

Environmental Management System

2 CHAPTER

Brookhaven National Laboratory (BNL) is committed to continually improving its environmental program. To further these ends, the Laboratory is developing and implementing an improved Environmental Management System (EMS) to ensure that it operates in an environmentally responsible manner that protects the ecosystem and human health. BNL's EMS is consistent with International Standards Organization (ISO) 14001 standards with enhancements in the area of compliance assurance. Compliance, pollution prevention, waste minimization and conservation of resources are being integrated into the planning, decision-making, and implementation phases of all site activities.

Programs such as the Facility Review Project have been established to continue to define, prioritize and remedy existing problems. The Process Evaluation Project, a comprehensive review of industrial and experimental processes used onsite, is scheduled for completion in early 1999.

An extensive program to monitor environmental quality is in place. Compliance monitoring, one aspect of the monitoring system, ensures adherence to regulatory and permit limits. A second aspect, restoration monitoring, measures the impact of past operations, determines the extent of problems and assures remedial measures are effective; and surveillance monitoring, the third aspect, evaluates what impact, if any, current operations have on environmental media.

Progress is reported on several crucial aspects of environmental stewardship at BNL. The Laboratory received a Department of Energy 1998 Energy Management Achievement Award for water conservation efforts. Water conservation efforts in 1997 resulted in a savings of 815 million liters per year. Reductions in cooling water implemented in 1998 should save in excess of an additional 500 million liters per year and require that fewer chemical additives be used and stored. Building energy use is 24 percent less today than it was in 1985 and hazardous waste generation meaningfully reduced.

Significant progress has been made in moving ecological protection to the forefront at BNL. The Laboratory is openly communicating on issues and progress with neighbors, regulators, employees, and other interested parties. Some issues remain. They will be discussed in the Compliance section (Chapter 3).

With the adoption of the environmental policy articulated by Director Marburger (see page 1-1), Brookhaven National Laboratory (BNL) furthered the implementation of a comprehensive Environmental Management System (EMS) designed to ensure that the Laboratory's programs are managed in an environmentally responsible manner that protects the ecosystem and human health. The following are the major principles and commitments associated with that policy which forms the EMS cornerstone:

2.1 ENVIRONMENTAL POLICY GOALS, AND COMMITMENTS

- ♦ Achieve and maintain compliance with applicable environmental requirements. These requirements include over 50 sets of local, state and federal laws, regulations and 60 permits.
- ♦ Integrate pollution prevention, waste minimization and resource conservation into site

activities in the planning, decision-making and implementation phases. Conserve natural resources and ensure that environmental emissions, effluents and waste generation are As Low As Reasonably Achievable (ALARA).

- ♦ Define, prioritize and remedy existing environmental problems. This commitment encompasses removal or treatment of contamination caused by historical practices as well as an environmental monitoring program to provide early detection of any threat to the environment. In addition, the monitoring program identifies potential pathways for exposure of the public and the environment, as well as evaluating what impact BNL activities may be having on the environment. Data from monitoring assesses compliance with applicable regulatory and permit limits.
- ♦ Emphasize continual improvement. Proactive measures to prevent problems are to be utilized. When problems do occur, the root

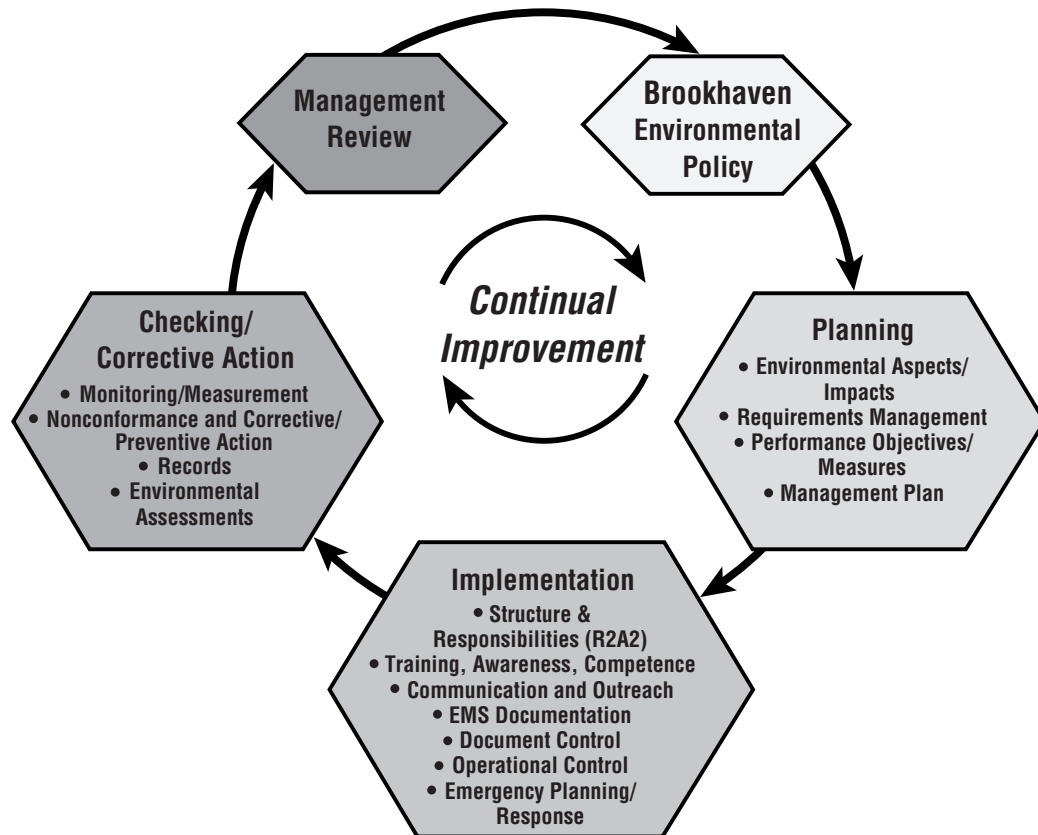


Figure 2-1. Key Elements of Environmental Management System

cause is investigated, and corrective actions taken as appropriate.

- ♦ Openly communicate with neighbors, regulators, employees and organizations about program progress and performance.

All BNL employees are expected to practice environmental stewardship so that BNL can excel in protecting the environment and thus regain public trust through improved compliance with environmental requirements.

An EMS improvement initiative is currently underway. The EMS improvement (Section 2.2.1), the Facility Review Project (Section 2.3) and the Process Evaluation Project (PEP) (Section 2.4) are discussed below. The Laboratory is investing over eight million dollars in these initiatives. They are designed to address problems created by historical activities, thoroughly evaluate present-day operations, and implement improvements in the future to protect the environment, and assure compliance.

