wastes generated are transported to BNL's Hazardous Waste Management Facility for packaging and storage pending final disposal at approved off-site locations by contract vendors.

For the new facility included in the proposed action, contributions of domestic solid wastes are not expected to increase beyond that generated by current radiation calibration instrumentation personnel as no staff increases are proposed for operations and the proposed action would provide improved instrument calibration which generates no solid waste. Current waste generation has no impact on BNL handling and disposal practices. Domestic wastes are checked for radioactivity prior to leaving the BNL reservation as they are transported to local landfills for final disposal.

4.2.3 Utility Demands

Operation of radiation sources and calibration equipment requires typical light industrial electrical service. Extension of service would be made from Building 348 to the new facility. Actual power demands would be similar for both the no-action and proposed-action alternatives since improvements relate to geometry of facility and source intensity rather than source operation. Calibration facility activities require less than 0.01% of the annual power demands at BNL. Current peak demands of all BNL operations are approximately 40 Megawatts.⁸

4.2.4 Radiation and Radionuclides

4.2.4.1 No-Action-Alternative

In 1992, the free-air gamma calibration system was operated for 220 hours and the neutron calibration system was operated for 325 hours. Under these conditions, exposures were calculated for individuals that could be found at various locations around the existing facility. Also taken into account was a conservative estimate of the amount of time an individual would spend in each location. These times were calculated in the preliminary safety analysis report for the proposed facility.⁹ Table 4-1 displays the calculated exposures for individuals both around and in Building 348 for calendar year 1992. It is anticipated that under the no-action-alternative that the exposures reported would continue.

TABLE 4-1: CALCULATED DOSE TO INDIVIDUALS FREQUENTING CERTAIN LOCATIONS DURING OPERATION OF EXISTING RADIATION CALIBRATION FACILITY

LOCATION	DISTANCE meters	GAMMA EXPOSURE ¹ mrem/hr	NEUTRON EXPOSURE ¹ mrem/hr	TOTAL EXPOSURE mrem/yr	BNL LIMIT ² mrem/y
Fence Line	30	0.72	0.043	6.26 ³	25
Start of Par Course	185	0.016	0.0012	1.04 ³	25
Building 599	250	0.0065	0.00064	1.64 ³	25
Building 348 Car Lot	30	0.72	0.043	6.26 ³	25
Building 51	60	0.2	0.01	47.25 ⁴	25
Site Boundary	1,500	1.0E-10	0.00002	0.0065 ³	25
Building 348	5	19.72	1.6	60.00 ⁵	1,250

¹Gamma and neutron exposures include direct beam and skyshine values.

²BNL limits as established in BNL's Radiological Control Manual for the general public and radiation workers. The DOE limit to the general public and radiation workers are 100 mrem/yr and 2,500 mrem/yr, respectively.¹⁰

³Total exposure assumes only one source operational at a given time. If person was in area for more than 220 hours (total operation of free-air gamma sources) then dose of neutron source was added. Because of administrative controls employed actual doses, which are unavailable because exposures fall below detection limits, are expected to be 1 - 10% of calculated figure. Under current operating conditions no measurable dose has been reported for any location.

⁴This is calculated assuming that an individual occupied Building 51 for the entire operating period of the neutron and free-air gamma systems. Actual individual dose would be less given administrative controls on operations in Building 348 require some operations to occur outside normal business hours. No measurable exposure was recorded to personnel occupying this facility in calendar year 1992.

⁵This is an actual reading of the most exposed individual within the radiation calibration facility. Administrative controls on operations reduce individual exposures which otherwise would calculate to be 4,860 mrem/yr.

