2 Environmental Management System

One of Brookhaven National Laboratory's highest priorities is ensuring that its environmental commitment is as strong as its passion for discovery. The contractor operating the Laboratory on behalf of DOE, Brookhaven Science Associates (BSA), takes environmental stewardship very seriously. As part of their commitment to environmentally responsible operations, they have established the BNL Environmental Management System (EMS).

One measure of an effective EMS is recognition of good environmental performance. In 2009, the Laboratory was recognized with two national or regional environmental awards: DOE awarded BNL a P2 STAR Honorable Mention for pollution prevention practices for Total Nitrogen Reduction at the BNL Sewage Treatment Plant Using Cafeteria Wastes, and the Laboratory received its third Silver Level Award for Electronics Recycling from the Office of the Federal Environmental Executive. BNL reused or recycled approximately 81,000 pounds of electronics during fiscal year 2009, a period from October 1, 2008 to September 30, 2009.

An EMS ensures that environmental issues are systematically identified, controlled, and monitored. Moreover, an EMS provides mechanisms for responding to changing environmental conditions and requirements, reporting on environmental performance, and reinforcing continual improvement. The Laboratory's EMS was designed to meet the rigorous requirements of the globally recognized International Organization for Standardization (ISO) 14001 Environmental Management Standard, with additional emphasis on compliance, pollution prevention, and community involvement.

Annual audits are required to maintain EMS registration. Recertification audits of the entire EMS occur every three years. In 2009, an EMS Surveillance Audit determined that BNL remains in conformance with the ISO 14001: 2004 Standard.

BNL continued its strong support of its Pollution Prevention Program, which seeks ways to eliminate waste and toxic materials. In 2009, pollution prevention projects resulted in more than $5.5 million in cost avoidance or savings and resulted in the reduction or reuse of approximately 17.9 million pounds of waste. Also in 2009, the BNL Pollution Prevention Council funded five new proposals or special projects, investing approximately $24,000. Anticipated annual savings from these projects are estimated at approximately $33,650, for an average payback period of less than 0.7 years. The ISO 14001-registered EMS and the nationally recognized Pollution Prevention Program continue to contribute to the Laboratory's success in promoting pollution prevention.

BNL continues to address legacy issues under the Environmental Restoration Projects Group and openly communicates with neighbors, regulators, employees, and other interested parties on environmental issues and cleanup progress on site.

2.1 INTEGRATED SAFETY MANAGEMENT, ISO 14001, AND OHSAS 18001

The Laboratory's Integrated Safety Management System (ISMS) integrates environment, safety, and health management into all work planning. The integrated safety processes within ISMS contributed to BNL achieving ISO 14001 and Occupational Health and Safety Assessment Series (OHSAS) 18001 registrations.

The ISO 14001 Standard is globally recognized and defines the structure of an organization's EMS for purposes of improving environmental performance. OHSAS 18001 mirrors the ISO 14001 structure. The process-based structure of the ISO 14001 and OHSAS 18001 Standards are based on the "Plan-Do-Check-Act" improvement cycle. Both standards require an organization to develop a policy, create plans to implement the policy, implement the plans, check progress and take corrective actions, and review the system periodically to ensure its continuing suitability, adequacy, and effectiveness.

BNL's EMS was officially registered to the ISO 14001 Standard in July 2001 and was the first DOE Office of Science Laboratory to obtain third-party registration to this environmental standard. BNL was officially registered to the OHSAS 18001 Standard in 2006, and was again the first DOE Office of Science Laboratory to achieve this registration. Each certification requires the Laboratory to undergo annual audits by an accredited registrar to assure that the systems are maintained.

In 2009, an EMS and OHSAS Surveillance Audit determined that BNL remains in conformance with the ISO 14001 and OHSAS 18001 Standards. In their recommendation for continued certification, auditors from NSF-International Strategic Registrations, Ltd. highlighted more than 14 noteworthy practices, some of which include: a strong commitment to achievement of Laboratory-wide environmental, safety & health (ES&H) objectives and targets; continued improvement in analysis of ES&H data to prevent issues from occurring; and strengths in environmental planning for the Long Island Solar Farm. The auditors also identified one minor nonconformity: to improve the use of causal analysis for ES&H issues. Nine opportunities for improvement were also noted, such as continued reductions in paper use and cafeteria waste reduction. Corrective actions were prepared and will be tracked to closure.

2.2 ENVIRONMENTAL, SAFETY, SECURITY, AND HEALTH POLICY

The cornerstone of an EMS is a commitment to environmental protection at the highest levels of an organization. BNL's environmental commitments are incorporated into a comprehensive Environmental, Safety, Security, and Health (ESSH) Policy. The policy, issued and signed by the Laboratory Director, makes clear the Laboratory's commitment to environmental stewardship, the safety of the public and BNL employees, and the security of the site. The policy continues as a statement of the Laboratory's intentions and principles regarding overall environmental performance. It provides a framework for planning and action and is included in employee, guest, and contractor training programs. The ESSH Policy is posted throughout the Laboratory and on the BNL website at http://www.bnl.gov. The goals and commitments focusing on compliance, pollution prevention, community outreach, and continual improvement include:

- **ENVIRONMENT:** We protect the environment, conserve resources, and prevent pollution.
- **SAFETY:** We maintain a safe workplace, and we plan our work and perform it safely. We take responsibility for the safety of ourselves, coworkers, and guests.
- **SECURITY:** We protect people, property, information, computing systems, and facilities.
- **Health:** We protect human health within our boundaries and in the surrounding community.
- **COMPLIANCE:** We achieve and maintain compliance with applicable ESSH requirements.
- **COMMUNITY:** We maintain open, proactive, and constructive relationships with our employees, neighbors, regulators, DOE, and our other stakeholders.
- **CONTINUAL IMPROVEMENT:** We continually improve ESSH performance.

2.3 PLANNING

The planning requirements of the ISO 14001 Standard require BNL to identify the environmental aspects and impacts of its activities, products, and services; to evaluate applicable legal and other requirements; to establish objectives and targets; and to create action plans to achieve the objectives and targets.

2.3.1 Environmental Aspects

An "environmental aspect" is any element of an organization's activities, products, and services that can interact with the environment. As required by the ISO 14001 Standard, BNL evaluates its operations, identifies the aspects that can impact the environment, and determines which of those impacts are significant. The Laboratory's criteria for significance are based on actual and perceived impacts of its operations and on regulatory requirements. BNL utilizes several processes to identify and review environmental aspects. Key among these is the Process Assessment Procedure. This is an evaluation that is documented on a Process Assessment Form, which consists of a written process description, a detailed process flow diagram, a regulatory determination of all process inputs and outputs, identification of pollution prevention opportunities, and identification of any assessment, prevention, and control measures that should be considered. Environmental professionals work closely with Laboratory personnel to ensure that environmental requirements are integrated into each process. Aspects and impacts are evaluated annually to ensure that they continue to reflect stakeholder concerns and changes in regulatory requirements.

2.3.2 Legal and Other Requirements

To implement the compliance commitments of the ESSH Policy and to meet its legal requirements, BNL has systems in place to review changes in federal, state, or local environmental regulations and to communicate those changes to affected staff. Laboratory-wide procedures for documenting these reviews and recording the actions required to ensure compliance are available to all staff through BNL's web-based Standards-Based Management System (SBMS) subject areas.

DOE Order 450.1A, Environmental Protection Program, established federal requirements for pollution prevention, reduction of toxic chemical use, purchase of environmentally preferred products, electronic stewardship, and the implementation of an Environmental Management System. The Laboratory's EMS objectives and targets have been established to mirror these requirements and are discussed in section 2.3.3. DOE Order 430.2B, Departmental Energy, Utilities, and Transportation Management, established federal requirements for certain criteria, and requires an annual certification and submission of an Executable Plan. The Executable Plan provides a roadmap on how the Laboratory intends to meet these requirements. Both orders incorporate the goals of Executive Order (EO) 13423, Strengthening Federal Environmental, Energy and Transportation Management.

EO 13514, Federal Leadership in Environmental, Energy, and Economic Performance, which was signed in 2009, sets sustainability goals for federal agencies and focuses on improving their environmental, energy, and economic performance. It also requires federal agencies to set a 2020 greenhouse gas emissions reduction target, increase energy efficiency, reduce fleet petroleum consumption, conserve water, reduce waste, support sustainable communities, and leverage federal purchasing power to promote environmentally responsible products and technologies. These requirements will direct the future of BNL's EMS program, and most have already been incorporated.

Table 2-1 provides a summary status on meeting the goals of DOE Order 430.2B and EO 13514.

2.3.3 Objectives and Targets

The establishment of environmental objectives and targets is accomplished through a Performance-Based Management System. This system is designed to develop, align, balance, and implement the Laboratory's strategic objectives, including environmental objectives. The system drives BNL's improvement agenda by establishing a prioritized set of key objectives, called the Performance Evaluation Management Plan. Annually, BSA works closely with DOE

Table 2-1. DOE Order 430.2B and Executive Order (EO) 13514 Goal Status.

430.2B Requirements	BNL Status
30 percent energy intensity reduction by FY2015, from an FY2003 baseline	FY2009 was 7.9 percent below the established baseline. BNL is currently developing solicitation for an energy service provider contractor for energy conservation measures. In addition, the Laboratory is implementing a steam charge-back and continuing lighting and controls upgrades.
16 percent water intensity reduction by FY2015, from an FY2007 baseline	FY2009 water intensity was above baseline due to increased programmatic (process cooling) usage. Based on forecasted loads, it is currently unlikely that the FY2015 goal can be achieved.
7.5 percent of a site's annual electricity consumption from on-site renewable sources by FY2010: FY2009 goal—3 percent; FY2010 goal—5 percent	BNL purchased 6,500 MWh (2.6 percent) of renewable energy credits in FY2009. The Laboratory is working with the Long Island Power Authority to develop a 37-MW solar photovoltaic (PV) project on site and investigating biomass feasibility.
Every site to have at least one on-site renewable energy generating system	A solar thermal heating system was installed on the BNL pool and a second solar thermal demonstration project at Building 30 is underway. BNL is working with the Long Island Power Authority to develop a 37-MW solar PV system on site.
10 percent annual increase in fleet alternative fuel consumption, relative to a FY2005 baseline	Due to lack of readily available compressed natural gas (CNG) vehicles, the Laboratory did not meet the goal for FY2009. BNL is in the process of providing E85 capability and installing a biodiesel fueling system. Currently, it is expected that the Laboratory may not meet the goal for FY2010 and later years.
2 percent annual reduction in fleet petroleum consumption, relative to a FY2005 baseline	Exceeded goal for FY2009; expect to meet goal for FY2010.
75 percent of light duty vehicle purchases must consist of alternative fuel vehicles	Exceeded goal for FY2009; may not be able to meet goal for FY2010.
All new construction and major renovations greater than $5 million to be LEED® Gold certified	Current major projects have been designed to achieve Gold certification; expect to meet goal.
15 percent of existing buildings to be compliant with the Five Guiding Principles of High Performance & Sustainable Buildings (HPSB) Design	Estimate goal will be exceeded by due date of 2015.
Advanced metering to the maximum extent practicable	Chilled water metering complete, electric metering nearly complete, and steam charge-back effort in process.
EO 13514 Requirements	**BNL Status**
Greenhouse gas emissions baseline inventory, reductions, and reporting	BNL computed its 2008 baseline inventory (using a model developed by Sandia National Laboratory) in December 2009. FY2009 emissions were 7.9 percent below baseline. As per EO requirements, the Laboratory will be ready to report comprehensive green house gas emission inventory for FY2010 by January 2011, and annually thereafter by the end of January of each year.
Increase use of renewable energy	A solar thermal heating system was installed on the BNL pool and a second solar thermal demonstration project at Building 30 is underway. The Laboratory is working with the Long Island Power Authority to develop a 37-MW solar PV project on site. BNL purchased 6,500 MW of REC's in FY2009.
Reduce fleet's consumption of petroleum products by 2 percent annually through the end of FY2020 (baseline FY2005)	Exceeded goal for FY2009.
2 percent annual reduction of potable water consumption intensity through FY2020 or 26 percent reduction by the end of FY2020 (baseline FY2007 water consumption)	FY2009 water intensity above baseline due to increased programmatic (process cooling) usage. See section 2.3.4.5, Water Conservation, for further detail.
Minimize generation of waste and pollutants through source reduction	BNL has an award-winning P2 program that has focused on minimizing wastes and pollutants since the program's inception. See section 2.3.4.4, Pollution Prevention and Waste Minimization, for further detail.
Divert 50 percent of non-hazardous solid waste from disposal and divert 50 percent of construction and demolition materials and debris from disposal by the end of FY2015	Based on the past 10 years, the Laboratory's annual recycling rate ranges between 53.8-68 percent. In addition, BNL diverts over 95 percent of construction and demolition materials. See section 2.3.4.4, Pollution Prevention and Waste Minimization, for further detail.