2.2 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS) AND IMPROVEMENTS

BNL continues to develop and implement an improved EMS to ensure that environmental policy considerations are integrated into all facets of BNL’s missions. This systematic approach is designed to eliminate, reduce or control environmental risks and impacts, and achieve and demonstrate environmental excellence. Figure 2-1 shows the five principles of the EMS and the program elements that comprise the system.

The U.S. Environmental Protection Agency (USEPA) and the U.S. Department of Energy (DOE) signed a Memorandum of Agreement (MOA) on March 23 1998. In the MOA, DOE and BNL committed to use the International Standards Organization (ISO) 14001 framework for their EMS, with improvements in the area of compliance assurance, pollution prevention and community outreach. The 17 major elements of an EMS are listed in Table 2-1,

Table 2-1. Elements of the Environmental Management System: Implementation of ISO 14001 at BNL

ENVIRONMENTAL POLICY	In November of 1998, BNL issued its environmental policy statement that describes BNL’s commitment to the environment. This policy is used as a framework for planning and action (see page 1-1).
ENVIRONMENTAL ASPECTS	<p>BNL has determined that the following environmental aspects of the Laboratory’s operations have the potential to affect the environment:</p> <ul style="list-style-type: none"> • Waste generation - regulated industrial, hazardous, radioactive, mixed, or regulated medical waste • Atmospheric emissions • Liquid effluents • Storage or use of chemicals and radioactive materials (potential for accidental release or contamination) • Natural resource usage - power consumption, water consumption. • Soil with the potential for induced radioactivity (e.g., soil activated at a beam stop). <p>In addition, each facility at BNL will determine if their operations have other aspects that have the potential to impact the environment. The combined set of significant environmental aspects is used to identify training requirements, develop operational controls (including engineering controls, administrative control procedures, and pollution prevention opportunities), assess emergency planning issues, and determine applicable requirements.</p>
LEGAL AND OTHER REQUIREMENTS	New or revised external requirement documents (e.g. new regulations) are analyzed to determine their applicability to the Laboratory, and what additional actions are required, if any, to achieve compliance. This may involve developing or revising laboratory documents, developing specific work instructions, administering training, installing engineered controls, or other methods.
OBJECTIVES AND TARGETS	BNL establishes environmental objectives and performance measures to drive improvements to the EMS and to measure progress in improving environmental performance. These objectives and measures focus on environmental aspects that can have a significant impact, reflect stakeholder concerns, and are aligned with commitments made in the environmental policy.

Table 2-1. Elements of the Environmental Management System: Implementation of ISO 14001 at BNL (cont'd.)

ENVIRONMENTAL MANAGEMENT PROGRAM	Organizations within BNL develop an action plan showing how they contribute to achieving BNL's objectives and targets while incorporating an EMS and committing needed resources to successfully implementing the plan. BNL also has a budgeting system designed to ensure that priorities are balanced, and that adequate resources are invested in environmental programs.
STRUCTURE AND RESPONSIBILITY	In 1998, BNL established a program to define employee's role and responsibilities in key areas including environmental protection. In addition, BNL reorganized to emphasize the importance of environmental activities by establishing an Environmental Services Division reporting directly to the Assistant Laboratory Director for the Environment, Safety, Health and Quality Directorate.
TRAINING, AWARENESS AND COMPETENCE	BNL is enhancing training programs for staff and visitors to ensure that they are trained and capable of carrying out their environmental responsibilities. Both the Process Evaluation Project and the Environmental Management System Improvement Project have training initiatives targeted for specific BNL populations. The training includes both a general environmental awareness course for all employees, and more specific training targeted for managers, internal assessors, team members responsible for coordinating EMS implementation, and operations personnel whose work has the potential to impact the environment.
COMMUNICATION	BNL is developing improved processes for internal and external communications on environmental issues and enhanced community outreach activities such as the establishment of a Citizens Advisory Committee.
EMS DOCUMENTATION	Procedures are being documented, maintained and implemented to ensure successful achievement of environmental goals. A web-based system called the Standards Based Management System (SBMS) will be developed to improve the quality, usability of and access to Laboratory-level information and providing a systematic framework for managing and operating the Laboratory. SBMS will contain BNL information that includes policy and standards, regulatory requirements, manuals, and Laboratory-wide procedures that control different processes and types of work performed at BNL.
DOCUMENT CONTROL	SBMS contains a comprehensive document control system to ensure effective management of procedures and other system records. When facilities require additional procedures to control their work, document control protocols are implemented to ensure that workers have access to the current versions of work instructions.
OPERATIONAL CONTROL	Systems are being evaluated to identify the need for additional administrative or engineered controls, then implementation plans are being developed for needed upgrades.
EMERGENCY PREPAREDNESS AND RESPONSE	BNL has a program to provide time critical response to hazardous materials or other environmental emergencies. This program includes procedures for preventing as well as responding to emergencies.
MONITORING AND MEASUREMENT	Appropriate monitoring, reviewing, and reporting is important to ensure effective functioning of the EMS and timely identification and implementation of corrective measures. BNL has a comprehensive, site-wide environmental monitoring program, and environmental performance is summarized annually in this Site Environmental Report.
NONCONFORMANCE, AND CORRECTIVE AND PREVENTIVE ACTIONS	BNL is improving processes to identify and correct problems. This includes development of a "lessons learned" program to prevent recurrences.
RECORDS	EMS related records, including audit and training records, are maintained to ensure integrity, to protect them from loss and enable retrieval.
EMS AUDIT	To periodically verify that the EMS is operating as intended, audits are conducted. These audits, conducted as part of the site-wide self-assessment program, are designed to ensure that any nonconformance to the ISO 14001 standard is identified and addressed. In addition, BNL has conducts regulatory compliance audits to assure operations comply with environmental requirements.
MANAGEMENT REVIEW	In addition to audits, a management review process is being implemented to ensure top management involvement in the assessment of the EMS, and as necessary, to address the need for changes and continual improvement.

along with a summary of how BNL plans to satisfy each element.

2.2.1 EMS IMPROVEMENT

The goal of the EMS improvement project is to develop, improve and deploy the EMS. It was initiated in July 1998 and is expected to be completed in the year 2000, when most of the site is registered to ISO 14001 standards. The first year of the project included two major steps: development of institutional EMS program requirements, and testing and validating the requirements in pilot facilities. Three facilities volunteered to participate in the pilot phase of project implementation: the Relativistic Heavy Ion Collider (RHIC) Project, Reactor Operations, and Waste Management Program (WM). Deployment throughout the balance of facilities at the BNL is scheduled to begin in July 1999.