4.2.4.2 Proposed Action

The proposed action would operate the neutron calibration system, free-air gamma calibration system, and gamma beam irradiator as described in Section 2.2. A preliminary safety analysis report has been prepared which assesses potential impacts to the public from the operation of these sources. Computer modelling was used to determine exposures to individuals that would enter certain areas

TABLE 4-2: CALCULATED DOSE TO INDIVIDUALS FREQUENTING CERTAIN LOCATIONS DURING OPERATION OF THE PROPOSED ACTION¹¹

LOCATION	DISTANCE meters	GAMMA EXPOSURE ¹ mrem/hr	NEUTRON EXPOSURE ¹ mrem/hr	TOTAL EXPOSURE ² mrem/yr	BNL LIMIT ³ mrem/y
Fence Line	30	0.72	0.26	6.26	25
Start of Par Course	150	0.026	0.01	1.69	25
Building 599	220	0.009	0.005	5.76	25
Building 348 Car Lot	65	0.018	0.008	1.01	25
Building 51	90	0.011	0.0035	19.80	25
Site Boundary	1,500	1.0E-10	0.00002	0.036	25
Building 348	45	0.026	0.0057	46.80	1,250 ⁴
Walkway New Facility	10	0.06	0.018	2.25	1,250 ⁴
New Control Room		0.099	0.081	178.20	1,250 ⁴
Outside Direct Beam		0.12	N/A	0.96	1,250 ⁴
Door to Large Source		4.26	N/A	4.26	1,250 ⁴

¹Gamma and neutron exposures include direct beam and skyshine values.

²Total exposure assumes only one source operational at a given time. This is stipulated in the Safety Analysis Report because otherwise sources would interfere with calibration activities of each other. Calculations are conservative, assuming exposure 100% of time at location. Actual exposures are expected to be 1 - 10% of the exposures reported.

³BNL limit as established in BNL's Radiological Control Manual for the general public. The DOE limit is 100 mrem/yr.¹⁰

⁴BNL limit as established in BNL's Radiological Control Manual for radiation workers. The DOE limit is 2,500 mrem/yr.¹⁰

around the perimeter of the facility and to radiation workers active within Building 348. The results of these calculations are provided in Table 4-2.

All exposures reported in Table 4-2 were calculated based upon the thickness of the concrete shielding being 61 centimeters. All anticipated values would be expected to be within BNL administrative limits given the calculations use the conservative assumptions that one source would operate 1,800 hours annually and no administrative controls would be employed to minimize exposures.

Products of air activation relative to operation of the neutron source have been conservatively calculated at 4.1×10^{-3} microcurie of Argon-41 (μCi of ^{41}Ar). This assumes all neutrons are thermalized (interact with air molecules) before reaching target volume, all Argon at one meter from the source is thermalized and

air is held within the building for the entire 1.8 hour half life of Ar^{41} and then exhausted in its entirety. Under normal operations this quantity of air activation would be several orders of magnitude lower. An evaluation of the impact of this release on the general public was calculated as required by EPA under the National Emissions Standards for Hazardous Air Pollutants (NESHAPs), 40 CFR 61. It was determined that total releases from operations would be 1.62×10^{-6} curies/yr. This would translate into an individual dose of 1.13×10^{-9} mrem/yr and a collective population dose of 5.06×10^{-9} person-rem/yr.¹¹ The individual dosimetric impact calculated is well below the EPA administrative level of 0.1 mrem/yr which would require EPA authorization to construct and operate this facility.

4.2.5 Abnormal Events

Abnormal events within the operational system of concern for both the no-action and proposed-action alternatives are major mechanical failures on any of the sources, major electrical failures during source operation, and a major fire event. The difference between alternatives would be the events impacting the gamma beam irradiator which would not be purchased for installation at Building 348 under the no-action-alternative. The existing and proposed new neutron calibration systems operate through the electrical raising and lowering of the source from a shielded box (See Figure 2-2). Should a malfunction lock the source in the exposed position, each calibration system has a manual gear that can be used to crank the source back into the shielding drum. The manufacturers estimates that for the new neutron calibration system an exposure of 2 mrem would occur to the worker. The free-air gamma calibration system raises and lowers the sources within tubes (See Figure 2-3) utilizing compressed air. Should a source lodge in the exposed position, it could be dislodged by first changing air pressure within the tube and if that fails, using compressed air from the exhaust air port to force the source back into its shield box. Similar procedure would be followed for the gamma beam irradiator system. In the event a source can not be returned to its shield box, the area would be secured and routinely monitored pending assistance from the manufacturer. For mechanical and electrical failures, primary concern rests with radiation workers that would be called upon to correct such situations as a source jammed in a system or a source which must be manually retrieved. For all possible events analyzed in the preliminary safety analysis report for facility operations, a dose of 60 mrem/event could occur with the neutron source and an extremity dose of 70 mR could occur during manual dropping the 2 curies of Cesium-137 (Ci of ^{137}Cs) free air gamma source.⁹ The gamma irradiator source could be handled in a hot cell and would not be expected to impact workers beyond normal operational activities.

