

BROOKHAVEN NATIONAL LABORATORY
SITE ENVIRONMENTAL REPORT
for Calendar Year 1997

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PREFACE

The U.S. Department of Energy Order 5400.1, "General Environmental Protection Program", establishes the requirement for environmental protection programs. These programs ensure that the Department of Energy's operations comply with applicable federal, state, and local environmental laws and regulations, executive orders, and departmental policies. Brookhaven National Laboratory established a plan for implementing this Order, which is described in the Environmental Monitoring Plan. This plan is updated annually.

The Brookhaven National Laboratory's Site Environmental Report is prepared annually pursuant to Department of Energy Order 5400.1 to summarize environmental data, characterize the Brookhaven National Laboratory Site, demonstrate compliance status, assess the impact of Brookhaven National Laboratory's operations on the environment, and document the efforts made by Brookhaven National Laboratory's Management to mitigate environmental impacts. More detailed environmental compliance, monitoring, surveillance, and study reports may be of value; therefore, to the extent practical, these additional reports are referred to in the text.

This report is prepared for the Department of Energy by the Environment, Safety and Health Services Division at Brookhaven National Laboratory; the document is the responsibility of the Environmental Protection Office of the Division. This Office is responsible for preparing the sampling plan, collecting environmental and facility samples, interpreting the results, performing impact analysis of the emissions and effluents from Brookhaven National Laboratory, and compiling the information presented here.

Although this report is written to meet Department of Energy requirements and guidelines, it is also intended to meet the needs of the public. The Executive Summary was written with a minimum of technical jargon, and a condensed version of this Site Environmental Report, titled the Summary Report, also has been prepared for public distribution. The Appendices give a list of acronyms, abbreviations, and other useful information.

Inquiries about this report and the Summary Report may be sent to the Public Affairs Office, Brookhaven National Laboratory, Upton, New York 11973 (516 344-2345).

ABSTRACT

This report documents the results of the Environmental Monitoring Program at Brookhaven National Laboratory and summarizes information about environmental compliance for 1997. To evaluate the effect of Brookhaven National Laboratory's operations on the local environment, measurements of direct radiation, and of a variety of radionuclides and chemical compounds in the ambient air, soil, sewage effluent, surface water, groundwater, fauna, and vegetation were made at the Brookhaven National Laboratory site and at adjacent sites. The report also evaluates the Laboratory's compliance with all applicable guides, standards, and limits for radiological and non-radiological emissions and effluents to the environment.

Areas of known contamination are subject to Remedial Investigation/Feasibility Studies under the Inter Agency Agreement established by the Department of Energy, Environmental Protection Agency and the New York Department of Environmental Conservation. Except for identified areas of soil and groundwater contamination, the environmental monitoring data have continued to demonstrate that compliance was achieved with the applicable environmental laws and regulations governing emission and discharge of materials to the environment. Also, these data show that the environmental impacts at Brookhaven National Laboratory are minimal, and do not pose a threat to the public or to the environment.

This report meets the requirements of Department of Energy Order 5400.1, General Environmental Protection Programs.

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Many individuals assisted in collecting data, and preparing this report. The editors express their gratitude to all these individuals. However, the following individual efforts require special acknowledgment.

Monitoring and surveillance data were obtained through the combined efforts of the Environmental Protection Office and the Analytical Services Laboratory. Special recognition is reserved for the dedication and professionalism of the Sampling Staff: M. Bero, R. Lagattolla, and L. Lettieri and W. Rizzitello; and the Analytical Services Laboratory Staff: C. Decker, R. Gaschott, P. Hayde, E. Klug, A. Meier, L. Muench, J. Odin-McCabe, and R. Wang.

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The Laboratory acknowledges the continued support of the: New York State Department of Environmental Conservation, Fisheries Bureau, in the collection of fish samples from the Peconic River and adjacent fresh water bodies; and the Suffolk County Department of Health Services for the collection of potable water samples for adjoining communities, collection of vegetation and fruit samples from local farms.

Finally, the authors would like to extend a special thanks to Rosemary Taylor for her infinite patience and quality of work in typing, reviewing, and finalizing this report.