BNL plans to pursue a phased approach to ISO 14001 registration by piloting the registration process at select facilities in 1999 and 2000, then seeking to register the entire Laboratory to the ISO 14001 standard in 2001. The registration process will involve rigorous audits by an independent, third-party auditor accredited by the American National Standards Institute, Registrar Accreditation Board. The auditors will evaluate BNL's conformance to the standard, whether or not the program is effectively implemented, and whether an effective corrective action program is in place.

The improved EMS that is being developed and deployed throughout BNL includes a commitment to continual improvement. The Performance Based Management System and the Integrated Assessment Program (IAP) provide processes for enhancing the EMS and achieving improvements in overall environmental performance.

The Performance Based Management System is a method of developing, aligning, balancing and deploying Laboratory strategic objectives. The system drives the improvement agenda of the BNL by linking a prioritized set of incentivized performance objectives. Objectives include: putting in place mechanisms assigning responsibility at all relevant levels of the organization, starting with senior management; implementing suggested actions for improvement; and routinely measuring progress against these objectives, to focus efforts and resources on relevant and important

areas. Employees can see how their work fits in and then align their efforts toward achieving BNL missions.

IAP provides BNL with a framework to support continual improvement in environmental strategic objectives. The primary elements of the Laboratory's IAP are:

- ♦ *Self-Assessment* is the evaluation of internal processes by an organization to allow for identification of strengths and opportunities for improvement. Among the many elements in a self-assessment program, the environmental portion of the assessment can include such items as performance measures and compliance checks (see additional discussion below).
- ♦ *Peer Review* is a process to evaluate and independently verify the adequacy of engineering designs and operational controls.
- ♦ *Independent Oversight* is a mechanism to independently verify the effectiveness, efficiency and adequacy of the Self-Assessments programs.
- ♦ *Internal Audit* is the process of examining and evaluating the adequacy and effectiveness of the Brookhaven Science Associates (BSA) systems of internal management controls.

These elements generate information on scientific, technical, environmental safety and health programs, quality, community involvement, business, and operational performance for the BNL management, staff, DOE, neighbors, and regulators. With respect to the environment, the program achieves the following:

- ♦ provides accurate environmental performance information to promote early identification and resolution of problems that may affect the Laboratory's ability to achieve its strategic objectives
- ♦ verifies and addresses the public's expectations to improve the environmental aspects associated with operations and research
- ♦ verifies conformance to established internal and external regulatory requirements.

The Self-Assessment Program is designed to promote an atmosphere of continuous improvement. This process ensures the development of high quality and efficient services and operations, establishes a sound environmental program foundation that will foster excellence across BNL, and is an integral component of the Laboratory's IAP. The activities selected

each year for assessment emphasize operations related to Laboratory Critical Outcomes, organizational goals as expressed through strategic planning initiatives, customer satisfaction, and compliance.

The program is augmented by programmatic, external audits conducted by DOE. BNL is also subject to oversight by external regulatory agencies (see Section 3.15 of Chapter 3). In addition, corporate offices for Battelle Memorial Institute and the subcontractors perform independent reviews. For example, Battelle and Waste Management Federal Services (the waste management contractor) conducted gap analyses to evaluate existing components of the EMS and identify areas where improvements were needed.

Self-Assessments conducted in 1998 utilized a combination of internal and independent peer reviews. Assessments conducted in 1998 included an evaluation of compliance with regulatory requirements, an appraisal of the achievements of waste/effluent/emission reduction goals, evaluation of the effectiveness of EMS project communication, the scientific and technical accuracy of environmental documents, an assessment of the current status of BNL's EMS, and an EMS gap analysis. A wide variety of assessment techniques were used in the reviews. These included direct observation, survey, customer feedback, and performance measure reviews. Self-Assessment activities culminate with a written summary report including an evaluation and development of corrective action plans or improvement goals with established milestones. Corrective actions are tracked to closure, with the manager being ultimately responsible for timely response.

2.3 FACILITY REVIEW PROJECT

In the spring of 1997, BNL initiated a comprehensive examination of site facilities to identify any past or current activities having the potential to degrade the environment. Program managers reviewed and prepared reports to document the BNL operational history of each building, including both current and previously demolished structures; to identify environmental vulnerabilities; and to recommend corrective actions if needed.

During this project, BNL reviewed more than 900 systems, facilities and operations that had the potential to affect the environment,

including tanks, pipes, sumps, cesspools, storage areas, past practices, etc. Representatives from the Suffolk County Department of Health Services (SCDHS) participated in the BNL Facility Review Project by accompanying Laboratory personnel on inspections of all BNL facilities. They also reviewed each individual building report that was prepared to document BNL's findings resulting from this project. However, the scope of the SCDHS examination of BNL included topics beyond that of the BNL Facility Review Project. For example, the SCDHS evaluated BNL facilities for compliance with Suffolk County Sanitary Codes and performed an extensive review of Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) activities. The SCDHS developed their own independent list identifying their environmental concerns with BNL; this list currently contains over 1300 issues. While a subset of issues on both BNL and the SCDHS lists are duplicates, there are also distinct issues on each list due to the differences in scope.

Among the processes, storage areas, past practices, pits and tanks identified in the building reviews, 75 have been categorized as either Significant Findings or Lesser Issues. A Significant Finding is one that has the potential for releases to the environment, now or in the past, that could contaminate the groundwater above drinking water standards (DWS). A Lesser Issue is one that has the potential for releases to the environment, now or in the past, that could impact the groundwater but not above the DWS.

Other items identified under this project include general operating practices; equipment storage and utilization; administrative issues (e.g., labeling and registration) particularly regarding tanks; past practices relating to undocumented releases of low-level radioactivity; and remediation activities that took place in the past but were not documented. None of these remaining processes, practices or areas is believed to have resulted in a significant impact to the groundwater or public safety. However, they will be evaluated to determine whether any further corrective actions are required.

Corrective actions have been developed for each of the Significant Findings and Lesser Issues. Notable progress has been made on 75 percent of these issues, including the removal

of ten underground storage tanks and the removal of contaminated water in the Brookhaven Graphite Research Reactor (BGRR) sump systems (see Section 1.2 of Chapter 1 for a discussion of BGRR). Two drywells, one septic tank, a series of oil-water separators, and underground piping have also been addressed.

An integrated database has been developed which includes the environmental issues identified by BNL as well as those identified by the SCDHS. This tool will be used to track and verify progress on all facility review issues. All of these issues will be reviewed to determine an appropriate disposition. Wherever possible, this disposition will include integration into existing long term Laboratory programs or new initiatives such as the EMS and the PEP.

2.4 PROCESS EVALUATION PROJECT (PEP)

The PEP has been developed to satisfy the requirements of Attachments 1 and 1A of the MOA. PEP evaluates all experiments and industrial processes at BNL that generate wastes, effluents or emissions. It identifies and establishes the regulatory status of wastes, effluents and emissions to ensure that they are managed in compliance with applicable local, state, and federal environmental regulations and permits, and ensure they pose no threat to the environment. Opportunities for pollution prevention and operational vulnerabilities are also identified during the review. This project will result in an unprecedented level of knowledge about processes at BNL and will improve efficiency as well as compliance.