Fire risk in the area is extremely low because the building is of concrete and steel construction with little combustible material present. Extinguishing materials would all be dry type so no potential would exist for radioactive liquid generation. Additionally, the size of the calibration sources in use would not induce water activation.

4.2.6 Cumulative and/or Long Term Environmental Effects

4.2.6.1 No-action Alternative

Continuation of current operations would have no environmental impacts as previously discussed. Radiation exposure to the general public projected from BNL once its relativistic heavy ion collider becomes operational would be approximately 2.0 mrem/yr of which the 0.3% would be attributable to radiation calibration efforts.⁸ This total individual exposure is still well below BNL's administrative limit of 25 mrem/yr. Disposal of the neutron and free-air gamma systems in Building 348 would generate approximately 6 cubic meters of radioactive waste. Once removed from the building, this facility could be reused by other disciplines.

The impact of continued operations on BNL research and monitoring operations can not be quantified at this time but would be expected to be substantial. Radiation calibration efforts would not continue to meet the requirements of DOE Order 5480.4 and ANSI Standard N323-1978. Failure to meet the requirements of these standards could result in DOE action to curtail research at BNL. Such actions would require potentially large personnel dismissals and loss of economic support to the surrounding community.

4.2.6.2 Proposed Action

Implementation of the proposed action would increase the site radiation dose to the general public by 1.8% under maximum operating conditions. The total projected BNL dose to an individual of the general public would still amount to roughly 2.0 mrem/yr as in the no-action-alternative. Disposal of the current neutron source in use would generate less than 2 cubic meters of radioactive waste for disposal. Assuming that the new sources would also require replacement on 20 year intervals, the total radioactive waste generated from the 40 year life of the new calibration facility would be approximately 12 cubic meters of material. Once the radiation sources have been removed from the facilities, all buildings would be capable of reuse so no additional waste would be generated.

Of great importance is that implementation of the proposed action would bring BNL into compliance with DOE and ANSI requirements. Availability of instruments with improved calibration standards could create new opportunities for the scientific research community. Improved calibration instrumentation would also improve measurements of environmental releases so impacts to the environment and general public from BNL operations could be better delineated.

5.0 SUMMARY

The existing radiation calibration facility at BNL does not meet DOE and ANSI standards and cannot accommodate continually increasing scientific research and support demands. To bring this facility into compliance with DOE Order 5480.4, ANSI Standard N323-1978, and allow for facility expansion, it is proposed to construct a 130 square meter building which would be connected to the existing facility by a 30 meter walkway. Alternatives to the proposed action would be to construct additional space at a different location, contract services off site, or take no action. Only the no-action and proposed-action alternatives are

evaluated in this document. Construction impacts associated with the proposed action would include the loss of up to 0.04 hectares of woodland habitat and 20 linear meters of woodland/grassland edge. The SHPO has been contacted in accordance with Section 106 of the National Historic Preservation Act and has issued a determination that no impact to historic resources would occur. From an operational standpoint, all doses associated with both current operations and the proposed action would not increase doses to on- or off-site persons above DOE permissible limits, and under administrative controls, would be maintained below BNL administrative limits. No formal approval of this action is required under 40 CFR 61 as the projected dose to the public is well below the 0.1 mrem/yr threshold. Disposal of sources now contained in Building 348 would generate approximately 6 cubic meters of radioactive waste. Over the 40 year life expectancy of the proposed action, this figure would increase to 12 cubic meters. All facilities would be useable to other disciplines once sources have been removed. The no-action alternative would not service BNL operational needs and could result in substantial operational impacts. Implementation of the proposed action would not limit current activities and would improve research and environmental monitoring capabilities. See Table 6-1 below for additional information on impacts associated with the no-action and proposed action alternatives.