EXECUTIVE SUMMARY

Brookhaven National Laboratory's (BNL) Environmental Monitoring Program is designed to determine whether BNL facility operations have met the requirements of applicable environmental and effluent control standards. The program is also used to assess the impact of past and present BNL operations on the environment. This report summarizes the data generated by that program.

The mission of the Environmental Restoration Program is to identify, characterize, mitigate, and eliminate, as appropriate, areas of soil and groundwater contamination that resulted from past chemical and radiological spills, discharges, and waste handling activities. This report also summarizes the data collected during Environmental Restoration activities in 1997 including those related to soil, groundwater, surface water, and private potable water quality.

Radiological Monitoring and Surveillance

Airborne emissions of radioactive material from BNL facilities were monitored in 1997. Radioactive airborne effluents originated primarily with the Brookhaven LINAC Isotope Producer (BLIP), the Brookhaven Medical Research Reactor (BMRR), and the High Flux Beam Reactor (HFBR). Argon-41, oxygen-15 and tritium were the predominant radionuclides released. A member of the public residing at the site boundary is projected to have received a radiation dose of 0.07 mrem (0.7 μ Sv) from all 1997 airborne emissions. The typical annual dose from natural background radiation sources to an individual living in the U.S. is approximately 300 mrem (3 mSv).

Air sampling was performed throughout the year to monitor airborne radionuclide concentrations. All annual average airborne tritium concentrations were below detectable levels. Gross alpha and gross beta activity levels were consistent with expected background levels; no site related elevations were observed. All measured values were comparable to those measured in Albany, NY (a location used as a control area by the NY State Department of Health in their statewide environmental radiation monitoring program).

An array of thermoluminescent dosimeters was used to monitor gamma radiation levels at 24 on-site and 25 off-site locations. The average annual on-site integrated dose for 1997 was 70 ± 6 mrem (0.70 \pm 0.06 mSv), while the off-site integrated dose was 67 ± 5 mrem (0.67 \pm 0.05 mSv). These levels are typical of those measured throughout the northeastern part of the United States and verify that airborne emissions from the Laboratory had no impact on the external radiation levels of the surrounding area.

All liquid discharges to the Peconic River and on-site recharge basins met the radiological limits specified by the DOE in Order 5400.5, "Radiation Protection of the Public and the Environment." The principal radionuclide detected at the Peconic River Outfall was tritium. The annual average tritium concentration was equal to 7% of the limit specified by the Safe Drinking Water Act. Other radionuclides were detected on an infrequent basis throughout the year at concentrations that were less than 2% of the applicable limits.

Due to past tritium discharges from the Sewage Treatment Plant, potable wells in a few homes near the Laboratory's eastern boundary continue to show the presence of tritium. Concentrations ranged from 2% to 11% of the Safe Drinking Water Act standard. The maximum individual dose resulting from the consumption of this drinking water is equal to 0.1 mrem (1 μ Sv). The typical annual dose to an individual from the ingestion of naturally-occurring radionuclides is 39 mrem (0.39 mSv).

Samples of regional soils, river sediments, vegetation, fish and deer were collected. Important conclusions drawn from the analysis of these samples are:

- Deer inhabiting BNL property contain Cesium-137 concentrations at levels that are above those in off-site deer. A committed effective dose equivalent of 9 mrem (0.09 mSv) would be received by an individual consuming deer meat from on-site animals at the highest observed concentration and an annual consumption rate of 67 lbs. per year.

- All radionuclides detected in soil and vegetation samples were either of natural origin, were deposited from the application of fertilizers, or were fallout-related. No radionuclides attributable to BNL operations were detected.
- Man-made radionuclides detected beyond the site boundary in the sediments of the Peconic River, the Carmans River, Peconic Bay, Flanders Bay, and Lloyd Harbor are consistent with global fallout patterns; no BNL contribution was indicated. No man-made radionuclides were observed in shellfish collected from local water bodies.
- Present day Cesium-137 concentrations in fish from the Peconic appear to be within the range of variability seen in fish from local waters which have never received discharges from BNL.