The strategy for implementing the process evaluations incorporates the development of the Environmental Compliance Representative (ECR) program. These environmental professionals are tasked with directly supporting process reviews and providing technical support to researchers and facility managers. Embedding environmental professionals in the line organizations will improve and assure compliance with environmental laws, regulations, and policy. Upon project completion, ECRs will transition to site-wide technical support roles. In this role, they will help implement systems for continuous improvement of environmental performance, with emphasis on pollution prevention and waste minimization.

During 1998, the PEP project management plan was developed, approved and funded by BNL. The ECR program was developed and the hiring process was initiated. Approximately 100 processes were determined to be "high priority", based upon criteria agreed to by BNL, DOE and USEPA. Process evaluations were initiated in September 1998 and expected to be completed in March 1999. The remainder of the processes will be evaluated by February 2000.

2.5 POLLUTION PREVENTION/WASTE MINIMIZATION

A strong Pollution Prevention /Waste Minimization Program (P2) is an essential element of successful accomplishment of BNL's environmental mission. The BNL P2 Program reflects national and DOE pollution prevention goals and policies, and represents an ongoing effort to make pollution prevention and waste minimization an integral part of the BNL operating philosophy.

Key elements of the P2 program are:

- ♦ Eliminating or reducing wastes, effluents, and emissions at the source where possible
- ♦ Ensuring that environmental effluents, emissions and wastes are As Low As Reasonably Achievable
- ♦ Achieving or exceeding BNL/DOE waste minimization, pollution prevention, recycling and affirmative procurement goals
- ♦ Conserving natural resources and energy
- ♦ Reusing and recycling materials
- ♦ Procuring environmentally preferable products (also known as "affirmative procurement")
- ♦ Complying with applicable requirements (e.g., New York State (NYS) Hazardous Waste Reduction Goal, Executive Orders)
- ♦ Reducing waste management costs
- ♦ Identifying funding mechanisms for evaluation and implementation of P2 opportunities
- ♦ Timely implementation of P2 projects
- ♦ Improving employee and community outreach and awareness of pollution prevention goals, plans and progress.

The overall goal of the P2 Program is to systematically integrate P2 considerations into all planning and decision making.

2.5.1 P2 PROGRAM ACCOMPLISHMENTS

BNL has achieved significant reductions in waste generated by routine operations. From 1993-1998, BNL reduced hazardous waste generation by 72 percent, mixed waste by 79 percent and radioactive waste by 51 percent. Implementation of P2 opportunities reduced waste management costs, and often resulted in process improvements.

Progress continued in 1998. The following P2 projects were implemented during the year:

- ♦ Ozone Water Treatment systems were installed on cooling towers for two RHIC experimental detectors (in buildings 1010 and 1002). Ozone is used to control bacterial fouling and prevent scale formation. The systems will eliminate the need for chemical treatment of the cooling water with corrosion inhibitors and biocides. It is estimated that this change will result in approximately \$15,000 of savings per year due to reduced maintenance and chemical purchases. The environmental benefit will be a chemical-free, blowdown waste stream entering recharge basins. The effectiveness of these systems will be monitored to determine whether additional cooling towers should be retrofitted.
- ♦ The Primary/Secondary Flow Instrumentation Upgrade replaced mercury-filled instrumentation at the Brookhaven Medical Research Reactor with non-mercury instrumentation. This reduces the risk of a mercury spill in a radiation control area, and eliminates the potential for mixed waste.
- ♦ The Industrial Waste Evaporator at Central Shops Project involved procurement and installation of an evaporator to replace and upgrade an existing evaporator in use in the Central Shops organization. The new system will be utilized to evaporate non-hazardous industrial wastewater from spent coolants, mop waters, chip storage sump waters, and baths from the Centralized Degreasing Facility. These waste streams would otherwise require management and disposal as industrial wastes. The project will be completed in 1999.
- ♦ The Excess Lead Shield Block Utilization Project involves the reuse of lead bricks, that had been targeted for disposal as mixed waste, as shielding in the walls of the hot cell being constructed by the Waste Management

program. The project involves segregation, surveying, inspection, and staging of lead-shielding stockpiles; the lead bricks in good condition going to the hot cell. This project, when fully implemented, will have a very high return-on-investment from the avoided cost of mixed waste disposal. The project will be completed in 1999.

- ♦ The Mercury Thermometer Substitution Project procured thermometers that contain alcohol instead of mercury but have the same scale and immersion length as currently stocked mercury-filled thermometers. This will reduce mercury waste generated by thermometer breakage. The project is part of a Laboratory-wide P2 program to reduce mercury use.
- ♦ The Natural Gas Conversion of the Central Steam Facility (CSF) Project was initiated in 1997 with the extension of a gas main (belonging originally to the Long Island Lighting Company, now KeySpan) leading into the CSF and burner modifications to Boilers 5 and 7. In 1998, with the installation of dual fuel burners on Boiler 6 earlier this year, natural gas became the primary fuel used at the CSF. Residual fuel oil burned at the CSF dropped more than 92 percent, from an average of 4,775,000 gallons per year for the three year period of 1994 to 1996, to just over 354,000 gallons in 1998. The use of cleaner burning natural gas, combined with the switch to low sulfur and low nitrogen residual fuel in 1995, resulted in significant reductions in CSF emissions enabling the plant to meet nitrogen oxide emission standards. Total criteria pollutant emissions from the CSF have been trimmed from approximately 561 tons in 1994 to just over 100 tons in 1998.

2.5.2 EMPLOYEE TRIP REDUCTION PLAN

BNL has had a rideshare program since 1995. This program was developed to comply with the Employee Travel Reduction Program rule (17 NYCRR Part 68). The New York State Department of Transportation repealed the rule in September 1996, in effect making employer participation in the program voluntary. Although the program is voluntary, BNL continues to assist employees in finding suitable rideshare partners by maintaining a ride-matching database. The Laboratory still

provides a guaranteed ride service for program participants, and continues to subsidize the cost of a defensive-driver course for employees active in ridesharing partnerships.

2.5.3 WATER CONSERVATION PROGRAM — 1998 ACCOMPLISHMENTS

The Reduction of Non-Contact Cooling-Water Program - Phase I project, initiated in 1997, was completed in early 1998. This project redirected cooling-water discharges from Buildings 555, 830, and 480 from sanitary to the storm sewer system. The goal was to reduce the contribution of “clean” water to the sanitary sewer, thereby increasing the concentration of biological matter in the Sewage Treatment Plant (STP) influent. Since biological matter is a food source for the microorganisms that treat the waste, the increased concentration of biological matter enhances biological activity and makes the treatment process more efficient. This project reduced water flow to the STP by 15 percent and saved over 800 million liters per year. BNL received a DOE Energy Management Achievement Award in 1998 for water conservation efforts.

