2 Environmental Management System

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

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 an EMS registration, and recertification audits of the entire EMS occur every 3 years. In 2013, an EMS re-certification audit determined that BNL remains in conformance with the ISO 14001: 2004 Standard.

In 2013, BNL continued its strong support of its Pollution Prevention Program, which seeks ways to eliminate waste and toxic materials. Pollution prevention projects resulted in more than $12.7 million in cost avoidance or savings and resulted in the reduction or reuse of approximately 13.4 million pounds of waste. Also in 2013, the BNL Pollution Prevention Council funded three new proposals, investing approximately $6,000. Anticipated annual savings from these projects are estimated at approximately $17,500, for an average payback period of approximately 4 months. 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 environmental issues, 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 and execution. The purpose of BNL's ISMS is to ensure that the way we do work integrates DOE's five Core Functions and seven Guiding Principles into all work processes.

The five Core Functions, as defined by DOE P 450.4, *Safety Management System Policy*, are:

- DEFINE THE SCOPE OF WORK: Missions are translated into work, expectations are set, tasks are identified and prioritized, and resources are allocated.
- IDENTIFY AND ANALYZE HAZARDS ASSOCIATED WITH THE WORK: Hazards associated with the work are identified, analyzed, and categorized.

- DEVELOP AND IMPLEMENT HAZARD CONTROLS: Applicable standards and requirements are identified and agreed upon, controls to prevent/mitigate hazards are identified, the safety envelope is established, and controls are implemented.
- PERFORM WORK WITHIN CONTROLS: Readiness is confirmed and work is performed safely.
- PROVIDE FEEDBACK ON ADEQUACY OF CONTROLS AND CONTINUE TO IMPROVE SAFETY MANAGEMENT: Feedback information on the adequacy of controls is gathered; opportunities for improving the definition and planning of work are identified and implemented; line and independent oversight is conducted; and, if necessary, regulatory enforcement actions occur.

The seven Guiding Principles, also defined by DOE P 450.4, are:

- LINE MANAGER CLEARLY RESPONSIBLE FOR SAFETY: Line management is directly responsible for the protection of the public, the workers, and the environment.
- CLEAR ROLES AND RESPONSIBILITIES: Clear and unambiguous lines of authority and responsibility for ensuring safety shall be established and maintained at all organizational levels.
- COMPETENCE COMMENSURATE WITH RESPONSIBILITIES: Personnel shall possess the experience, knowledge, skills, and abilities that are necessary to discharge their responsibilities.
- BALANCED PRIORITIES: Resources shall be effectively allocated to address safety, programmatic, and operational considerations. Protecting the public, the workers, and the environment shall be a priority whenever activities are planned and performed.
- IDENTIFY STANDARDS AND REQUIREMENTS: Before work is performed, the associated hazards shall be evaluated and an agreed-upon set of safety standards and requirements shall be established which, if properly implemented, will provide adequate assurance that the public, the workers, and the environment are protected from adverse consequences.
- HAZARD CONTROLS TAILORED TO WORK BEING PERFORMED: Administrative and engineering controls to prevent and mitigate hazards shall be tailored to the work being performed and associated hazards.
- OPERATIONS AUTHORIZATION: The conditions and requirements to be satisfied for operations to be initiated and conducted shall be clearly established and agreed upon.

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 for purposes of improving safety and providing a safe and healthy workplace, free from recognized hazards for all operations. 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.

The Laboratory'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.

An ISO 14001 and OHSAS 18001 re-assessment audit was conducted by auditors from NSF International Strategic Registrations in May 2013 (OHSAS 18001 results are not included in this report). The Laboratory was recommended for continued certification to both standards. During the audit, one minor nonconformance was identified; the need for the Laboratory to

consistently communicate BNL's Environmental, Safety, Security, and Health (ESSH) Policy to contractors. The Contractor Vendor Orientation (CVO) program training was updated to communicate the ESSH Policy.

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 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 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 impact 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.

Signed in 2009, Executive Order (EO) 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, establishes sustainability goals for federal agencies and focuses on improving their environmental, energy, and economic performance. In addition to guidance, recommendations, and plans, which are due by specific sustainability due dates, EO 13514 has set numerical targets for agencies.

Each governmental facility is required to have a Site Sustainability Plan (SSP) in place detailing the strategy for achieving these long-term goals, and to provide an annual status. The requirements will influence the future of BNL's EMS program and most have already been incorporated into BNL's SSP. Table 2-1 identifies the EO goal, the actions contained in the SSP, and BNL's performance in 2013.

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. BSA works closely with DOE to clearly define expectations and performance measures. Factors for selecting environmental priorities include:

- Meeting the intent and goals of EO 13514
- 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. For FY 2013, BNL's environmental objective included maintaining ISO 14001 and OHSAS 18001 certifications.