Potential radiological doses were less than specified limits for each exposure pathway and equal to a fraction of the dose received annually from natural background sources (approximately 300 mrem [3 mSv]). All measurements and dose calculations demonstrate that in 1997, BNL's radiological effluents had no impact on the health of the public or environment in the surrounding area.

Non-Radiological Monitoring

Liquid discharge limits for non-radiological parameters are subject to conditions listed in BNL's State Pollutant Discharge Elimination System (SPDES) Permit (No. NY-0005835), issued by the New York State Department of Environmental Conservation (NYSDEC). Administrative controls are used to maintain all liquid discharges at or below concentrations prescribed by the Safe Drinking Water Act (SDWA) and DOE Orders. The compliance rate for Sewage Treatment Plant effluents exceeded 99% for the year. The SPDES permit also requires monthly and quarterly monitoring of discharges to the BNL recharge basins. Except for a single pH excursion at one recharge basin (Outfall 003), all discharges complied with the SPDES limitations.

For collected surface water samples, all water quality parameters were consistent with off-site control locations and with historical data. Except for iron, analytical data for metals showed all parameters to be consistent with historical data. All concentrations were below the NY State Drinking Water Standard (NYS DWS). Except for zinc and iron, all analytical data for metals were consistent with the New York State Ambient Water Quality Standards (NYS AWQS). The presence of iron and zinc is due to the natural sediment.

Groundwater Surveillance

During 1997, over 400 groundwater surveillance wells were monitored by the ERD and ES&HS Division. Groundwater samples were collected for non-radiological and radiological analyses, with greater than 1,500 individual sampling events taking place. Groundwater surveillance data are compared to New York State Ambient Water Quality Standards (NYS AWQS), NYS DWS and DOE Derived Concentration Guides (DCGs) (for radionuclides). Comparison of surveillance well data to Environmental Protection Agency (EPA), NYSDEC, and NYSDOH reference levels provides a mechanism to evaluate the radiological and non-radiological levels of contamination relative to current standards.

Water-quality analyses conducted on groundwater samples collected site wide show that the pH of groundwater typically ranges from 5.5 to 7.2, which is below the lower limit of the NYS AWQS of 6.5 to 8.5. Chloride, sulfate, and nitrate concentrations in most areas of the site were typically below the NYS AWQS. However, metals and VOCs in groundwater exceed NYS AWQS in several locations on-site.

Several areas of known surface radiological contamination have introduced man-made radionuclides into the groundwater underlying the Laboratory. The most common radionuclides which have been introduced include tritium, Cesium-137, Strontium-90, and Sodium-22. Often these radionuclides are below applicable drinking water standards, but concentrations have been found above these standards downgradient of the HWMF (Strontium-90 and Tritium), "Current" and "Former" Landfills (Strontium-90), HFBR (Tritium), WCF (Strontium-90), and Building 650 sump outfall (Strontium-90).

During 1997, Well Nos. 10, 11, and 12 were used to supply drinking water at BNL. Water samples collected from these wells were analyzed for radioactivity, metals, organic material, and water quality

parameters. In 1997, the BNL potable water system was found to be in full compliance with the requirements of the SDWA and NY State DWS.

Environmental Restoration

During 1997, the BNL Environmental Restoration Program made significant progress in its ongoing efforts to characterize and remediate contaminated soil and groundwater resulting from past spills, releases and disposal practices. The highlights of accomplishments in 1997 include:

- Completion of the free public water hookups to approximately 1,500 homes in North Shirley and East Yaphank;
- Characterization of the HFBR tritium plume and the construction of an interim pump and recharge system;
- Construction and operation of a groundwater cleanup system at the BNL southern boundary that pumps and treats groundwater contaminated with chemical solvents;
- Construction and operation of an air sparging/soil vapor extraction treatment system that treats soil and groundwater contamination at the Central Steam Facility;
- Excavation, characterization, and back filling of fifty-five unlined chemical/animal/glass holes at the Former Landfill area; and
- Capping of the Interim Landfill.

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