During 1998, the Alternating Gradient Synchrotron (AGS) cooling-water source was changed from process water wells (i.e., Wells 101, 102 and 103) to the domestic water system. Previously the water drawn from these wells contained high concentrations of naturally occurring iron. The conversion to domestic water has significantly improved the quality of the discharge and has lowered water usage from 4,500 liter per minute (lpm) to 3,000 lpm (1,200 gpm to 800 gpm). Based on continuous use during the AGS operation cycle (approximately 250 days/year), this lowered consumption rate corresponds to water savings of approximately 545 million liter/year (144 million gallons/year). In addition, by converting to the domestic water system, fewer chemical additives are necessary to prevent iron fouling of the heat exchanges. Fouling of the recharge basin by iron deposition is also reduced.

2.5.4 ENERGY MANAGEMENT

Many of the BNL scientific experiments use particle beams generated and accelerated by electricity with the particles controlled by large electromagnets. The Laboratory spends over

\$20 million for energy each year. To help deal with large energy expenditures, as well as meet DOE goals for energy conservation, BNL’s Energy Management Group was established in 1979. It is responsible for the development, implementation and coordination of an Energy Management Plan, and for leading BNL’s effort to meet DOE’s energy reduction goals.

DOE’s In-House Energy Management Order 430.2 set a goal to demonstrate, on an annual basis, continuous cost-effective improvement in reducing building energy use per square foot and increase energy efficiency in industrial facilities, for all DOE sites. Success is measured by comparing current year consumption to the year prior. Energy management initiatives have been very successful at BNL. Laboratory energy-use per square foot of building for 1998, was 24 percent less than in 1985, well ahead of the DOE goal of a 20 percent reduction by 2000.

2.6 WASTE MANAGEMENT (WM) PROGRAM

The BNL WM is charged with managing the routine hazardous and radioactive wastes generated by the Laboratory. In addition, WM has a role in managing some industrial wastes (e.g., used oils, oil-contaminated debris) and assists the Environmental Restoration program in managing wastes resulting from cleanup activities. WM also manages onsite and offsite hazardous material waste shipments.

2.6.1 WASTE GENERATION

In 1998, BNL generated the following quantities and types of routine waste:

- ♦ Hazardous Waste: 38.1 metric tons (42 tons)
- ♦ Mixed Waste: 1.2 cubic meters (42.4 cu ft)
- ♦ Radioactive Waste: 256 cubic meters (9041 cu ft)
- ♦ Regulated and Toxic Substances Control Act Waste: 76.8 metric tons (84.6 tons).

2.6.2 FACILITIES AND CAPABILITIES

WM currently operates the Waste Management Facility (WMF) and the Waste Concentration Facility (WCF). The WMF is a permitted waste-storage facility (New York State Department of Environmental Conservation [NYSDEC] Part 373 Permit No. 1-422-00032/00102-0) consisting of four operations buildings: 855, 860, 865, and 870. See [Figure 2-2](#) for

an aerial photograph of the WMF. Building 860 houses technical and operations staff. Building 855 is the waste-storage facility where hazardous, Polychlorinated biphenyl (PCB), and industrial solid, liquid, and gaseous wastes are stored and segregated by hazard class. Building 870 is the mixed-waste storage facility where radioactively-contaminated, hazardous, PCB, and industrial solid, liquid, and gaseous wastes are stored and segregated by hazard class. Building 865 is used for storage of radioactive waste solids.

WM plans two upgrades to Building 865 in 1999: construction of a hot cell and installing a waste compactor. The hot cell will allow management of high-activity wastes in a safe and more cost-effective manner. The waste compactor will allow consolidation of large radioactive solid packages into smaller packaging to minimize BNL waste disposal costs and conserve landfill space.

The WCF consists of Building 811 and 802. Building 811 provides storage of bulk quantities of radioactively contaminated aqueous

liquids. Liquids are stored in permitted tanks for either onsite processing or offsite treatment. Building 802 contains the current onsite processing unit. The processing consists of evaporating aqueous liquids, which have been treated for the removal of heavy radioisotopes, under an existing air permit. There were no facility upgrades to the WCF for 1998. WM plans two major upgrades for the WCF in 1999. An annex to Building 811 will be constructed to concentrate and remove radioactive particles from aqueous liquids, effectively minimizing the amount of waste for processing or treatment. The second upgrade will take place at Building 802, replacing the current evaporating unit with a new, more energy efficient unit.

Before the new WMF was opened, WM operations were carried out in another onsite permitted hazardous waste-storage facility, the Hazardous Waste Management Facility (HWMF). The HWMF consisted of Buildings 360 (ignitable labpack storage), 361 (ignitable labpack storage), 368 (ignitable mixed-waste