(continued on next page)

Table 2-1. DOE Order 430.2B and Executive Order (EO) 13514 Goal Status *(concluded).*

EO 13514 Requirements	BNL Status
Acquire uncoated printing and writing paper containing at least 30 percent post-consumer fiber	BNL printing/copy paper has a minimum 30 percent recycled content. Some paper used by the Laboratory contains 100 percent recycled content.
Reduce and minimize the quantity of toxic and hazardous chemicals and materials acquired, used, and disposed of by FY2015	BNL has an active P2 program which has resulted in the reduction in hazardous waste generation by 85 percent or more since 1995. See section 2.3.4.3., Waste Management, for more detail.
Increase diversion of compostable and organic material from waste streams	A portion of the cafeteria waste is diverted to the BNL Sewage Treatment Plant as part of a P2 process change, and used animal bedding is composted on site.
Implement pest management and other landscaping management practices	The Laboratory has an established Integrated Pest Management policy, plants native vegetation where practical, and does not install inground sprinklers as a rule.
Participate in regional transportation planning	In 2009, BNL received a grant from the Long Island Transportation Management group to foster ride sharing and the reduction of single occupancy vehicles. The Laboratory also participates in NURIDE, a ridesharing network available to BNL employees.
By 2003, achieve zero-net-energy in buildings entering the planning process after 2020	BNL's design standard for all new construction and major renovations requirements have been modified to include energy conservation design that has a goal (where life-cycle, cost-effective) to exceed the base case of ASHRAE 90.1--2004 by a minimum of 30 percent of energy cost; attain a minimum of LEED Gold certification; purchase Energy Star equipment where applicable; and provide a Sustainability Design Report, which includes a metering plan for energy inputs.
Ensure 95 percent of new contract actions for products and services are energy efficient, water efficient, bio-based-content, environmentally preferable, non-ozone depleting, recycled-content, and non-toxic or less-toxic than alternatives	The Laboratory's web requisition system has been revised to inform users of Environmentally Preferable Products (EPP) requirements. The system is used to track EPP purchases to demonstrate the level of compliance with the requirement. An electronic justification is required for eligible purchases not meeting the requirement.
Ensure Procurement Preference for EPEAT-Registered electronic products	The BNL web requisition system has been revised to inform users of the EPEAT/Energy Star requirement for electronic products. An electronic justification is required for eligible purchases not meeting the requirement.
Continue implementation of an Environmental Management System (EMS) and ensure it is maintained to achieve the goals of the EO	BNL has an established EMS, which has been certified by NSF International since 2001. See section 2.1, Integrated Safety Management, ISO 14001, and OHSAS 18001, for further detail.

to clearly define expectations and performance measures. Factors for selecting environmental priorities include:

- Significant environmental aspects
- Risk and vulnerability (primarily, threat to the environment)
- Legal requirements (laws, regulations, permits, enforcement actions, and memorandums of agreement)
- Commitments (in the ESSH Policy) to regulatory agencies, and to the public
- Importance to DOE, the public, employees, and other stakeholders

Laboratory-level objectives and targets are developed on a fiscal year (FY) schedule. In FY2009 (October 1, 2008 through September 30, 2009), BNL's environmental objectives included:

- Reduce or eliminate the generation and/or toxicity of waste and other pollutants at the source through pollution prevention
- Reduce or eliminate the acquisition, use, and release of toxic and hazardous chemicals and materials
- Maximize the acquisition and use of environmentally preferable products in the conduit of operations
- Reduce or eliminate the environmental impacts of electronics assets
- Reduce degradation and depletion of environmental resources through post-consumer materials recycling
- Increase energy efficiency

2.3.4 Environmental Management Programs

Each organization within BNL develops an action plan detailing how they will achieve their environmental objectives and targets and commit the resources necessary to successfully implement both Laboratory-wide and facility-

specific programs. BNL has a budgeting system designed to ensure that priorities are balanced and to provide resources essential to the implementation and control of the EMS. The Laboratory continues to review, develop, and fund important environmental programs to further integrate environmental stewardship into all facets of its missions.

2.3.4.1 Compliance

BNL has an extensive program to ensure that the Laboratory remains in full compliance with all applicable environmental regulatory requirements and permits. Legislated compliance is outlined by the Clean Air Act, National Emission Standards for Hazardous Air Pollutants (NESHAPs), Clean Water Act (e.g., State Pollutant Discharge Elimination System [SPDES]), Safe Drinking Water Act (SDWA), Resource Conservation and Recovery Act (RCRA), and other programs. Other compliance initiatives at the Laboratory involve special projects, such as upgrading petroleum and chemical storage tank facilities, upgrading the sanitary sewer system, closing underground injection control devices, retrofitting or replacing air conditioning equipment refrigerants, and managing legacy facilities. See Chapter 3 for a list of regulatory programs to which BNL subscribes, and a thorough discussion of these programs and their status.

2.3.4.2 Groundwater Protection

BNL's Groundwater Protection Management Program is designed to prevent negative impacts to groundwater and to restore groundwater quality by integrating pollution prevention efforts, monitoring groundwater restoration projects, and communicating performance. The Laboratory has also developed a Groundwater Protection Contingency Plan that defines an orderly process for quickly taking corrective actions in response to unexpected monitoring results. Key elements of the groundwater program are full, timely disclosure of any off-normal occurrences, and regular communication on the performance of the program. Chapter 7 and SER Volume II, Groundwater Status Report, provide additional details about this program, its performance, and monitoring results for 2009.

2.3.4.3 Waste Management

As a byproduct of the world-class research it conducts, BNL generates a large range of wastes. These wastes include materials common to many businesses and industries, such as aerosol cans, batteries, paints, and oils. However, the Laboratory's unique scientific activities also generate waste streams that are subject to additional regulation and special handling, including radioactive, hazardous, and mixed waste.

Collecting, storing, transporting, and disposing of waste generated at the Laboratory is the responsibility of BNL's Waste Management Facility (WMF). This modern facility was designed for handling hazardous, industrial, radioactive, and mixed waste and is comprised of three staging areas: a facility for hazardous waste, regulated by RCRA; a mixed-waste building for material that is both hazardous and radioactive; and a reclamation building for radioactive material. The RCRA and mixed-waste buildings are managed under a permit issued by the New York State Department of Environmental Conservation (NYSDEC). These buildings are used for short-term storage of waste before it is packaged or consolidated for off-site shipment to permitted treatment and disposal facilities. Due to the relatively small quantities and infrequent generation of mixed waste, BNL has reduced its waste storage footprint by consolidating hazardous and mixed wastes into its RCRA waste building. The Laboratory has submitted a permit modification request to NYSDEC to effect the closure of its mixed waste building and subsequently remove the building from BNL's NYSDEC RCRA Permit.

In 2009, BNL generated the following types and quantities of waste from routine operations:

- Hazardous waste: 4.5 tons
- Mixed waste: 32 ft^3
- Radioactive waste: 5,778 ft^3

Hazardous waste from routine operations in 2009 were 20 percent less than 2008 generation rates, as shown in Figure 2-1a. This is typically attributed to operational changes and waste reduction techniques. The increase in routine mixed waste generation, as shown in Figure 2-1b, can be attributed primarily to increased operations within the Collider–Accelerator

Department (CAD), which is normally associated with the dismantling/reconstruction of beamlines. As shown in Figure 2-1c, the radioactive waste quantity for routine operations increased, but is still considered a normal operating quantity, based on historical generation rates and facility operations. The primary contributor to this waste stream is also CAD. Routine operations are defined as ongoing industrial and experimental operations.

Wastes generated by remediation projects, decommissioning activities performed by the Environmental Restoration Projects (ERP) Group, or one-time events (e.g., lab clean-out) are considered non-routine. In 2009, EPD continued to reduce the inventory of legacy waste materials and disposed of equipment from the Brookhaven Medical Research Reactor (BMRR) and the former Building 462 Hot Machine Shop. Restoration and decommissioning activities included: remediation of contaminated soils in the former Hazardous Waste Management Facility perimeter areas and Waste Loading Area (WLA); removal of underground waste piping systems (A&B waste lines) and a old duct running between Buildings 801 and 811; removal of control rod blades, other reactor internal components, and beam plugs from the HFBR; disposal of water from the spent fuel canal and reactor at the HFBR; and the removal of contaminated and non-contaminated equipment from the former fan house,

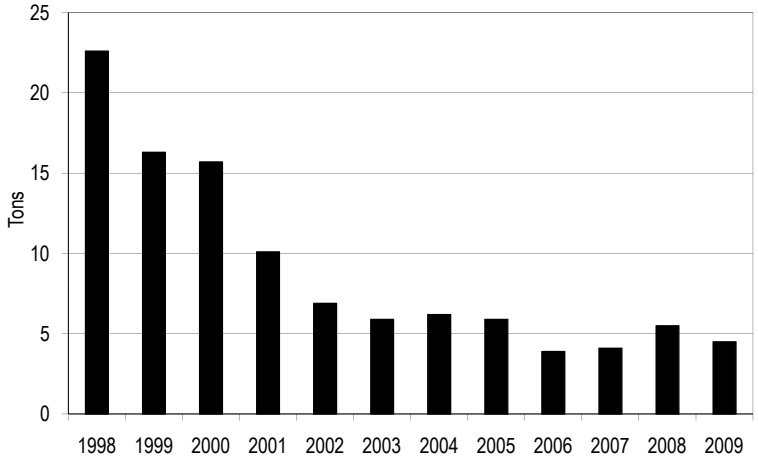

Figure 2-1a. Hazardous Waste Generation from Routine Operations, 1998 – 2009.