2.3.4 Environmental Management Programs

Each organization within BNL develops an action plan detailing how they will achieve their environmental objectives and targets, as well as 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 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 developed a Groundwater Protection Contingency Plan that defines an orderly process for quickly verifying the results and taking corrective actions in response to unexpected monitoring results (BNL 2013).

Table 2-1. EO 13514 Goals: Status Summary for Fiscal Year (FY) 2013.

DOE Goal	BNL Performance Status	BNL Planned Actions and Contributions
Goal 1: Greenhouse Gas Reduction and Comprehensive Greenhouse Gas Inventory		
28 percent Scope 1 and 2 greenhouse gas reduction by fiscal year 2020 from a fiscal year 2008 baseline (2013 status: 17 percent).	The fiscal year 2008 baseline was 205,542 $MtCO_2e$. In fiscal year 2013, BNL's Scope 1 and 2 greenhouse gas emissions totaled 80,466 $MtCO_2e$, a decrease of 60.9 percent against the fiscal year 2008 baseline.	Continuing efforts in fiscal year 2014 include hydropower, on-site Long Island Solar Farm, photo voltaic research and development, Renewable Energy Credit purchases, and energy intensity reduction through the Utility Energy Service Contract Phase 1. Planned actions include the Utility Energy Service Contract Phase II and consideration of small combined heat and power.
13 percent Scope 3 greenhouse gas reduction by fiscal year 2020 from a fiscal year 2008 baseline (2013 status: 4 percent).	Overall, Scope 3 greenhouse gas emissions have been reduced by 13 percent from the fiscal year 2008 baseline of 20,003 MtCO2e to 17,397 MtCO2e in fiscal year 2013. Emissions from employee business travel have increased 12.8 percent from 8,667 MtCO2e in fiscal year 2008 to 9,780 MtCO2e in fiscal year 2013.	Planned efforts include: consideration of options to reduce greenhouse gas from employee business travel; improving metrics for commuting greenhouse gas; amending domestic and foreign travel procedures to encourage use of hybrid vehicles; expanding user teleconferencing capabilities through the deployment of enhanced communication technologies during sitewide telephone replacement; conducting a survey about expanding shuttle services and possible introduction of a bussing service and on-site communal bicycles; and working with MetroPool on a BNL Rideshare Portal.
Goal 2: High Performance and Sustainable Buildings, Energy Saving Performance Contracts Initiative Schedule, and Regional and Local Planning		
30 percent energy intensity BTU/GSF (British Thermal Units Per Gross Square Foot) reduction by fiscal year 2015 from a fiscal year 2003 baseline (2013 status: 24 percent).	BNL's current level of energy intensity is 296,375 Btu/GSF. This level represents a cumulative reduction of 8.5 percent from the fiscal year 2003 baseline of 323,780 Btu/GSF.	The Utility Energy Services Contract was awarded on October 22, 2013. Phase I implementation will start in early 2014. It is estimated to result in an approximate 11 percent reduction in energy intensity. Energy conservation measures include improving the efficiency of supplying chilled water; lighting upgrades throughout the Laboratory, and installation of building controls with enhanced temperature setback. Further phases and other planned initiatives include providing free cooling, improving the steam system, and combined heat and power and/or biomass.
Energy Independence and Security Act Section 432 energy and water evaluations.	100 percent completed within last 4 years.	Green Energy Surveys will continue to be combined with Facility Condition Assessments to reduce audit costs.
Individual buildings metering for 90 percent of electricity (by October 1, 2012); for 90 percent of steam, natural gas, and chilled water (by October 1, 2015). (2013 status: 90 percent and 50 percent, respectively).	The status of individual building metering is as follows: electric: 97 percent; natural gas: 100 percent; steam: 85 percent; and chilled water: 100 percent. Several Ethernet-based Power Quality meters were installed throughout the Laboratory; several steam meters were upgraded to the advanced metering platform; chilled water metering in the National Synchrotron Light Source II includes segregated metering for the ring/process loads and the laboratory-office buildings cooling loads; and advanced potable water metering has been installed in the Interdisciplinary Science Building-1.	Data Center 459: An advanced dual channel ultrasonic chilled water meter will be installed to separate data center and office load, and an electric meter will be installed on UPS to meter data center electric load. Data Center 515: The small chilled water meter line serving perimeter offices will be meter-advanced, and two electric sub-meters will be installed to segregate office and data center electric load.
Cool roofs, unless uneconomical, for roof replacements unless project already has CD-2 approval. New roofs must have thermal resistance of at least R-30.	In fiscal year 2013, one cool roof was added to Building 734.	In October 2013, a reminder was sent to all roofing project managers to review potential projects against the DOE Cool Roof requirements.