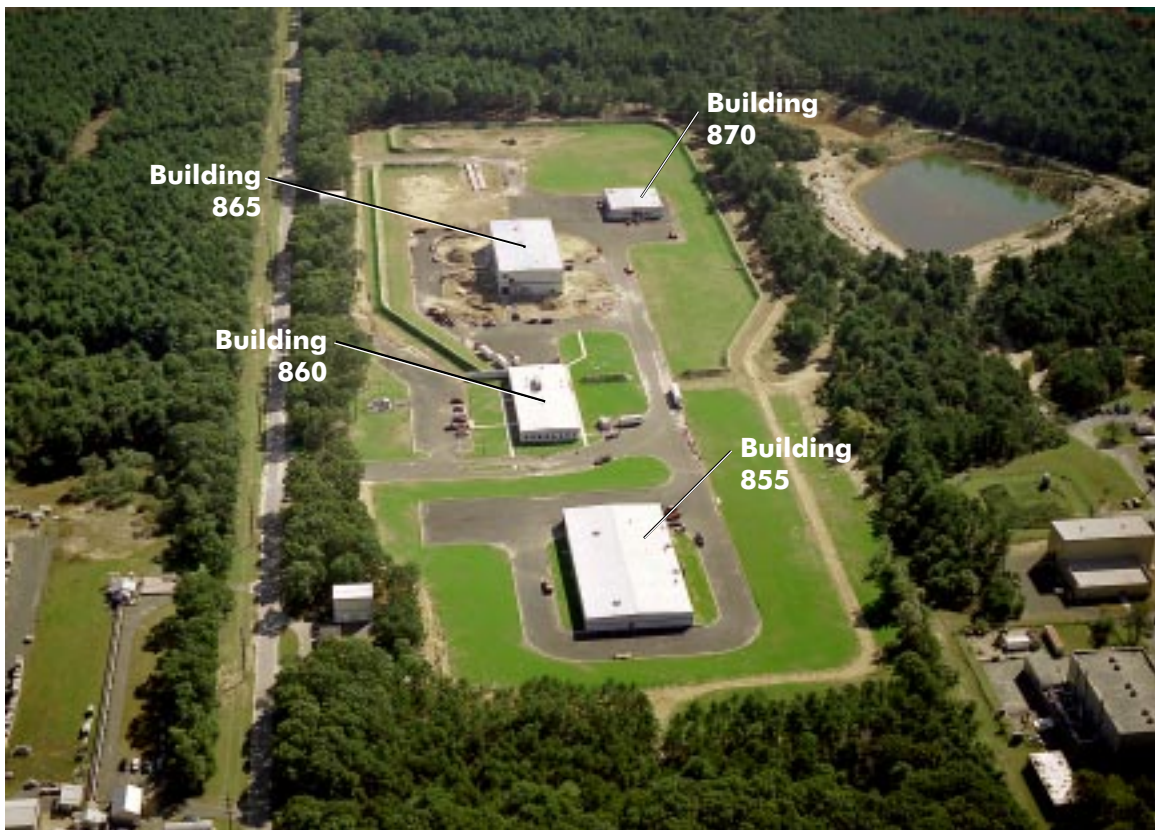


Figure 2-2. Aerial photograph of the Waste Management Facility

storage), 444 (mixed-waste storage), 448 (labpack storage), and 483 (drum storage). All hazardous and mixed wastes were removed by the end of July 1998, and operations in the HWMF ceased. The facility was subsequently certified "closed" by a licensed Professional Engineer and documentation on the closure submitted to the NYSDEC. The ultimate management of the closed-HWMF will be addressed under the ER Program (BNL Operating Unit I Record of Decision).

In addition to the WMF and WCF, BNL has a number of 90-Day Hazardous Waste Accumulation and Hazardous Waste Satellite Accumulation Areas. Groups generating waste are responsible for properly packing, labeling, and segregating wastes at the generating location prior pick up by WM. Personnel handling waste are required to have training.

2.7 ENVIRONMENTAL RESTORATION (ER)

In 1980, the U.S. Congress enacted CERCLA (also known as Superfund) to ensure that sites with historical contamination were cleaned up, and to hold the responsible party liable for the cleanup. CERCLA established the National Priorities List (also known as the NPL). The NPL is a list of sites nationwide where cleanup of past contamination is required. In November 1989, BNL was included as one of 24 sites on the NPL that are located on Long Island. Much of the contamination at BNL is due to past accidental spills and practices for handling chemical and radiological material storage and disposal.

The process CERCLA mandates includes conducting a Preliminary Assessment (review of historical documents, interviews with employees, site reconnaissance), making a Site Inspection (which often includes sampling), conducting a Remedial Investigation (to characterize the nature, the extent of contamination and the existing risks), preparing a Feasibility Study (to present remedial action alternatives and evaluate alternatives), issuing a Record of Decision (to present DOE, USEPA and NYSDEC remedy), and performing Remedial Design/Remedial Action (which includes final design, construction specifications and carrying out the remedy selected). At each step, USEPA distinguishes between sites that do or do not require further action, based on threat to human health and the environment. An expedited cleanup action called a

Removal Action can also be conducted. This only requires an Engineering Evaluation/Cost Analysis. This document evaluates and recommends specific cleanup actions.

Since its establishment in 1991, the Laboratory's ER program has been characterizing and removing sources of contamination (e.g., under ground tanks and pools) or treating the groundwater and soil contamination resulting from past BNL practices. ER groundwater cleanup efforts have included monitoring of existing groundwater wells, overseeing the installation of new, permanent groundwater monitoring wells, installing groundwater treatment systems and extension of public water service. Soil cleanup efforts have identified contaminated soils through sampling and resulted in various programs involving soil removal and treatment. Several landfills have been capped and 55 waste pits have been excavated.

2.7.1 PROGRESS BY OPERABLE UNIT (OU)

ER used historical facility records and sampling to determine where contamination might be present on the site today. These areas were geographically grouped into Operable Units (OU). (See Areas of Concern at BNL, Upton, New York. A Reference Handbook, June 1998). Table 2.2 provides a description of each Operable Unit (I - VII) and the ER actions taken during 1998. See Chapter 8 for a more detailed discussion.

2.7.2 ETHYLENEDIAMINETETRA ACID (EDTA) INVESTIGATION

In response to stakeholder inquiries, in 1998, BNL investigated soils, groundwater and potable water supplies near the AGS cooling water system outfall for ethylenediaminetetra acid (EDTA); a chelating agent. Chelating agents such as EDTA are used in cooling water systems to keep metal ions in suspension and prevent the metals from accumulating in heat exchange equipment. Low concentrations of EDTA were found in the groundwater adjacent to the AGS outfall. EDTA was also found in soil samples collected from within the AGS recharge basin. Stakeholders were concerned that a plume containing radionuclide contaminants might commingle with a plume containing excess chelating agents, and increase the movement of radionuclides in groundwater. There was no evidence, however, that the