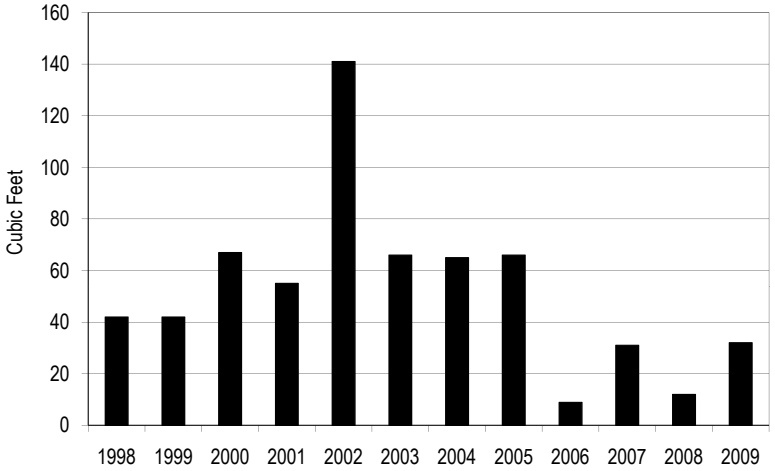

Figure 2-1b. Mixed Waste Generation from Routine Operations, 1998 – 2009.

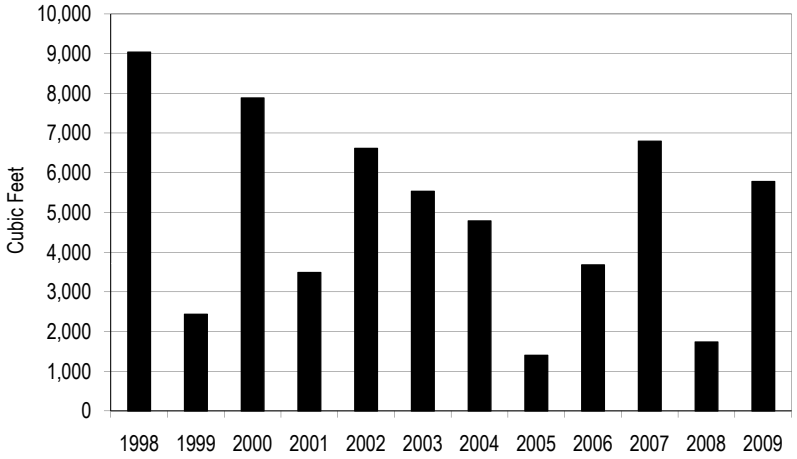

Figure 2-1c. Radioactive Waste Generation from Routine Operations, 1998 – 2009.

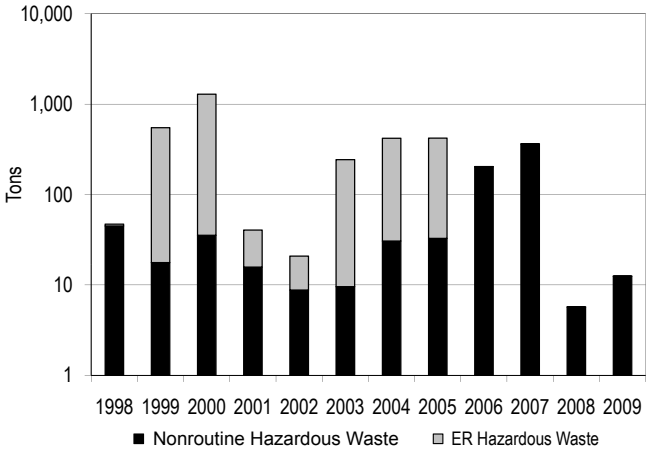

Figure 2-1d. Hazardous Waste Generation from ER and Nonroutine Operations, 1998 – 2009.

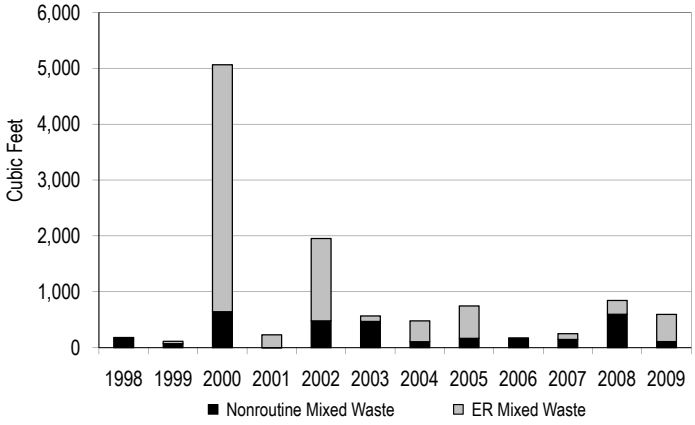

Figure 2-1e. Mixed Waste Generation from ER and Nonroutine Operations, 1998 – 2009.

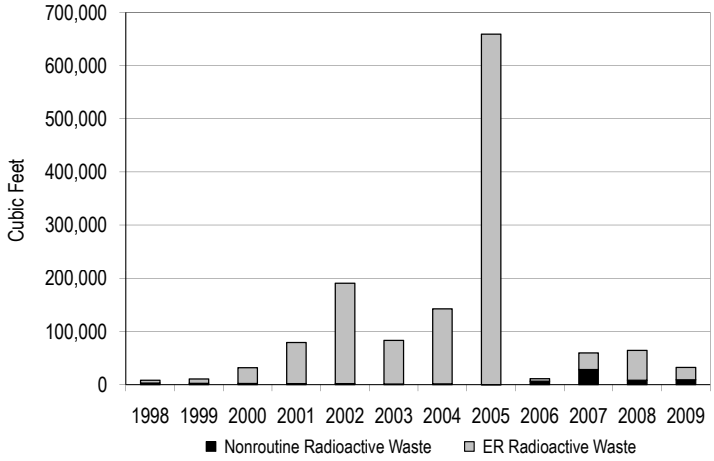

Figure 2-1f. Radioactive Waste Generation from ER and Nonroutine Operations, 1998 – 2009.

Building 704. Other non-routine wastes included disposal of lead contaminated debris, lead shielding, and polychlorinated biphenyl (PCB) wastes.

Figures 2-1d through 2-1f show wastes generated under the ERP Group, as well as non-routine operations. Waste generation from these activities has varied significantly from year to year. This is expected, as restoration activities move from remedial investigations and feasibility studies to remedial actions, which change annually based on the progress of the Laboratory's cleanup schedule.

2.3.4.4 Pollution Prevention and Waste Minimization

The BNL Pollution Prevention (P2) Program is an essential element for the successful accomplishment of the Laboratory's broad mission. The P2 Program reflects the 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 Laboratory's operating philosophy.

Pollution prevention and waste reduction goals have been incorporated into the DOE contract with BSA, into BNL's ESSH Policy, and into the Performance Evaluation Management Plan associated with the Laboratory's operating contract with DOE. Key elements of the P2 Program include:

- Eliminate or reduce emissions, effluents, and waste at the source where possible, and ensure that they are "as low as reasonably achievable" (i.e., uphold the E-ALARA policy)
- Procure environmentally

preferable products (known as "affirmative procurement")
- Conserve natural resources and energy
- Reuse and recycle materials
- Achieve or exceed BNL/DOE waste minimization, P2, recycling, and affirmative procurement goals
- Comply with applicable requirements (e.g., New York State Hazardous Waste Reduction Goal, Executive Orders, etc.)
- Reduce waste management costs
- Implement P2 projects
- Improve employee and community awareness of P2 goals, plans, and progress

Fifteen P2 proposals were submitted to the BNL P2 Council for funding in FY2009. Five proposals were funded, for a combined investment of approximately $24,000. The anticipated annual savings from these projects is estimated at $33,650, for an average payback period of approximately 0.7 years. The BNL P2 and recycling programs have achieved significant reductions in waste generated by routine operations, as shown in Figures 2-1a through 2-1c. This continues a positive trend and is further evidence that pollution prevention planning is well integrated into the Laboratory's work planning process. These positive trends are also driven by the EMS emphasis on preventing pollution and establishing objectives and targets to reduce environmental impacts. Table 2-2 describes the P2 projects implemented through 2009, and provides the number of pounds of materials reduced, reused, or recycled, as well as the estimated cost benefit of each project.

The implementation of pollution prevention opportunities, recycling programs, and conservation initiatives has significantly reduced both waste volumes and management costs. In 2009, these efforts resulted in more than $5.5 million in cost avoidance or savings and approximately 17.9 million pounds of materials being reduced, recycled, or reused annually.

The Laboratory also has an active and successful solid waste recycling program, which involves all employees. In 2009, BNL collected approximately 127 tons of office paper for recycling. Cardboard, bottles and cans, construction debris, motor oil, scrap metals, lead, automotive

Table 2-2. BNL Pollution Prevention, Waste Reduction, and Recycling Programs.

Waste Description	Type of Project	Pounds Reduced, Reused, Recycled or Conserved in 2009	Waste Type	Potential Costs for Treatment and Disposal	Cost of Recycle, Prevention	Estimated Cost Savings	Project Description Details *
Alkaline batteries	Recycling	200	Industrial waste	$10	$0	$10	Two hundred pounds of alkaline batteries were collected and recycled.
Solar-powered street lamp	Energy conservation	N/A	Greenhouse gas/Energy conservation	$10,000	$5,131	$5,386	Installation of a solar-powered street lamp in the rear parking area of Building 490. Cost savings based on avoided costs of trenching and wire pulling.
Bio-diesel tank	Alternative fuels	0	Greenhouse gas/Energy Conservation	$0	$11,772	$0	Per DOE Order 430.2B, BNL is utilizing bio-diesel to operate maintainance vehicles.
Sewage sludge and sand filter media	Landfill	9,690,000	Low-level Radiological waste	$4,000,000	$755,000	$3,245,000	Processing, treatment, and disposal of sewage sludge and sand filter media from the BNL Sewage Treatment Facility. This process removed all low-level radioactive contaminants from the operating facility. The sludge can now be shipped to a municipally owned facility.