TABLE 6-1: SUMMARY OF IMPACTS ASSOCIATED WITH NO-ACTION AND PROPOSED ACTION ALTERNATIVES

AREA OF IMPACT	NO-ACTION	PROPOSED ACTION
Land Use	None	0.04 hectares lost
Ecology	None	20 meters edge lost
Noise	None	None
Cultural	None	None
Emissions	None	None
Effluents	None	None
Hazardous Waste	4.5 kilograms/yr	4.5 kilograms/yr
Power Demands	4.0 kilowatts/yr	4.0 kilowatts/yr
Nonradiation Worker	Within BNL Limits ¹	Within BNL Limits ²
Radiation Worker	Within BNL Limits ¹	Within BNL Limits ²
Operating Limitations	Yes	No
ANSI Standards	No	Yes
DOE 5480.4	No	Yes
Research Requirements	No	Yes
Future Land Use	Unrestricted	Unrestricted

¹No-Action alternative can meet BNL dose limits on nonradiation and radiation workers only if administrative constraints are enacted. Constraints include limits on hours of operation and constraints on time of day operations can be carried out.

²Proposed action alternative would meet BNL dose limits on nonradiation and radiation workers without administrative constraints required.

6.0 LITERATURE CITED

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7.0 ACRONYMS

ALARA	As Low as Reasonably Achievable
ANSI	American National Standards Institute
BNL	Brookhaven National Laboratory
CFR	Code of Federal Regulations
ci	Curie
DOE	Department of Energy
EPA	Environmental Protection Agency
mrem	millirem
NESHAPs	National Emission Standards for Hazardous Air Pollutants
SHPO	State Historic Preservation Officer

8.0 DEFINITIONS

Activated materials - Material made radioactive by the bombardment with neutrons, protons, or other nuclear particles.

Collective dose equivalent - The summation of the absorbed radiation dose received by all individuals in a population group.

Curies - A unit of activity equal to 3.7×10^{10} atoms per second disintegrations.

Direct exposure - Radiation encountered through proximity to an external source.

Evapotranspiration - Form of respiration employed by plants where water is removed from the soil and oxygen is released through the leaves.

Half life - Time necessary for half the nuclei of a sample of a specific isotope species to undergo radioactive decay.

Hazardous waste - A solid, liquid, semisolid, or gaseous material which may pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of or otherwise managed.

Hot cells - A heavily shielded enclosure for handling and processing or storing highly radioactive materials.

Ionizing radiation - Waves of particles capable of producing energetic charged particles such as alpha and beta rays and nonparticulate radiation such as x-rays and neutrons.

Low-level radioactive waste - Solid, liquid, and gaseous materials from nuclear operations in the range of 1 microcurie per gallon or cubic foot.

Monotypic habitat - A environmental setting where only one general type of vegetative cover exists.

mrem - A special unit of absorbed dose equivalent equal to the absorbed dose in rads multiplied by a quality factor.

Person-rem - Unit of population exposure obtained by summing individual absorbed dose values for all people in the population.

Radionuclides - Any radioactive form of an element.

Sky shine - Radiation reflected back to earth by the atmosphere above a radiation-producing facility.

Sole source aquifer - A layer of ground water determined to be the only available source of drinking water to a defined region or population.