Table 2.2. Environmental Restoration Progress

Operable Unit/ Project	Description and Contamination Type	1998 CERCLA Actions
Operable Unit I	Former Hazardous Waste Management Area, Landfills, and Disposal Pits <i>Low level radiological soil contamination, primarily cesium-137</i>	<p>Feasibility Study</p> <ul style="list-style-type: none"> Completed OU I Draft Feasibility Study <p>Preliminary Assessment/Site Investigation</p> <ul style="list-style-type: none"> Completed soil and groundwater sampling at the Former Medical Complex Area <p>Building 811</p> <ul style="list-style-type: none"> Completed the Waste Pipe Trench Removal, Draft Work Plan for Bldg 811 Completed the Bldg. 811 D-waste pipe trench removal Completed the Work Plan for removal, treatment and disposal of sludges from Bldg. 811 <p>Landfill Removal Action & Chemical Holes</p> <ul style="list-style-type: none"> Completed the Draft Closure Report for the Chemical Holes Completed the Chemical Holes gas cylinder decommissioning Shipped biological waste to GTS Duratek for incineration Completed the 1997 Environmental Monitoring Report for the Current and Former Landfills Shipped 150 cubic yards of debris from the glass holes staging area to GROWS landfill Completed partial restoration (fill, grading and topsoil) of the Chemical Holes
Operable Unit II/VII	AGS Scrapyard & Soil Contamination <i>Low level radiological soil contamination, primarily cesium-137 & strontium-90</i>	<p>Remedial Investigation / Risk Assessment</p> <ul style="list-style-type: none"> Completed the Draft Remedial Investigation Report Received DOE approval on Brookhaven LINAC Isotope Producer (BLIP) Soil Sampling and Analysis Plan and completed soil sampling
Operable Unit III	Potable Supply Wells/Spills <i>Low level chemical and radiological groundwater contamination primarily VOC's, tritium & strontium-90</i>	<p>Remedial Investigation / Risk Assessment & Feasibility Study</p> <ul style="list-style-type: none"> Completed the Draft Final OU III Remedial Investigation/Risk Assessment Completed the Draft OU III Feasibility Study Held four community roundtables and one community workshop to obtain early input on the alternatives for cleaning up groundwater contaminated with volatile organics, tritium and strontium-90. <p>Onsite Actions</p> <ul style="list-style-type: none"> Removed two Bldg 830 underground storage tanks and excavated contaminated soil Completed the Work Plan for characterization of the Former Scrapyard & Drum Storage Area <p>Offsite Treatment</p> <ul style="list-style-type: none"> Submitted the Offsite Groundwater Removal Action, Action Memo to the Administrative Record Submitted the Offsite Action Pre-Design Report for Groundwater Cleanup to the Administrative Record Conducted community information sessions on construction of groundwater treatment systems in the industrial park south of the lab Received access agreement from North Fork Bank allowing construction of the offsite groundwater treatment system and initiated monitoring and remedial well installations Installed and sampled six vertical profile wells in the industrial park south of BNL Finalized the design for the offsite Groundwater Removal Action Sent mailings and held three poster sessions on the groundwater treatment system for the industrial park south of BNL <p>Tritium Contamination</p> <ul style="list-style-type: none"> Completed groundwater modeling for the HFBR tritium plume Completed additional tritium groundwater characterization adjacent to the HFBR stack Continued operation of the tritium pump and recharge system <p>Brookhaven Graphite Research Reactor (BGRR)</p> <ul style="list-style-type: none"> Completed the BGRR Draft Soil/Groundwater Sampling Report and Sampling and Analysis Plan for the Pile Fan Sump Completed the BGRR Final Sampling and Analysis Report

Table 2.2. Environmental Restoration Progress (cont'd.)

Operable Unit/ Project	Description and Contamination Type	1998 CERCLA Actions
Operable Unit IV	Central Steam Facility Spill & Bldg. 650 Sump Outfall <i>Low level chemical and radiological soil and groundwater contamination, primarily VOC's & strontium-90</i>	<ul style="list-style-type: none"> • Completed the Final OM&M Manual for the Air Sparge/Soil Vapor Extraction (AS/SEV) System • Completed the Quarterly 1, 2 & 3 OM&M Reports for AS/SVE System • Maintained operations, maintenance and monitoring for the AS/SVE System • Completed the Final Interim Remedy Monitoring Plan for Bldg. 650 Sump and Sump Outfall Area • Completed the 1997 Interim Remedy Monitoring Report for Bldg. 650 Sump & Sump Outfall Area • Maintained Interim Remedy Monitoring for the Bldg. 650 Sump and Sump Outfall Area • ETDA Investigation conducted
Operable Unit V	Sewage Treatment Plant & Peconic River <i>Low level heavy metal and radiological sediment and soil contamination, primarily Mercury, silver, copper & cesium-137</i>	<ul style="list-style-type: none"> • Submitted the Remedial Investigation / Risk Assessment Report to Administrative Record • Mailed information on the Remedial Investigation . Risk Assessment Report to members of the public on the environmental mailing list • Held five community roundtables on the plan for future sampling of the Peconic River • Additional sampling of OU V and the Peconic River for plutonium. 1998 sampling results were ambiguous, and resampling will be conducted in 1999. See discussion in Chapter 6, Section 6.1.1.
Operable Unit VI	Biology Fields <i>Low level pesticide groundwater contamination— ethylenedibromide (EDB)</i>	<ul style="list-style-type: none"> • Prepared Long-term Groundwater Monitoring Plan • Installed 20 permanent monitoring wells and 15 vertical profile borings offsite according to Draft Record of Decision and October 1997 Work Plan • Performed modeling and established baseline for monitored natural attenuation
Groundwater Monitoring	On-going Site-wide Project	<ul style="list-style-type: none"> • Completed the CY 1997 ERD Groundwater Monitoring Report • Submitted the CY 1999 ERD Sampling and Analysis Plan • Collected and analyzed over 1200 groundwater samples from 16 monitoring programs
Removal Actions		<ul style="list-style-type: none"> • Completed the Final Draft Closeout Report for the Cesspools Removal Action • Shipped 142 tons of contamination from the Boneyard Waste Project for offsite disposal (five Argonne bins and ten B-25 containers of sludge) • Completed the OM&M Manual for South Boundary Groundwater Pump and Treat System • Continued operation of Removal Action Groundwater Pump and Treat Rystem • Treated over 326 million gallons of groundwater and removed over 50 pounds of volatile organics

presence of EDTA has hastened the movement of radionuclides in the soil and groundwater downgradient of the AGS outfall or off the site. BNL discontinued the use of EDTA in the AGS cooling water system in 1998. Investigation of potential impacts of EDTA will continue in 1999. The investigation was conducted under the OU IV and OU III CERCLA related activities under the BNL Environmental Restoration program.

2.8 ENVIRONMENTAL MONITORING

In order to determine whether current BNL operations affect the environment and to ensure compliance with environmental permit requirements, the Laboratory has established a comprehensive, multi-media environmental monitoring program. Over 5000 samples were collected in 1998 as part of the Environmental Monitoring Program as shown in Table 2-3. The monitoring program is reviewed and

**Table 2.3. BNL 1998 Sampling Program
Summary of Samples Collected Sorted by Media**

Samples	Total Collected in 1998	Purpose
Groundwater	1,718	Monitoring is performed by the ER and ES organizations to determine impacts of past and present operations on groundwater quality.
Air - Tritium	1,240	Silica gel cartridges are used to collect atmospheric moisture for subsequent tritium analysis. This data is used to assess tritium levels downwind of the reactors.
Air - Particulate	480	Gamma analysis is performed on samples of particulate matter collected from air samples. Purpose is to ensure that there is no impact from BNL operations.
Air - Charcoal	190	Charcoal samples are used to assess for radioiodines, which may be released in reactor emissions.
Potable Water	195	Potable water wells are monitored routinely for chemical and radiological parameters to ensure compliance with SDWA requirements and for environmental surveillance purposes.
Fauna	56	Fish and deer are monitored routinely by gamma analysis to assess impacts to wildlife from past BNL operations.
Flora	15	Since the primary pathway from soils to fauna is via ingestion, vegetation is sampled to assess uptake of contaminants by plants.
On-Site Recharge Basins	115	Recharge basins used for waste water and storm water disposal are monitored in accordance with SPDES requirements and for environmental surveillance purposes.
Sewage Treatment Plant and the Peconic River	1,037	The STP influent and effluent and several Peconic River stations downstream are monitored routinely for organic, inorganic, and radiological parameters to assess BNL impacts on the estuary.
Precipitation	22	To determine impacts of Laboratory emissions on rainfall, precipitation samples are collected routinely from two locations.
Soils	138	Soil samples are collected from adjacent farms and other local areas to confirm that Laboratory emissions have no impact on surrounding areas.
Collected in 1998 Total Samples	5,198	

revised as necessary on an annual basis, to reflect changes in permit requirements, changes in facility specific monitoring activities, and the need to increase or decrease monitoring based upon the review of previous analytical results. As required under DOE Order 5400.1, an Environmental Monitoring Plan outlines annual sampling goals by specific media and frequency.