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Table 2-2. BNL Pollution Prevention, Waste Reduction, and Recycling Programs *(continued).*

Waste Description	Type of Project	Pounds Reduced, Reused, Recycled or Conserved in 2009	Waste Type	Potential Costs for Treatment and Disposal	Cost of Recycle, Prevention	Estimated Cost Savings	Project Description Details *
Recycling containers	Recycling	600	Industrial waste	$3,000	$3,253	$0.00	Purchased four sets of recycling containers in 2009 to increase recycling rates in conference rooms.
Timer switches*	Energy conservation	N/A	Greenhouse gas/Energy Conservation	N/A	$3,415	$5,386	Installation of motion detector and infrared lighting in labs in Building 535.
Water timers	Water conservation	80,000	Potable water	N/A	$580	$164	Water timers allow taps to be shut off after a specified amount of time running or a specified number of gallons are released, which saves water and energy required to run the still.
Motion sensors for labs*	Energy conservation	N/A	Greenhouse gas/Energy Conservation	N/A	$4,320	$5,817	Installation of motion detector lighting in common areas of Buildings 490 and 463.
"Bio Circle Cleaner" parts washer	Substitution	640	Hazardous waste	$10,000	$4,461	$10,000	Eliminates the need for toxic solvents, chemical storage, and disposal associated with the cleaning of vacuum parts.
Aerosol can disposal system	Recycling	528	Hazardous waste	$12,000	$0	$12,000	Empty aerosol cans are recycled as scrap, rather then sent to the Waste Management Division as hazardous waste. Eight units (Facilities and Operations=5; Collider Accelerator=1; National Synchrotron Light Source=1; Basic Energy Sciences=1) each handle 66 lbs. of hazardous waste.
Portable closed-head drum mixer	Neutralization	1,600	Hazardous waste	$15,089	$0	$15,089	The National Synchrotron Light Source purchased a closed drum mixer to neutralize Rydlyme, used to descale cooling pipes.
Formaldetox	Source reduction	280	Non-hazardous waste (neutralized ~ 1 gallon)	$3,772	$0	$3,772	Neutralizes nonhazardous para-formaldehyde, chlorix, bleach, and rat blood.
High Performance Liquid Chromatography (HPLC) solvent recycler	Reuse	110	Hazardous waste	$2,500	$0	$6,755	Allows reuse of approximately 50 liters of solvent and saves approximately 50 labor hours.
Propane cylinder de-valver	Recycling	75	Hazardous waste	$7,500	$0	$7,500	The Collider Accelerator Division purchased a propane cylinder de-valver to avoid sending cylinders to a disposal vendor at $75 each; they are now recycled as scrap.

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Table 2-2. BNL Pollution Prevention, Waste Reduction, and Recycling Programs *(continued).*

Waste Description	Type of Project	Pounds Reduced, Reused, Recycled or Conserved in 2009	Waste Type	Potential Costs for Treatment and Disposal	Cost of Recycle, Prevention	Estimated Cost Savings	Project Description Details *
Fluorescently labeled oligonucleotides	Waste minimization	3,144	Radiological waste (396 ft^3); Mixed waste (35 galllons); Hazardous waste (108 galllons)	$67,600	$0	$67,600	This project was cost-shared with Biology. The process avoids the use of radioactivity, thus avoiding radiological waste generation. This process won a 2008 DOE P2 Star Award.
Electronic recycling	Recycling	33,907	E-waste	$84,768	$2,300	$82,468	The Laboratory has partnered with a government-based e-waste recycler (UNICOR), which guarantees that its e-waste is recycled in the most environmentally friendly manor. BNL pays shipping fees to the recycling facility.
Electronic Reuse	Reuse	22,851	E-waste	$57,128	$0	$57,128	BNL tracks electronic equipment and takes a reuse credit for transfer of equipment to another user.
Building demolition recycling	Recycling	6,400,000	Industrial waste	$291,200	$32,000	$259,200	On-site demolition products (steel and concrete) are segregated, recycled, and reused.
System One parts cleaner	Substitution	1,280	Hazardous waste	$11,317	$0	$11,317	Central Fabrications and Motor Pool each purchased a System One parts washer to re-distill dirty solvent, eliminating the need for a vendor, such as Safety Kleen. Removed grit and sludge are mixed with the waste oil.
Photon-counting spectro-fluorimeter	Substitution	54	Mixed waste (2 ft^3)	$20,730	$0	$70,730	Eliminated the need for radioactive assays and their radioactive waste. Savings include 1,000 work-hours and savings on material costs.
Replacement of mercury utility devices	Substitution	16	Mercury	$2,350	$4,000	$2,350	Approximately 48 lbs. of mercury-containing devices were removed from utility devices during 2009. Savings are based on the cost of one mercury spill and cleanup.
Animal bedding conveying system	Composting	72,000	Low-level Radiological Waste	$1,153,475	$0	$1,153,475	Animal bedding material is no longer sent to sanitary landfill. It is now conveyed to a dumpster that is emptied or composted at the stump dump.
Plant Engineering grounds vehicle wash system *	Waste minimization	8,000	Oils/grease to soils	$16,000	$3,000	$13,000	This multi-year, multi-department project was completed in 2007 and eliminates the potential of oil and grease being released to soil.
Organic solvents	Substitution	678	Hazardous waste	$1,694	$0	$26,000	Life Sciences utilizes a Microwave Peptide Synthesizer, which significantly reduces the hazardous wastes generated and saves ~1,000 work-hours/year (reflected in cost savings).

(continued on next page)

Table 2-2. BNL Pollution Prevention, Waste Reduction, and Recycling Programs *(continued).*

Waste Description	Type of Project	Pounds Reduced, Reused, Recycled or Conserved in 2009	Waste Type	Potential Costs for Treatment and Disposal	Cost of Recycle, Prevention	Estimated Cost Savings	Project Description Details *
Organic solvents	Purification/re-use	44	Hazardous waste	$110	$0	$3,510	The primary savings of the solvent purification system used by Basic Energy Sciences are in not purchasing new solvent and labor savings from not running the stills.
Cooling water	Reuse	63,400	Deionized water	$0	$0	$7,925	A closed-cycle water recycling system for the Building 480 melt spinner saved 7,925 gallons of ultra-pure water and extends the life expectancy of equipment worth $100,000.
Lead acid batteries	Recycled	7,920	Universal waste	$59,753	$0	$59,753	Avoids hazardous waste disposal costs for approximately 40 lbs. of lead per battery.
Short half-life waste	Decay in storage	136	Radioactive waste	$69,168	$0	$69,168	During 2009, 19 boxes of filters from Buildings 914 and 918 (136 ft^3) were managed in accordance with BNL decay-in-storage requirements, rendering the wastes eligible for volumetric release.
Cooling Tower chemicals	Source reduction	9,563	Industrial waste	$22,500	$0	$22,500	Ozone water treatment units were installed on cooling towers at SEM, the National Space Radiation Laboratory, and the Relativistic Heavy Ion Collider Reseach Facility, for biological control of cooling water. These systems eliminate the need for water treatment chemicals (typically, toxic biocides), save labor, and reduce analytical costs for monitoring cooling tower blowdown.
Blasocut machining coolant	Recycled/ reused	30,480	Industrial waste	$74,345	$0	$79,945	Central Shops Division operates a recycling system that reclaims Blasocut machining coolant and supplies it Laboratory-wide. In 2009, 3,340 gal (26,720 lbs.) of Blasocut lubricant were recycled. Recycling involves aeration, centrifuge, and filtration. This avoids cost of disposal as industrial waste and an avoided cost of buying seven drums of concentrate ($800/drum) and 67 empty drums for shipping ($50/drum).
Fluorescent bulbs	Recycled	11,780	Universal waste	$88,875	$20,000	$68,875	Fluorescent bulbs are collected and sent to a recycling facility under the Universal Waste exemption rule.
Tyvek	Recycled	180	Industrial waste	$10	$0	$10	BNL is recycling tyvek through Garment Recovery Systems.

(continued on next page)

Table 2-2. BNL Pollution Prevention, Waste Reduction, and Recycling Programs *(concluded).*

Waste Description	Type of Project	Pounds Reduced, Reused, Recycled or Conserved in 2009	Waste Type	Potential Costs for Treatment and Disposal	Cost of Recycle, Prevention	Estimated Cost Savings	Project Description Details *
Used motor oil	Energy recovery	12,544	Industrial waste	$35,508	$0	$35,508	Used motor oil from the motor pool and the on-site gas station is given to Strebel's Laundry Service to fire their boilers. In 2009, they collected 1,568 gallons of oil at no charge to BNL, which avoided the costs for disposal and 32 shipping drums ($50/drum).
Office paper	Recycled	254,880	Industrial waste	$13,509	$0	$13,509	Cost avoidance based on $106/ton for disposal as trash.
Cardboard	Recycled	303,760	Industrial waste	$16,099	$0	$16,099	Cost avoidance based on $106/ton for disposal as trash.
Metals	Recycled	181,050	Industrial waste	$9,596	$0	$27,701	Cost avoidance based on $106/ton for disposal as trash, plus $150/ton revenue.
Bottles/cans	Recycled	47,480	Industrial waste	$2,516	$0	$2,516	Cost avoidance based on $106/ton for disposal as trash.
Construction debris	Recycled	624,540	Industrial waste	$14,052	$0	$14,052	Cost avoidance based on $45/ton difference for disposal as trash.
	TOTALS	17,863,720		$6,176,173	$849,232	$5,481,217	

* Cost savings of projects funded by the BNL Pollution Prevention Council will be tracked for 3 years.

batteries, electronic scrap, fluorescent light bulbs, and drill press/machining coolant were also recycled. Table 2-3 shows the total number of tons (or units) of the materials recycled in 2009.

2.3.4.5 Water Conservation

BNL's water conservation program has achieved dramatic reductions in water use since the mid 1990s. The Laboratory continually evaluates water conservation as part of facility upgrades or new construction initiatives. These efforts include more efficient and expanded use of chilled water for cooling and heating/ventilation and air conditioning (HVAC) systems, and reuse of once-through cooling water for other systems, such as cooling towers. The goal is to reduce the consumption of potable water and reduce the possible impact of clean water discharges on Sewage Treatment Plant (STP) operations. Figure 2-2 shows the 10-year trend of water consumption. A slight rise in water consumption in 2009 was the result of a failed thermostatic control valve at the CAD. This resulted in 60 million gallons of water used for once-through cooling. In each of the past five years, the water consumption total was approximately half the 1998 total—a reduction of nearly a half-billion gallons per year.

2.3.4.6 Energy Management and Conservation

Since 1979, the Laboratory's Energy Management Group has been working to reduce energy use and costs by identifying cost-effective, energy-efficient projects, monitoring energy use and utility bills, and assisting in obtaining the least expensive energy sources pos-

Table 2-3. BNL Recycled Program Summary.

Recycled Material	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Mixed paper	336	246	209	182	185	193	184	177	151	127
Cardboard	132	127	157	176	179	143	135	121	147	152
Bottles/Cans	20	29	19	23	22	22.1	27.7	24.4	19.6	23.7
Tires	0	0	3.5	12.3	11	12.8	32.5	19.9	34.5	15.5
Construction debris	243	289	304	334	367	350	297	287	302	312
Used motor oil (gallons)	3,295	3,335	1,920	3,920	3,860	4,590	2,780	2,020	1,500	1,568
Metals	534	38	48	193	128	559	158	382	460	91
Lead	2.5	0	0	–	5	0	0	0	0	0
Automotive batteries	2.2	4.8	6.3	4.6	5	4.6	5.5	2.5	2.7	4
Printer/Toner cartridges (units)	–	363	449	187	105	0	0	0	3,078	1,251
Fluorescent bulbs (units)	5,874	17,112	25,067	13,611	12,592	7,930	11,740	25,448	36,741	10,223
Blasocut coolant (gallons)	7,500	10,660	8,180	5,030	6,450	3,890	3,970	2,432	3,340	3,810
Antifreeze (gallons)	110	200	0	165	325	0	0	0	0	0
Tritium exit signs (each)	185	190	28	181	142	0	0	0	0	0
Smoke detectors (each)	–	171	40	0	0	0	0	0	0	0
Road base	–	–	2,016	0	2,666	0	0	0	0	0
Electronic reuse	–	–	–	–	–	–	–	–	16.3	11.4
Scrap electronics	–	–	–	–	–	6.1	70.3	40.5	48.9	17
Animal bedding (composted)	–	–	–	–	–	--	6.3	19.6	42	41
Tyvek (lbs)	–	–	–	–	–	–	–	–	–	84
Metals (building demolition)	–	–	8	23	11	6	35	--	–	–
Concrete (building demolition)	–	–	891	590	3,000	328	5,505	6175	–	–
Other construction and debris (building demolition)	–	–	790	388	1,200	157	818	--	–	–

Notes:
All units are tons unless otherwise noted.