9.0 LIST OF AGENCIES CONSULTED

New York State Department of
Environmental Conservation
Stony Brook, New York
(516/751-7900)

New York Natural Heritage Program
Delmar, New York
(518/783-3901)

New York State Historic
Preservation Office
Albany, New York
(518/474-0479)

Suffolk County Department
of Health Services
Hauppauge, New York
(516/853-3077)

U.S. Army Corps of Engineers
New York, New York
(212/264-4662)

U.S. Department of Energy
Chicago, Illinois
(708/252/2556)

U.S. Department of Energy
Upton, New York
(516-282-3424)

U.S. Environmental Protection Agency
New York, New York
(212/264-5170)

U.S. Fish and Wildlife Service
Cortland, New York
(607/753-9334)

U.S. Geological Survey
Syosset, New York
(516/938-8830)

10.0 CORRESPONDENCE

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1340

THIS IS RADIATION CALIBRATION FACILITY - SEP 27

DOE RADIATION FACILITY/ ADDITION

2-27-91

Agency/Project Name

Date

BROOKHAVEN SUPPLY COUNTY

91PR0329

MCD/County

Project Review Number

Dear Mr. Timko:

The New York State Historic Preservation Officer (SHPO) has reviewed the materials you submitted in accordance with the relevant implementing regulations. Based upon this review, it is the opinion of the SHPO that:

- ☒ your project will have no effect/impact on those characteristics of the property which would qualify it for inclusion in the National Register of Historic Places:
- ☐ there are no properties in the impact area
- ☐ there are no known archeological resources in the project impact area.

If you need any additional information, please contact the Project Review Unit of the Field Services Bureau at (518) 474-6479.

Sincerely,

Julia S. Stokes
Deputy Commissioner for
Historic Preservation

cc:

U.S. Department of Energy
Finding of No Significant Impact
Construction and Operation of an Improved
Radiation Calibration 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-0891, evaluating alternatives for the proposed construction and operation of an addition to the radiation calibration facility at Brookhaven National Laboratory (BNL), Upton, New York, that would bring the facility into compliance with DOE Order 5480.4 and American National Standards Institute (ANSI) N373-1978. This order and standard establish calibration methods for portable radiation protection instruments used in the detection and measurement of levels of ionizing radiation fields or levels of radioactive surface contamination.

Growth of research facilities, projects in progress, and more stringent requirements have placed a substantial burden on the existing radiation calibration facility. Compliance with the order and standard stipulations require higher energy calibration sources which cannot be operated safely nor efficiently in the existing facility because of personnel exposures and poor geometry for instrument calibration.

An addition to the existing radiation calibration facility would accommodate higher energy sources and permit the space vacated by these sources to be

renovated so that all instrument calibration and repair services at BNL could be consolidated in one location.

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 would provide for the construction of a new 130 square meter building for the purpose of moving both existing and proposed new radiation sources into this new structure to conduct radiation calibration operations. Once all sources and associated calibration instrumentation are moved to the new facility, the existing facility (Building 348) would undergo minor interior modifications to consolidate radiation instrumentation testing and repair operations now conducted at various locations on the BNL campus. This new facility would be connected to Building 348 via a roof covered 30 meter walkway. The new building would be constructed of structural steel frame and include 61 centimeter thick concrete shielding walls, heating, air conditioning, sprinkler systems, electric power, and lighting within a newly fenced area.

The new building would be constructed in a northeast/southwest orientation with the walkway connecting the southwest corner of the new building to the northeast corner of Building 348. Chain link fencing around the existing building encloses about 0.16 hectares of wooded and landscaped area. With construction of the new facility, the fenced area would be roughly doubled to 0.32 hectares. This new

building would be constructed in accordance with ANSI N323-1978. Site work would include the removal of 0.04 hectares of wooded area, excavation up to 1.6 meters below grade, back filling, and regrading. All utilities would be provided to this new building by connecting into existing site utilities. Useful life of this new facility is expected to be 40 years.

Sources to be located in the new building include a Model 149-D20 Shepherd neutron calibration system, a free-air gamma calibration system, and a gamma beam irradiator. The Shepherd neutron calibration system would include a 100 microgram californium-252 neutron source. This source would be located near the center of the proposed facility. This Shepherd neutron calibration system would replace the existing neutron calibration system which would be disposed. This new system would make higher neutron exposures available and, coupled with improved exposure geometries, would permit calibrations to be completed in shorter time periods and with reduced scattering neutron contributions to the calibration exposures.