There are three components to the environmental monitoring program:

- ◆ Compliance monitoring is conducted to ensure that wastewater effluent, air emissions and groundwater monitoring data comply with regulatory permit conditions (issued under the federal Clean Air Act (CAA), Clean Water Act (CWA), Oil Pollution Act, Safe Drinking Water Act and New York State equivalents).

- ◆ Restoration monitoring is performed to determine overall impacts of past operations, to delineate the real extent of contamination, and to assure that remedial systems are performing as designed (CERCLA, Resource Conservation and Recovery Act [RCRA]).
- ◆ Surveillance monitoring is conducted to ensure there are no negative impacts on environmental media from Laboratory operations (DOE Order).

These programs may be broken down further by the relevant law or requirement (e.g., State Pollutant Discharge Elimination System [SPDES] or CAA) and even further by specific media and type of analysis. Control or background samples are also collected in order to compare BNL samples to areas that could not have been impacted by BNL operations.

2.8.1 ENVIRONMENTAL MONITORING PROGRAM PURPOSE AND SCOPE

Compliance monitoring is performed in accordance with environmental requirements (permits, regulations, etc.). These requirements may be separated into three categories: air, wastewater and groundwater.

- ♦ Monitoring of air emissions is conducted at reactors, accelerators and other radiological emission sources as well as the CSF. Real-time, continuous emission monitoring or continuous sample collection equipment is installed and maintained at these facilities, as required by permit conditions. Analytical data is reported routinely to the permitting agency (see Chapter 3 for details).
- ♦ Wastewater discharges are subject to CWA permit monitoring requirements. Monitoring is performed at the point of the wastewater discharge, and is used to ensure that the effluent complies with release limits. Twelve point source discharges are monitored under the BNL CWA program: three from the ER program, and nine under the SPDES program. Samples are collected daily, weekly, monthly, or quarterly as required by permit conditions, and monitored for organics, inorganics and radiological parameters. Monthly reports are filed with the permitting agency, which provide analytical results and an assessment of compliance for that reporting period.
- ♦ Groundwater monitoring is also performed in accordance with permit requirements. Specifically, monitoring of groundwater is required under the Major Petroleum Facility License and RCRA permit for the WM facility. Extensive groundwater monitoring is also conducted under the ER program as required under the Records of Decision for many of the OUs or Areas of Concern (see Chapter 8 for details). Additionally, to ensure that the Laboratory maintains a viable potable water supply, groundwater is monitored as required by the NYS Department of Health (see Chapter 3 for details).

Monitoring performed under the ER program is conducted to determine if past operations released or deposited contaminants in the environment or otherwise resulted in degradation of environmental media. This program typically includes collection of soil and groundwater samples in order to determine the

lateral and vertical extent of the contaminated area. These samples are analyzed for organics, inorganics and radiological contaminants and the analytical results compared with recognized guidance or background concentrations. Areas where impacts have been confirmed are fully characterized and if necessary, remediated to mitigate continual impacts. Follow-up monitoring of groundwater is conducted in accordance with a Record of Decision.

The focus of the environmental surveillance program is to assess potential environmental impacts resulting from routine facility operations. This program includes collection of ambient air, surface water, groundwater, flora, fauna, and precipitation samples. Samples are analyzed for radiological, organic, and inorganic contaminants. Additionally this program performs routine review of data collected by thermoluminescent dosimeters (TLDs) (devices to measure radioactive exposure) placed on and offsite.

The results of monitoring and the analysis of the monitoring data are the subject of the rest of this SER report. Chapter 3 summarizes environmental requirements and compliance data; Chapters 5 through 9 give details on media specific monitoring data and its analysis; chapter 10 provides supporting information for understanding and validating most of the data shown in this report.

2.9 COMMUNITY INVOLVEMENT

A Community Advisory Council was formed to advise the Laboratory Director on BNL issues, operations, and activities of concern or interest to the community. BNL also has an Envoy Program, which builds on relationships that BNL employees have established within community organizations as a way to communicate about the Laboratory to a broader audience. Additionally, BNL has held several roundtables to solicit input from internal and external stakeholders on Laboratory matters of interest to them.

Public outreach activities include local civic association briefings; meetings and presentations to local, state and federal regulators and elected officials; and regular interactions with the business and educational community. In 1998, BNL hosted more than 10,000 student visitors; another 3,200 people visited the Laboratory through its Summer Sunday programs.

To improve communications between BNL and the community, the Community Involvement, Government and Public Affairs Directorate updated the look and information on the Laboratory's World Wide Web site. A survey was conducted that identified issues of importance to the community in order to focus coverage. To highlight the cutting-edge environmental research conducted at the Laboratory and provide information regarding cleanup initiatives, the Laboratory hosted an Environmental Fair, which drew over 3,000 visitors.

The Laboratory also issues press releases, publishes the Brookhaven Bulletin and Cleanupdate, and issues e-mail updates, to inform the public and staff about environmen-

tal activities. In 1998, BNL granted Newsday, the major daily Long Island newspaper, unprecedented access to employees and the site for a series of articles that explored the Laboratory's culture, detailed environmental cleanup activities on- and offsite, and reported on community initiatives.

BNL has made strong commitments to the Long Island environment and the safety and health of its community. The Laboratory is developing a broad spectrum of opportunities for community involvement and public outreach. BNL's Community Involvement Policy, written with input from BNL employees and the general public, lays the foundation for a heightened emphasis on community involvement throughout the Laboratory.

REFERENCES:

Memorandum of Agreement by and between the Environmental Protection Agency and the United States Department of Energy, EPA and DOE, March 23, 1998

ISO/DIS 14001, ASTM, Environmental Management System—Specification with Guidance for Use. September, 1996.

Areas of Concern at BNL, A Reference Handbook. June 1998. Brookhaven National Laboratory, Upton, New York.

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