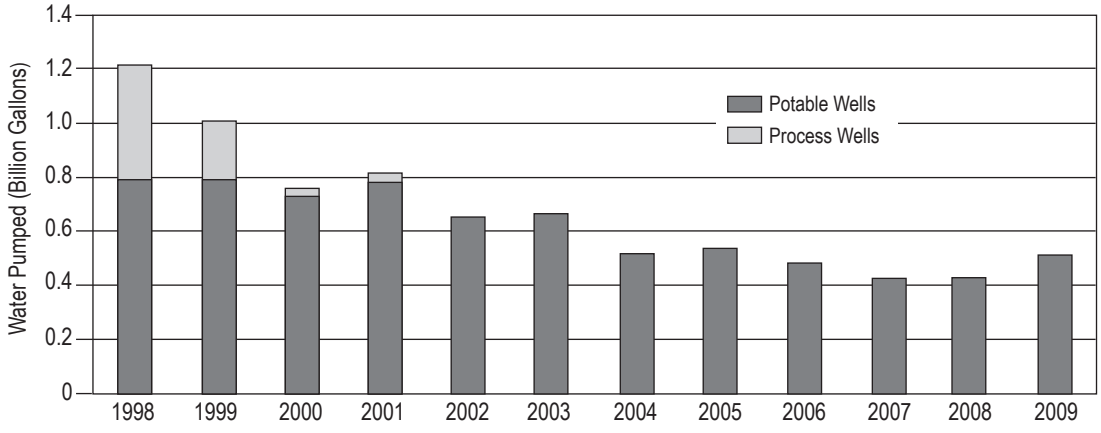

Figure 2-2. BNL Water Consumption Trend, 1998–2009.

sible. The group is responsible for developing, implementing, and coordinating BNL's Energy Management Plan and assisting DOE in meeting the energy goals in DOE Order 430.2B and the Secretary's initiatives.

The Laboratory has more than 4 million square feet of building space. Many BNL scientific experiments use particle beams generated and accelerated by electricity, with the particles controlled and aligned by large electromagnets. In 2009, the Laboratory used approximately 257 million kilowatt hours (kWh) of electricity, 2.8 million gallons of fuel oil, 36,000 gallons of propane, and 257 million ft^3 of natural gas. Fuel oil and natural gas produce steam at the Central Steam Facility (CSF). Responding to market conditions, fuel oil and natural gas were used whenever each respective fuel was least expensive. Additional information on natural gas and fuel oil use can be found in Chapter 4. In addition, over 4,000 gallons of biofuels were used in several applications.

BNL is a participant in the New York Independent System Operator (NYISO) Special Case Resource (SCR) Program, which is an electric load reduction curtailment program. Through this program, the Laboratory has agreed to reduce electrical demand during critical days throughout the summer when NYISO expects customer demand to meet or exceed the available supply. In return, BNL receives a rebate for each megawatt reduced on each curtailment day. No curtailment days were required in 2009, but BNL participated in some test exercises. However, limited participation in this program produced a rebate of $102,000. The Laboratory continues to keep electric loads at a minimum during the summer by scheduling operations at the Relativistic Heavy Ion Collidar (RHIC) to avoid peak demand periods. This scheduling reduces the electric demand by 25 MW, which allowed BNL to save $4.5 million in electric costs in 2009, and greatly helps maintain the reliability of the Long Island Power Authority (LIPA) electric system to meet all of its users' needs.

BNL also maintains a contract with the New York Power Authority (NYPA) that resulted in an overall cost avoidance of $26 million in 2009. The Laboratory will continue to seek alternative energy sources to meet its future energy needs, support federally required "green" initiatives, and reduce energy costs.

LIPA issued a Request for Proposals in 2008 for 50 MW of solar photovoltaic (PV) generating projects. The construction of a 32 MW solar array at BNL by BP Solar was one of two projects selected by LIPA for development. The Laboratory and DOE worked to complete several key requirements in 2009, including the preparation of a comprehensive Environmental Assessment (EA). The EA concluded that the project will have minimal environmental impact on the Laboratory site, and was approved by the LIPA Board in December 2009. To reduce energy use at non-research facilities, other activities also were undertaken in 2009. These activities included:

- Continued development of a sitewide Utility Energy Services Contract (UESC) that will reduce the Laboratory's overall energy intensity (Btu/ft^2) by 11 percent and will save over $2 million/year in energy costs.
- 25 MW of demand was rescheduled to avoid coinciding with the utility summer peak, saving several million dollars in electricity charges.
- A demonstration project for a solar hot water combination system at BNL's Brookhaven Center was near completion.
- Work continued in the replacement of aging, inefficient T-40 fluorescent lighting fixtures with new, efficient T-8 and T-5 units; two to three hundred fixtures are typically replaced annually, saving tens of thousands of kWhs and reducing costs by several thousand dollars.
- Due to continued conservation efforts, overall facilities energy usage for FY2009 was approximately 8 percent less than in FY2003, saving over $1.8 million.
- Efficient fuel purchasing strategies (buying and storing oil and burning the least expensive fuel) saved over $2 million, compared to purchasing only oil as it is consumed.
- Over 25,000 gge (gasoline gallon equivalents) of natural gas were used in place of gasoline for the Laboratory's vehicle fleet.

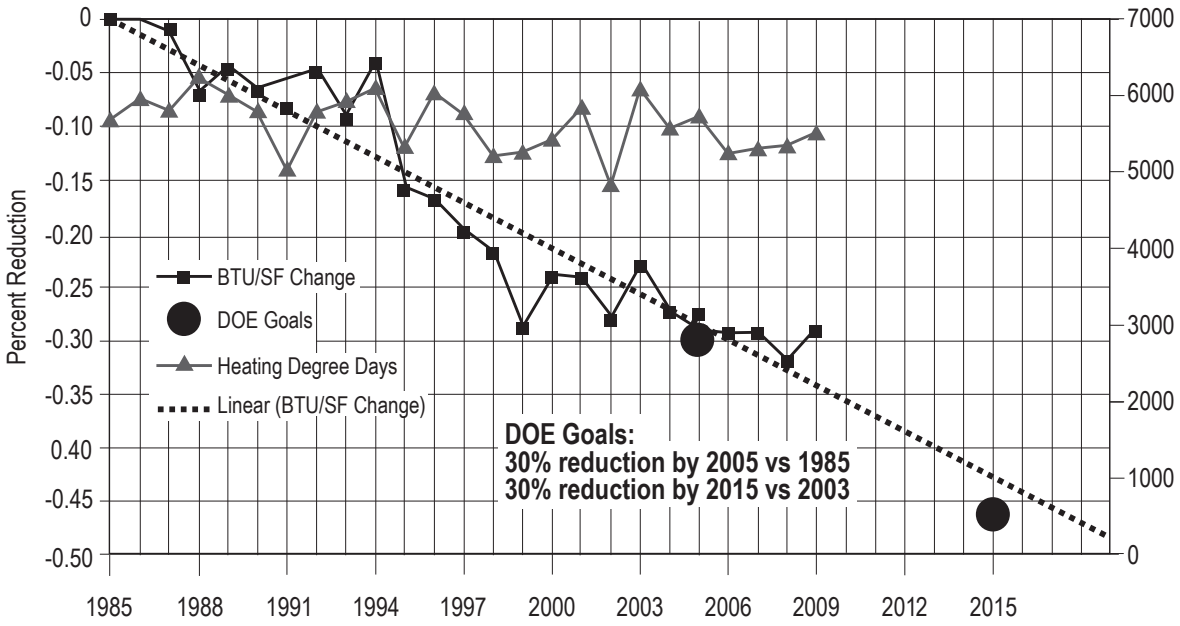

Figure 2-3. BNL Building Energy Performance.

BNL is working on its annual Executable Plan (soon to be called Strategic Sustainability Performance Plan [SSPP]) for energy, transportation, and water management. The plan includes strategies, energy costs, and indicators and goals, including energy use/square foot and an overall carbon reduction of 28 percent. The plan also documents the Laboratory's efforts to reduce energy use and costs to the lowest cost-effective levels, while striving to meet DOE and EO goals.

DOE and BNL have teamed with BP Solar and LIPA to construct a 32 MW, 200-acre PV solar farm on the Laboratory site. This collaboration will assist the Laboratory in developing additional solar research, as well as education and community outreach. The project has been approved by all of the required parties, and is scheduled to start construction by late summer or early fall of 2010.

In February 2009, NYPA agreed to provide 15 MW of low-cost hydropower to BNL, for a period of up to 15 years. Estimated savings are approximately $8 million per year. In addition, the hydropower will help stabilize electric rates and keep them competitive with other DOE Laboratories. Several key steps in the complex contractual process were completed, including the approval of the LIPA/NYPA sale-for-resale contract for the 15 MW of low-cost hydropower. Currently, the Laboratory is on track for final contract approval before the end of calendar year 2010.

The National Energy Conservation Policy Act, as amended by the Federal Energy Management Improvement Act of 1988 and the Energy Policy Acts of 1992 and 2005, requires federal agencies to apply energy conservation measures and to improve federal building design to reduce energy consumption per square foot. Current goals are to reduce energy consumption per square foot, relative to 2003, by 2 percent per year from FY2006–FY2015. In 2007, an EO increased the target reduction to 3 percent per year, which is a 30 percent reduction by the end of FY2015. Further, DOE Order 430.2B and the Secretary's TEAM initiative have set even more stringent requirements, including renewable energy and transportation fuels that go significantly beyond the previous goal of a 30 percent reduction by 2005, compared to 1985. BNL's energy use per square foot in 2009 was 30 percent less than in 1985 (see Figure 2-3) and 8 percent less than in 2003. It is important to note that energy use for buildings and facilities at the Laboratory is largely weather dependent.

2.3.4.7 Natural and Cultural Resource Management Programs

BNL continues to enhance its Natural Resource Management Program in cooperation with the Foundation for Ecological Research in the Northeast (FERN) and the Upton Ecological and Research Reserve. The Laboratory also continues to enhance its Cultural Resource Management Program. A BNL Cultural Resource Management Plan has been developed to identify and manage properties that are determined to be eligible or potentially eligible for inclusion on the National Register of Historic Places. See Chapter 6 for further information about these programs.