The free-air gamma calibration system is presently in service in Building 348 and would be relocated to the new facility addition. This calibration system contains five sealed radiation sources: a 2 curie cesium-137 source; a 16 millicurie cobalt-60 source; a 48 millicurie cobalt-60 source; a 72 millicurie cobalt-60 source; and a 133 millicurie cobalt-60 source. The gamma beam irradiator does not exist in the present calibration facility but one would be purchased for use in the new building addition. This new gamma beam irradiator would be based on the Model 81 Shepherd Beam Irradiator and possess a 3,000 curie cesium-137 source. The irradiator would permit the calibration of a large variety of radiation monitors over a broad range of exposures.

ALTERNATIVES

Alternatives to the proposed action discussed in the EA include the no-action alternative, construction and operation of a new radiation calibration facility at a different location on the BNL property, and use of contract services to meet Laboratory radiation calibration needs. The no-action alternative was eliminated from consideration because without the proposed action the Laboratory would continue to operate out of compliance with DOE Order 5480.4 and ANSI N373-1978. The failure to improve radiation calibration of instruments would also curtail some research programs. The alternate location alternative was eliminated from consideration because this action would further segment the radiation instrumentation and calibration activities at the laboratory and location of the facility closer to either the developed portion of the Laboratory or the site boundary would increase costs for additional shielding needed to minimize public radiation exposures. The contractor service alternative was eliminated from consideration because it would be cost prohibitive, and not necessarily responsive to immediate Laboratory needs.

ENVIRONMENTAL IMPACTS

The potential environmental impacts from the proposed construction and operation, of an addition to the radiation calibration facility as described under the proposed action, and 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, ecology, emission and effluent releases, waste generation, cultural/historic resources, and radiation exposures to both Laboratory workers and the general public.

Impacts of Facility Construction

The proposed building construction area has received only limited disturbance since the occupation of Camp Upton by the U.S. Army which ended in 1947. Landscaped areas are managed on part of the land to provide proper clearance surrounding a radio tower used to receive weather information. The remainder of the property is wooded. No wetlands, environmentally sensitive habitats, or 100 year floodplain are located within the project impact area. The net result of the proposed facility construction would be the loss of approximately 0.04 hectares of wooded area and about 20 linear meters of landscaped edge. No threatened or endangered species occur on site.

The New York State Historic Preservation Officer has reviewed the proposed action in accordance with the National Historic Preservation Act and issued a determination dated February 27, 1991 which states that the project will have no effect/impact on those characteristics of the property which would qualify it for inclusion in the National Register of Historic Places.

Construction of the proposed action would require the use of heavy equipment for earthwork and general construction. Operation of heavy equipment would temporarily generate noise that may disrupt operations at adjacent facilities in Buildings 51, 348, and 599.

Impacts of Facility Operation

Other than generation of domestic wastes, no liquid effluent or point source air emissions would be operated. Increased input of domestic waste water that would be directed to the sanitary system from higher personnel occupancy rates would be less than 0.1% of current BNL volume. This increase would be imperceptible

at BNL's Sewage Treatment Plant operation which currently operates during maximum flow at approximately 60% of its permitted discharge of 1.8 million gallons per day.

Hazardous waste generation would remain unchanged from existing operations of 4.5 kilograms per year. This waste is generated from the use of small quantities of 1,1,1-trichloroethane and nickel cadmium batteries. Wastes generated are transported to BNL's Hazardous Waste Management Facility for packaging and storage pending final disposal at approved off site locations by contract vendors.

Contributions of domestic solid wastes are not expected to increase beyond that generated by current radiation calibration instrumentation personnel as no staff increases are proposed for operations and the proposed action would provide improved instrument calibration which generates no solid waste. Current waste generation has no impact on BNL handling and disposal practices. Domestic wastes are checked for radioactivity prior to leaving the BNL reservation en route to final disposition at local landfills.