2.3.4.8 Environmental Restoration

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), commonly known as Superfund, was enacted by Congress in 1980. As part of CERCLA, EPA established the National Priorities List, which identifies sites where cleanup of past contamination is required. BNL was placed on the list with 27 other Long Island sites, 12 of which are in Suffolk County.

Each step of the CERCLA cleanup process is reviewed and approved by DOE, EPA, and NYSDEC, under an Interagency Agreement (IAG) contract. This agreement was formalized in 1992. Although not a formal signatory of the IAG, the Suffolk County Department of Health Services (SCDHS) also plays a key role in the review process. Most of the contamination at the Laboratory is associated with past accidental spills and outmoded practices for handling, storing, and disposing of chemical and radiological material.

BNL follows the CERCLA process, which includes the following steps:

- Conduct a Remedial Investigation to characterize the nature and extent of contamination and assess the associated risks
- Prepare a Feasibility Study and Proposed Plan to identify and evaluate remedial action alternatives and present the proposed best alternative
- Issue a Record of Decision (ROD), which is the remedy/corrective action agreed to by DOE, EPA, and NYSDEC
- Perform the Remedial Design/Remedial Action, which includes final design, construction specifications, and carrying out the remedy selected

In 2009, significant work was performed for the Brookhaven Graphite Research Reactor (BGRR) and HFBR, and routine work continued for the groundwater treatment systems. The BGRR ROD requires the removal of the graphite pile and the biological shield, and the installation of a water infiltration control and monitoring system. Work planning, preparatory activities, and readiness reviews for the graphite pile removal were completed in 2009, and control rods, boron shot canisters (used for emergency shut down), and roof shielding plugs were removed. A remote manipulator fitted with special tools was installed on top of the biological shield to remove the graphite blocks from the pile and load them into soft-sided containers called "supersacks." The supersacks will be placed inside metal containers using a remote controlled crane for shipment to DOE's Nevada Test Site for disposal. All graphite handling will take place inside a contamination control enclosure that is maintained at a slight negative pressure (with respect to the atmosphere), in order to eliminate the release of radioactive material to the environment.

In April 2009, DOE, EPA, and NYSDEC agreed on a final cleanup action for the HFBR, and finalized the ROD. The final remedy incorporates many completed interim actions, several near-term actions, and the long-term segmentation, removal, and disposal of the remaining HFBR structures, systems, and activated components, including the reactor vessel. The near-term actions specified in the ROD include dismantling the remaining ancillary buildings, removing contaminated underground utilities and piping, and preparing the reactor confinement building for safe storage. The ROD requires that these near-term actions be completed no later than 2020. Completion date for a number of these near-term actions has been accelerated to 2011 as a result of funding made available through the American Recovery and Reinvestment Act of 2009. Planning and preparations to complete these activities were

well underway in 2009. The ROD also lays out a plan for the long-term segmentation, removal, and disposal of the remaining HFBR structures, systems, and components (including the reactor vessel and thermal and biological shields). These long-term actions will be conducted following a safe storage period (not to exceed 65 years) to allow for the natural reduction of high radiation levels to a point where conventional demolition techniques can be used to dismantle these reactor components. Stabilization activities to prepare the HFBR confinement building for long-term safe storage were initiated in 2009. The removal and disposal of the HFBR control rod blades and beam plugs were also completed in 2009. Also included in the HFBR ROD is the remediation of contaminated soils in the WLA and removal of the A&B waste lines.

The productive operation and maintenance (O&M) of the Laboratory's groundwater treatment systems removed approximately 229 pounds of solvents and 1.9 mCi of strontium-90 (Sr-90) from the sole source aquifer in 2009. Since the operation of the first treatment system in 1996, a cumulative total of approximately 6,363 pounds of solvents and 21 mCi of Sr-90 have been removed from the groundwater. The OU III Explanation of Significant Differences for the Building 96 Groundwater Treatment System was signed by the regulators in September 2009, and calls for the removal of the perchloroethylene-contaminated source area soils. Excavation and disposal of soils containing high levels of contamination will begin in 2010, and will ensure that groundwater cleanup objectives will be met.

Other planned work for 2010 includes the addition of four extraction wells to the Brookhaven Graphite Research Reactor/Waste Concentration Facility Groundwater Treatment System to remediate the downgradient high concentration area of Sr-90 identified in 2008. Post-cleanup monitoring of Peconic River surface water, sediment, fish, and wetland vegetation continued in 2009, and the results were reported in the Annual Peconic River Monitoring Report (see Chapter 6.) Sediment remediation of several areas of the Peconic River with continuing elevated concentrations of mercury is also planned for 2010. The groundwater systems operate in accordance with the O&M manuals, while the Peconic and surface soil cleanup areas are monitored via the OU I Soils and OU V Long-Term Monitoring and Maintenance Plan. Institutional controls are also monitored and maintained for the cleanup areas in accordance with the RODs to help ensure the remedies remain protective of human health and the environment. An annual evaluation of these controls is submitted to the regulators.

Table 2-4 provides a description of each OU and a summary of environmental restoration actions taken. See Chapter 7 and SER Volume II, Groundwater Status Report, for further details.

2.3.4.9 EPA Performance Track Program

BNL was accepted into the EPA's Performance Track (PTrack) Program in 2004. This program recognizes top environmental performance among participating U.S. facilities of all types, sizes, and complexity, both public and private. It is considered the "gold standard" for facility-based environmental performance—a standard that participating members strive to attain as they "meet or exceed their performance commitment." Under this program, partners provide leadership in many areas, including preventing pollution at its source. The PTrack Program requires that sites commit to several improvement goals for a three-year period and report on the progress of the goals annually. This program was suspended in 2009 while EPA conducts an overall review of the program, as well as other environmental leadership programs.

2.4 IMPLEMENTING THE ENVIRONMENTAL MANAGEMENT SYSTEM

2.4.1 Structure and Responsibility

All employees at BNL have clearly defined roles and responsibilities in key areas, including environmental protection. Employees are required to develop and sign their own Roles, Responsibilities, Accountabilities, and Authorities (R2A2) document, which must also be signed by two levels of supervision. BSA has clearly defined expectations for management and staff which must be included in this document. Under the BSA performance-based management

Table 2-4. Summary of BNL 2009 Environmental Restoration Activities

Project	Description	Environmental Restoration Actions
Soil Projects	Operable Unit (OU) I/II/III/VII	▪ Performed monitoring and maintenance of institutional controls for cleanup areas. An annual evaluation of compliance with the controls was submitted to the regulators. ▪ Completed remediation of radiologically contaminated soil at the Waste Loading area, including rail shipments for disposal. ▪ An Explanation of Significant Differences documenting the proposed Building 96 volatile organic compound (VOC) source area soil excavation project was submitted to the regulatory agencies.
Groundwater Projects	OU III/IV/VI	▪ Continued operation of 12 groundwater treatment systems that remove VOCs and two systems that remove strontium-90 (Sr-90). ▪ 229 pounds of VOCs and nearly 1.9 mCi of Sr-90 were removed during the treatment of 1.6 billion gallons of groundwater. Since the first groundwater treatment system started operating in December 1996, approximately 6,363 pounds of VOCs and 21.3 mCi of Sr-90 have been removed, while treating more than 16 billion gallons of groundwater. ▪ Collected and analyzed over 2,000 sets of groundwater samples from 806 monitoring wells. ▪ Continued monitoring and operation of the High Flux Beam Reactor tritium pump and recharge system. ▪ Obtained regulatory agency approval for the decommissioning of the Carbon Tetrachloride groundwater treatment system. ▪ Continued post-closure groundwater monitoring at OU IV. ▪ Continued installing temporary wells to characterize Sr-90 in the Waste Concentration Facility plume. This will support the installation of additional extraction wells that are necessary to achieve cleanup goals. ▪ Continued monitoring the g-2 tritium plume using temporary and permanent monitoring wells.
Peconic River	OU V	▪ Performed fourth year of long-term post-cleanup monitoring of Peconic River surface water, sediment, fish, and wetland vegetation.
Reactors	Brookhaven Graphite Research Reactor (BGRR)	▪ Developed detailed procedures for graphite pile removal. ▪ Performed a Management Self Assessment, Contractor Readiness Assessment, and Confirmatory DOE Readiness Assessment for graphite pile removal and received DOE authorization for removal. ▪ Trained and qualified personnel for graphite pile removal. ▪ Contractor for graphite pile removal mobilized on site. ▪ Installed a contaminated control enclosure around the graphite pile, biological shield, and excavation equipment. ▪ Installed structural steel supports for graphite removal equipment. ▪ Installed and tested remote excavator and associated equipment for graphite pile removal. ▪ Removed existing structural interferences from reactor face and bioshield areas. ▪ Removed control rods from the BGRR graphite pile. ▪ Implemented new Safety Basis that established the BGRR as a “Below Hazard Category 3 Facility by Analysis.”
	High Flux Beam Reactor (HFBR)	▪ Removed 16 control rod blades (CRB) and 9 beam plugs and shipped off site for disposal. ▪ Drained contaminated water from the reactor vessel, piping systems, and fuel canal needed for CRB removal; the water was solidified and shipped off site for disposal. ▪ Disposed of water cleanup systems and tools used in reactor vessel and fuel canal. ▪ Initiated draining and isolation of all utility piping penetrating the reactor building. ▪ Installed alternate power supplies to allow for the demolition of the fanhouse. ▪ Rendered all formal Article 12 storage tanks permanently out of service. ▪ Implemented revised Safety Basis to reduce the HFBR from a “Hazard Category 3” Nonreactor Nuclear Facility to a radiological facility “Below Hazard Category 3 Facility by Analysis.” ▪ Completed final survey and acceptance of the Waste Loading Area soil remediation. ▪ Completed soil remediation work at the former Hazardous Waste Management Facility perimeter soils area.

(continued on next page)

Table 2-4. Summary of BNL 2009 Environmental Restoration Activities *(concluded).*

Project	Description	Environmental Restoration Actions
	Building 704 Fanhouse Demolition	▪ Initiated demolition planning and design. ▪ Initiated removal and disposal of contaminated and non-contaminated materials and equipment from Building 704. ▪ Initiated characterization and disposal of contaminated materials stored in Building 704. ▪ Prepared for utility isolations. ▪ Completed radiological walkover survey of the Building 704 perimeter.
	Brookhaven Medical Research Reactor (BMRR) (Project managed by the BNL Environmental Protection Division)	▪ Continued surveillance and maintenance activities.
Buildings 801/811	A&B waste lines	▪ Completed removal of underground waste lines from Building 801 to Building 811. ▪ Work completed under Removal Action Memorandum.
Building 801	Inactive Radiological Liquid Holdup Facility	▪ Performed routine surveillance and maintenance of the facility.
Building 650	Inactive Radiological Decon Facility	▪ Performed routine surveillance and maintenance of the facility.

model, senior managers must communicate their expectation that all line managers and staff take full responsibility for their actions and be held accountable for ESSH performance. Environmental and waste management technical support personnel assist the line organizations with identifying and carrying out their environmental responsibilities. The Environmental Compliance Representative Program, initiated in 1998, is an effective means of integrating environmental planning and pollution prevention into the work planning processes of the line organizations. A comprehensive training program for staff, visiting scientists, and contractor personnel is also in place, thus ensuring that all personnel are aware of their ESSH responsibilities.

2.4.2 Communication and Community Involvement

Communication and community involvement are commitments under BNL's EMS. The Laboratory maintains relationships with its employees, key stakeholders, neighbors, elected officials, regulators, and other community members. The goals are to provide an understanding of BNL's science and operations, including environmental stewardship and restoration activities, and to incorporate community input into the Laboratory's decision-making.

BNL staff participates in or conducts: on- and off-site meetings, which include discussions, talks, presentations, and roundtables; workshops; local civic association meetings; canvassing surrounding neighborhoods; Laboratory tours; and informal information sessions and formal public meetings held during public comment periods for environmental projects.

2.4.2.1 Communication Forums

To facilitate effective dialogue between the Laboratory and key stakeholders, several forums for communication and involvement have been established. The Brookhaven Executive Roundtable (BER), established in 1997 by DOE's Brookhaven Site Office, meets routinely to update local, state, and federal elected officials and regulatory agencies on environmental and operational issues, as well as on scientific discoveries and initiatives. The Community Advisory Council (CAC), established by BNL in 1998, advises the Laboratory Director, primarily on environmental, safety, and health issues related to the Laboratory that are of importance to the community. The CAC is composed of approximately 27 member organizations representing business, civic, education, employee, community, environmental, and health organizations. The CAC sets its own agenda

in cooperation with the Laboratory and meets monthly in sessions that are open to the public. Weekly phone calls with regulators keep them up-to-date on project status, obtain feedback and input, and provide an opportunity to discuss emerging environmental findings.

The Community Relations Office manages several outreach programs that provide opportunities for stakeholders to become familiar with the Laboratory's facilities and research projects and new initiatives, while helping to identify issues of concern in the community. The Envoy Program educates employee volunteers regarding Laboratory issues and provides a link to local community organizations. Feedback shared by envoys helps BNL gain a better understanding of local community concerns. The Speakers' Bureau Program provides speakers for educational and other organizations, such as Rotary Clubs, civic organizations, and professional societies, to update the community about Laboratory research and/or operations, including environmental efforts and cleanup status. The Summer Sundays Program enables the public to visit BNL science facilities, experience hands-on activities, and learn about research projects and environmental stewardship initiatives.

The Community Relations Office also provides lunchtime tours each month to offer employees the opportunity to learn about the Laboratory's science facilities, program areas, and activities outside the scope of their jobs. Brown bag lunch meetings, held periodically with employees, have covered topics on Laboratory research, history, cleanup project status, and newly proposed initiatives. Specific topics of interest, such as health benefits or wildlife management concerns, have also been covered.

BNL's Media and Communications Office issues press releases and publishes The Bulletin, a weekly employee newsletter. A Director's Office web-based publication is issued bi-weekly, focusing on topics important to the administration. The Laboratory maintains an informative website at http://www.bnl.gov, where these publications, as well as extensive information about BNL's science and operations, past and present, are posted. Employees and the community can also subscribe to the Laboratory's e-mail update service at http://lists.bnl.gov/mailman/listinfo/bnl-announce-1.

In addition, BNL participates in various annual events hosted by EPD, such as a week-long celebration in honor of Earth Day, Earth Day Festivals, and the Brookhaven Town's Longwood Fair.

2.4.2.2 Community Involvement in Cleanup Projects

In 2009, BNL stakeholders had the opportunity to provide input for three projects that were subject to public participation notice in local and regional newspapers. These projects included: a Notice of Intent to Modify, issued by NYSDEC, that established a public comment period on the renewal of the Laboratory's SPDES permit; a Notice of Availability, announcing that the Final OU III Explanation of Significant Differences for Building 96 Remediation, which established a change to the cleanup remedy, was complete; and a legal notice announcing the completion of an EA and Finding of No Significant Impact (FONSI) to construct and operate a solar array project on site.

The Laboratory's SPDES permit, up for renewal in 2010, authorizes discharges of wastewater to surface and ground water. Established under the Clean Water Act, the goals of the SPDES program are to eliminate the discharge of pollutants into the nation's waters and to achieve water quality to protect fishing and recreational interests. BNL has 12 SPDES-permitted outfalls. A revised draft permit, subject to public comment, was issued by NYSDEC in February 2009, and a Notice of Intent to Modify was published. NYSDEC released a Response to Public Comments on the Proposed Draft SPDES Permit in June 2009, which explained how input had been used.

Under the June 2000 OU III ROD, the remedy for Building 96 consisted primarily of a groundwater treatment system to capture contamination from VOCs. When contaminants failed to respond to treatment, further characterization of the area was conducted. As a result, a change to the remedy that called for the excavation and off-site disposal of the soil, discovered to be the source of the VOC contamination, was

proposed. An Explanation of Significant Differences (ESD) was prepared and notice was published. The remedy was also discussed via Annual Groundwater Report presentations, as well as a CAC meeting.

When LIPA called for proposals for solar projects, DOE and BNL proposed making a portion of the Laboratory site available to prospective respondents. The resulting collaboration with BP Solar is for a large-scale solar PV project on 200 acres near the southeast corner of the Laboratory adjacent to a LIPA substation. Prior to the release of an EA, the community and employees provided early input into the process via a brown bag lunch meeting, CAC presentation, and a public information forum. In December 2009, a notice of a completed EA and FONSI was published, and BNL notified local civic associations, elected officials, and interested stakeholders.

Stakeholders were also updated on the progress of other environmental cleanup projects and health and safety issues via briefings and presentations given at CAC and BER meetings throughout the year. One topic of continuing interest was the safety of nanotechnology. At the CAC's request, Vicki Colvin, co-director of the Richard E. Smalley Institute for Nanoscale Science and Technology and Director of the Center for Biological and Environmental Nanotechnology at Rice University, Texas visited the Laboratory to discuss the safety of engineered nanomaterials and managing risk.

Other environmental topics covered included:

- The Laboratory's 2008 Annual Site Environmental Report provided the CAC with an overall update on BNL's clean-up projects and provided specific information on the protection and monitoring of groundwater and the remediation process, including the operational status of treatment systems, progress toward achieving cleanup goals, and recommended or proposed actions in response to monitoring data.
- Deer management employee survey results.
- Numerous updates on the BGRR and HFBR decommissioning projects.
- Environmental Management cleanup projects under the American Recovery and Reinvestment Act.
- The 2008 Annual Peconic River monitoring results, which included data on sediment, surface water, and fish sampling.
- A briefing on how the input received from the community was incorporated into the HFBR ROD, which was signed in April 2009.
- CAC members toured Peconic River restoration areas.

Working closely with the community, employees, elected officials, and regulatory agency representatives, DOE and BNL continue to openly share information on issues and projects and provide feedback on how that input was used.

2.4.3 Monitoring and Measurement

The Laboratory monitors effluents and emissions to ensure the effectiveness of controls, adherence to regulatory requirements, and timely identification and implementation of corrective measures. BNL's Environmental Monitoring Program is a comprehensive, sitewide program that identifies potential pathways for exposure of the public and employees, evaluates the impact activities have on the environment, and ensures compliance with environmental permit requirements. The monitoring program is reviewed and revised, as necessary or on an annual basis, to reflect changes in permit requirements, changes in facility-specific monitoring activities, or the need to increase or decrease monitoring based on a review of previous analytical results.

As required under DOE Order 450.1A, Environmental Protection Program, BNL prepares an Environmental Monitoring Plan, Triennial Update (BNL 2009), which outlines annual sampling goals by media and frequency. The plan uses the EPA Data Quality Objective approach for documenting the decisions associated with the monitoring program. In addition to the required triennial update, an annual electronic update is also prepared.

As shown in Table 2-5, in 2009 there were 7,810 sampling events of groundwater, potable water, precipitation, air, plants and animals, soil, sediment, and discharges under the Environmental Monitoring Program. Specific sampling

Table 2-5. Summary of BNL 2009 Sampling Program Sorted by Media.

Environmental Media	No. of Sampling Events(a)	Purpose
Groundwater	1,617 ER (b) 183 ES/C (c)	Groundwater is monitored to evaluate impacts from past and present operations on groundwater quality, under the Environmental Restoration, Environmental Surveillance, and Compliance sampling programs. See Chapter 7 and SER Volume II, Groundwater Status Report for further detail.
On-Site Recharge Basins	63	Recharge basins used for wastewater and stormwater disposal are monitored in accordance with discharge permit requirements and for environmental surveillance purposes. See Chapter 5 for further detail.
Potable Water	40 ES 141 C	Potable water wells and the BNL distribution system are monitored routinely for chemical and radiological parameters to ensure compliance with Safe Drinking Water Act requirements. In addition, samples are collected under the Environmental Surveillance Program to ensure the source of the Laboratory's potable water is not impacted by contamination. See Chapters 3 and 7 for further detail.
Sewage Treatment Plant (STP)	463	The STP influent and effluent and several upstream and downstream Peconic River stations are monitored routinely for organic, inorganic, and radiological parameters to assess BNL impacts. The number of samples taken depends on flow. For example, samples are scheduled for collection at Station HQ monthly, but if there is no flow, no sample can be collected. See Chapters 3 and 5 for further detail.
Precipitation	8	Precipitation samples are collected from two locations to determine if radioactive emissions have impacted rainfall, and to monitor worldwide fallout from nuclear testing. The data are also used, along with wind speed, wind direction, temperature, and atmospheric stability, to help model atmospheric transport and diffusion of radionuclides. See Chapter 4 for further detail.
Air – Tritium	302	Silica gel cartridges are used to collect atmospheric moisture for subsequent tritium analysis. These data are used to assess environmental tritium levels. See Chapter 4 for further detail.
Air – Particulate	482 ES/C 55 NYSDOH	Samples are collected to assess impacts from BNL operations and to facilitate reporting of emissions to regulatory agencies. Samples are also collected for the New York State Department of Health Services (NYSDOH) as part of their program to assess radiological air concentrations statewide. See Chapter 4 for further detail.
Air – Charcoal	51	Samples are collected to assess impacts from BNL operations and to facilitate reporting of emissions to regulatory agencies. See Chapter 4 for further detail.
Fauna	284	Fish, deer, and small mammals are monitored to assess impacts on wildlife associated with past or current BNL operations. See Chapter 6 for further detail.
Flora	7	Vegetation is sampled to assess possible uptake of contaminants by plants and fauna, since the primary pathway from soil contamination to fauna is via ingestion. See Chapter 6 for further detail.
Soils	68	Soil samples are collected as part of the Natural Resource Management Program to assess faunal uptake, during Environmental Restoration investigative work, during the closure of drywells and underground tanks, and as part of preconstruction background sampling.
Miscellaneous	409	Samples are collected periodically from potable water fixtures and dispensers, manholes, spills, to assess process waters, and to assess sanitary discharges.
Groundwater Treatment Systems and Remediation Monitoring	1,562	Samples are collected from groundwater treatment systems and as long-term monitoring after remediation completion under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program. The Laboratory has 14 operating groundwater treatment systems. See discussion in Chapter 7.
Vehicle Monitor Checks	245	Materials leaving the Laboratory pass through the on-site vehicle monitor that detects if radioactive materials are present. Any radioactive material discovered is properly disposed of through the Waste Management Program. The vehicle monitor is checked on a daily basis.
State Pollutant Discharge Elimination System (SPDES)	332	Samples are collected to ensure that the Laboratory complies with the requirements of the New York State Department of Environmental Conservation (NYSDEC)- issued SPDES permit. Samples are collected at the STP, recharge basins, and four process discharge sub-outfalls to the STP.