Operation of radiation sources and calibration equipment requires typical light industrial electrical service. Extension of service would be made from Building 348 to the new facility. Calibration facility activities require less than 0.01% of the annual power demands at BNL. Current peak demands of all BNL operations are approximately 40 Megawatts.

Computer modelling was used to determine exposures to individuals that would enter certain areas around the perimeter of the facility and to radiation workers

active within Building 348. It was determined that the maximum exposure a non-radiation worker at BNL could receive, given 100% operation during normal working hours and 100% worker attendance, would be 19.8 millirem per year. This conservative estimate is expected to be 10 to 100 times the actual exposure that would occur during operations. The DOE permissible limit of exposure to the public from an operation of 100 millirem per year. For radiation workers the calculated maximum radiation exposure would be 178.2 millirem per year. This value is also 10 to 100 times the exposure expected during actual operation because of the implementation of routine practices that lower radiation exposures. The DOE permissible limit of exposure to radiation workers is 2,500 millirem per year. Operations would also add a maximum 0.036 mrem per year to the affected individual inhabiting BNL's site boundary. This dose represents a 1.8% increase over projected operations which is 2 mrem per year. Both the general public/non-radiation worker and radiation worker would receive exposures well below DOE permissible limits.

Products of air activation relative to operation of the neutron source have been conservatively calculated at 4.1×10^{-3} microcuries of argon-41. This assumes all neutrons are thermalized (interact with air molecules) before reaching target volume. All Argon at one meter from the source is thermalized and air is held within the building for the entire 1.8 hour half life of Ar^{41} and then exhausted in its entirety. Under normal operations this quantity of air activation would be several orders of magnitude lower. An evaluation of the impact of this release on the general public was calculated as required by EPA under the National Emissions Standards for Hazardous Air Pollutants (NESHAPs), 40 CFR 61. It was determined that total releases from operations would be 1.62×10^{-6} curies per year. This would translate into an individual dose of 1.13×10^{-9} millirem

per year and a collective population dose of 5.06×10^{-9} person-rem per year. The individual dosimetric impact calculated is well below the EPA administrative level of 0.1 millirem per year which would require EPA authorization to construct and operate this facility. The total dose to an individual residing at the BNL site boundary from all BNL operations would continue to be projected at 2 millirem per year including the operation of the proposed relativistic heavy ion collider (RHIC) now under construction.

Abnormal events within the operational system of concern are major mechanical failures on any of the sources, major electrical failures during source operation, and a major fire event. Should a malfunction lock the source in the exposed position, each calibration system has a manual gear that could be used to crank the source back into the shielding drum. The manufacturer estimates that for the new neutron calibration system, an exposure of 2 millirem would occur to the worker. In the event a source cannot be returned to its shield box, the area would be secured and routinely monitored pending assistance from the manufacturer. For mechanical and electrical failures, primary concern rests with radiation workers that would be called upon to correct such situations as a source jammed in a system or a source which must be manually retrieved. For all possible events analyzed for facility operations, a dose of 60 millirem per event could occur with the neutron source and an extremity dose of 70 mR could occur during manual dropping the 2 curies of cesium-137 free-air gamma source.

Fire risk in the area is extremely low because the building is of concrete and steel construction with little combustible material present. Extinguishing materials would all be dry type so no potential would exist for radioactive liquid generation. Additionally, the size of the calibration sources in use

would not induce water activation.

Impacts of Decommissioning and Decontamination

The new facility has a projected life expectancy of 40 years. Over that period, calibration sources would require replacement once, assuming no additional upgrades are required. The total radioactive waste generated from the disposal of these sources would be approximately 12 cubic meters. No activation of surrounding facilities would occur so once calibration sources are removed, facilities would be available for unrestricted use.

DETERMINATION

Based on the analyses in the EA, DOE has determined that the proposed construction and operation of an addition to the existing radiation calibration facility at BNL 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-0891) are available from:

Carson L. Nealy, Manager
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Brookhaven Area Office
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(516) 282-3424

For further information regarding the DOE NEPA process, contact:

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Issued in Argonne, IL, this 14TH day of February 1995.

Cherri J. Langenfeld
Manager