(continued on next page)

Table 2-5. Summary of BNL 2009 Sampling Program Sorted by Media *(concluded).*

Environmental Media	No. of Sampling Events(a)	Purpose
Flow Charts	634	Flowcharts are exchanged weekly as part of BNL's SPDES permit requirements to report discharge flow at the recharge basin outfalls.
Floating Petroleum Checks	96 C 29 ES	Tests are performed on select petroleum storage facility monitoring wells to determine if floating petroleum products are present. The number of wells and frequency of testing is determined by NYSDEC licensing requirements (e.g., Major Petroleum Facility), NYSDEC spill response requirements (e.g., Motor Pool area), or other facility-specific sampling and analysis plans.
Radiological Monitor Checks	492	Daily instrumentation checks are conducted on the radiation monitors located in Buildings 569 and 592. These monitors are located 30 minutes upstream and at the STP. Monitoring at these locations allows for diversion of wastes containing radionuclides before they are discharged to the Peconic River.
Quality Assurance/ Quality Control Samples (QA/QC)	537	To ensure that the concentrations of contaminants reported in the Site Environmental Report are accurate, additional samples are collected. These samples detect if contaminants are introduced during sampling, transportation, or analysis of the samples. QA/QC samples are also sent to the contract analytical laboratories to ensure their processes give valid, reproducible results.
Total number of sampling events	**7,810**	The total number of sampling events includes all samples identified in the Environmental Monitoring Plan (BNL 2009), as well as samples collected to monitor Environmental Restoration (CERCLA) projects, air and water treatment system processes, and by the Environmental Protection Division Field Sampling Team as special requests. The number does not include samples taken by Waste Management personnel, waste generators, or Environmental Compliance Representatives for waste characterization purposes.

Notes:
(a) A sampling event is the collection of samples from a single georeferenced location. Multiple samples for different analyses (i.e., tritium, gross alpha, gross beta, and volatile organic compounds) can be collected during a single sample event.
(b) Includes 86 temporary wells; many of which are used to collect multiple samples at different depth intervals.
(c) Includes 29 temporary wells, many of which are used to collect multiple samples at different depth intervals.
C = Compliance
ER = Environmental Restoration (CERCLA)
ES = Environmental Surveillance

programs for the various media are described further in Chapters 3 through 8.

The Environmental Monitoring Program addresses three components: compliance, restoration, and surveillance monitoring.

2.4.3.1 Compliance Monitoring

Compliance monitoring is conducted to ensure that wastewater effluents, air emissions, and groundwater monitoring data comply with regulatory and permit limits issued under the federal Clean Air Act, Clean Water Act, Oil Pollution Act, Safe Drinking Water Act, and the New York State equivalents. Included in compliance monitoring are the following:

- *Air emissions monitoring* is conducted at reactors, accelerators, and other radiological emission sources, as well as the CSF. Real-time, continuous emission monitoring equipment is installed and maintained at some of these facilities, as required by permits and other regulations. At other facilities, samples are collected and analyzed periodically to ensure compliance with regulatory requirements. Analytical data are routinely reported to the permitting authority. See Chapters 3 and 4 for details.
- *Wastewater monitoring* is performed at the point of discharge to ensure that the effluent complies with release limits in the Laboratory's SPDES permits. Twenty-four point-source discharges are monitored under the BNL program: 12 under the ER Program and 12 under the SPDES permit. As required by permit conditions, samples are collected daily, weekly, monthly, or quarterly and monitored for organic, inorganic, and radiological parameters. Monthly

reports that provide analytical results and an assessment of compliance for that reporting period are filed with the permitting agency. See Chapter 3, Section 3.6 for details.

- *Groundwater monitoring* is performed to comply with regulatory operating permits. Specifically, monitoring of groundwater is required under the Major Petroleum Facility License for the CSF and the RCRA permit for the WMF. Extensive groundwater monitoring is also conducted under the CERCLA program (described in Section 2.4.3.2 below). Additionally, to ensure that the Laboratory maintains a safe drinking water supply, BNL's potable water supply is monitored as required by the SDWA, which is administered by the SCDHS.

2.4.3.2 Restoration Monitoring

Restoration monitoring is performed to determine the overall impact of past operations, to delineate the real extent of contamination, and to ensure that Removal Actions are effective and remedial systems are performing as designed under CERCLA.

This program typically involves collecting soil and groundwater samples to determine the lateral and vertical extent of the contaminated area. Samples are analyzed for organic, inorganic, and radiological contaminants, and the analytical results are compared with guidance, standards, cleanup goals, or background concentrations. Areas where impacts have been confirmed are fully characterized and, if necessary, remediated to mitigate continuing impacts. Follow-up monitoring of groundwater is conducted in accordance with a ROD with the regulatory agencies (see Chapter 7 and SER Volume II, Groundwater Status Report, for details).

2.4.3.3 Surveillance Monitoring

Pursuant to DOE Order 450.1, surveillance monitoring is performed in addition to compliance monitoring, to assess potential environmental impacts that could result from routine facility operations. The BNL Surveillance Monitoring Program involves collecting samples of ambient air, surface water, groundwater, flora, fauna, and precipitation. Samples are analyzed for organic, inorganic, and radiological contaminants. Additionally, data collected using thermoluminescent dosimeters (devices to measure radiation exposure) strategically positioned on and off site are routinely reviewed under this program. Control samples (also called background or reference samples) are collected on and off the site to compare Laboratory results to areas that could not have been affected by BNL operations.

The monitoring programs can be broken down further by the relevant law or requirement (e.g., Clean Air Act) and even further by specific environmental media and type of analysis. The results of monitoring and the analysis of the monitoring data are the subject of the remaining chapters of this report. Chapter 3 summarizes environmental requirements and compliance data, Chapters 4 through 8 give details on media-specific monitoring data and analysis, and Chapter 9 provides supporting information for understanding and validating the data shown in this report.

2.4.4 EMS Assessments

To periodically verify that the Laboratory's EMS is operating as intended, audits are conducted as part of BNL's Self-Assessment Program. The audits are designed to ensure that any nonconformance to the ISO 14001 Standard is identified and addressed. In addition, compliance with regulatory requirements is verified through routine inspections, operational evaluations, and focused compliance audits. BNL's Self-Assessment Program consists of several processes:

- *Self-assessment* is the systematic evaluation of internal processes and performance. The approach for the environmental self-assessment program includes evaluating programs and processes within organizations that have environmental aspects. Conformance to the Laboratory's EMS requirements is verified, progress toward achieving environmental objectives is monitored, operations are inspected to verify compliance with regulatory requirements, and the overall effectiveness of the EMS is evaluated. BNL environmental staff routinely participate in

these assessments. Laboratory management conducts assessments to evaluate BNL environmental performance from a programmatic perspective, to determine if there are Laboratory-wide issues that require attention, and to facilitate the identification and communication of "best management" practices used in one part of the Laboratory that could improve performance in other parts. BNL management also routinely evaluates progress on key environmental improvement projects. The Laboratory and DOE periodically perform assessments to facilitate the efficiency of assessment activities and ensure that the approach to performing the assessments meets DOE expectations.

- *Independent assessments* are performed by BNL staff members who do not have line responsibility for the work processes involved, to ensure that operations are in compliance with Laboratory requirements. These assessments verify the effectiveness and adequacy of management processes (including self-assessment programs) at the division, department, directorate, and Laboratory levels. Special investigations are also conducted to identify the root causes of problems, as well as identify corrective actions and lessons learned.

The Laboratory's Self-Assessment Program is augmented by programmatic, external audits conducted by DOE. BSA staff and subcontractors also perform periodic independent reviews. An independent third party conducts ISO 14001 registration audits of BNL's EMS. The Laboratory is also subject to extensive oversight by external regulatory agencies (see Chapter 3 for details). Results of all assessment activities related to environmental performance are included, as appropriate, throughout this report.

2.5 ENVIRONMENTAL STEWARDSHIP AT BNL

BNL has extensive knowledge of its potential environmental vulnerabilities and current operations due to ongoing process evaluations, the work planning and control system, and the management systems for groundwater protection, environmental restoration, and information management. Compliance assurance programs have improved the Laboratory's compliance status; pollution prevention projects have reduced costs, minimized waste generation, and reused and recycled significant quantities of materials.

BNL is openly communicating with neighbors, regulators, employees, and other interested parties on environmental issues and progress. To regain and maintain stakeholder trust, the Laboratory will continue to deliver on commitments and demonstrate improvements in environmental performance. The Site Environmental Report is an important communication mechanism, as it summarizes BNL's environmental programs and performance each year. Additional information about the Laboratory's environmental programs is available on BNL's website at http://www.bnl.gov. The Laboratory continues to pursue other ways to communicate timely data in a more user-friendly, visual manner.

Due to external recognition of the Laboratory's knowledge and unique experience implementing the EMS program, BNL is often asked to share its experiences, lessons learned, and successes. The Laboratory's environmental programs and projects have been recognized with international, national, and regional awards.

Audits have consistently observed a high level of management involvement, commitment, and support for environmental protection and the EMS. Audits and EMS management reviews have noted the following improvements made since BSA began managing BNL:

- The EMS has been strengthened, integrated with other Laboratory management systems, and formalized.
- Line ownership for environmental stewardship has been established, key roles and responsibilities have been identified and clarified, and expectations have been made explicit.
- A comprehensive environmental training program has been implemented.
- From the process evaluation project, BNL has improved its understanding of environmental aspects, waste streams, and applicable requirements.
- There is much greater formality with regard to control of EMS documents, manuals, and procedures. Procedures and requirements

have been updated, and environmental management programs have been improved.

- The Laboratory has been very successful in achieving its environmental goals. There have been successes in ISO 14001 registration and recertification, compliance improvements (e.g., facility modifications, implementation of SBMS, enhanced operational controls), and increased environmental knowledge and awareness on the part of management, employees, contractors, and visitors.
- Communication on environmental issues has improved, occurs at the highest levels of management, and reporting is more formal. Managers are better informed about environmental aspects, issues, and performance.
- Core EMS teams representing many organizations have been formed. A consensus process is used to develop the system, improving acceptance and support.
- There has been strong implementation of the EMS throughout the organizations, and cultural change has been notable.
- The value of the EMS process led to the site certification to the OHSAS 18001 Standard, which is helping to improve ES&H awareness.

For more than 50 years, the unique, leading-edge research facilities and scientific staff at BNL have made many innovative scientific contributions possible. Today, BNL continues its research mission while focusing on cleaning up and protecting the environment. The Laboratory's environmental motto, which was generated in an employee suggestion contest, is "Exploring Earth's Mysteries … Protecting Its Future," and reflects the Laboratory's desire to balance world-class research with environmentally responsible operations.

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