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Table 2-1. EO 13514 Goals: Status Summary for Fiscal Year (FY) 2013 *(continued).*

DOE Goal	BNL Performance Status	BNL Planned Actions and Contributions
15 percent of existing buildings greater than 5,000 gross square feet (GSF) are compliant with the Guiding Principles of High Performance and Sustainable Buildings by fiscal year 2015 (2013 status: 11 percent).	The Modernization Project Office continues to make progress towards the 15 percent requirement and received a High Performance and Sustainable Buildings recognition letter from DOE Headquarters. At the end of fiscal year 2013, BNL is 72 percent High Performance and Sustainable Buildings compliant for the nine buildings that will not achieve Leadership in Energy and Environmental Design (LEED) certification. Tasks completed in fiscal year 2013 include: replacement of the HVAC system at Building 438; installation of occupancy sensors in all High Performance and Sustainability Buildings; installation of night setback controls in Buildings 438 and 935; and HVAC, lighting, and hot water High Sustainability Buildings improvements in Building 817.	The Modernization Project Office has put together a schedule for the completion of the remaining High Performance and Sustainability Buildings projects in fiscal year 2014 and early fiscal year 2015. For fiscal year 2014, work planned includes HVAC, fume hood, and lighting upgrades in Building 599; roof replacement for Building 438; miscellaneous metering; and bid/award of Building 459 indoor air quality improvements and HVAC upgrade. In fiscal year 2015, work will include the completion of Building 459, data center improvements if required, and retrocommissioning. This work is planned for the first quarter of fiscal year 2015 to ensure completion well ahead of the milestone of September 30, 2015.
All new construction, major renovations, and alterations of buildings greater than 5,000 gross square feet must comply with Guiding Principles.	The Interdisciplinary Science Building-I was completed in fiscal year 2013 and achieved LEED Gold certification, indicating compliance with the Guiding Principles.	LEED Gold for the National Synchrotron Light Source II laboratory-office buildings was achieved in fiscal year 2013. No new major construction or renovation projects are expected in fiscal year 2014.
Goal 3: Fleet Management		
Achieve a 10% annual increase in fleet alternative fuel consumption by fiscal year 2015 relative to a fiscal year 2005 baseline (2013 status: 114 percent cumulative since 2005).	Fiscal year 2013 performance compared to fiscal year 2012 showed a 21 percent increase in alternative fuel consumption from 42,629 gallons in fiscal year 2012 to 51,713 gallons in fiscal year 2013. Alternative fueling infrastructure exists for compressed natural gas, 85 percent ethanol fuel, and biodiesel.	Continue to purchase alternative fuel vehicles and remove petroleum vehicles as much as practical.
Achieve a 2% annual reduction in fleet petroleum consumption by fiscal year 2020 relative to a fiscal year 2005 baseline (2013 status: 114 percent cumulative since 2005).	Fiscal year 2013 performance compared to 2012 showed an 18 percent decrease in petroleum consumption from 84,449 gallons in fiscal year 2012 to 69,263 gallons in fiscal year 2013. BNL is reducing petroleum consumption by replacing gasoline and diesel vehicles with alternative fuel vehicles, as budgets permit.	Continue to purchase alternative fuel vehicles and remove petroleum vehicles as much as practical.
Ensure that 100 percent of light duty vehicle purchases consist of alternative fuel vehicles by fiscal year 2015 and thereafter (75 percent by fiscal year 2000-2015).	In past several years, all light duty vehicles purchased were alternative fuel vehicles.	Continue to ensure that 100 percent of light duty vehicles are purchased as alternative fuel vehicles.
Reduce fleet inventory of non-mission critical vehicles by 35 percent by fiscal year 2013 relative to a fiscal year 2005 baseline.	Identified 253 mission-critical vehicles and reduced the fleet from a 2005 baseline of 298 vehicles to the current size of 259 vehicles.	This goal has been achieved.
Goal 4: Water Use Efficiency and Management		
Reduce potable water (gallons per square foot) by 26 percent by FY 2020 from a FY 2007 baseline (2013 status: 12 percent).	Annual water use intensity has decreased from 101 gallons per square foot to 85 gallons per square foot, a 15.5 percent water usage reduction since base year 2007. The Sewage Treatment Plant modification contract was awarded, and fieldwork commenced in the fourth quarter of fiscal year 2013.	A contractor is scheduled to complete the Sewage Treatment Plant modification in the second quarter of fiscal year 2014. The project will result in the recycling of approximately 70 percent of the potable water used at BNL. In fiscal year 2014, the Laboratory will continue with the replacement of existing water-related fixtures with low flow fixtures.

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Table 2-1. EO 13514 Goals: Status Summary for Fiscal Year (FY) 2013 *(concluded).*

DOE Goal	BNL Performance Status	BNL Planned Actions and Contributions
Reduce water consumption of industrial, landscaping, and agricultural water by 20 percent by fiscal year 2020 from a fiscal year 2010 baseline (2013 status: 6 percent).	No permanent landscaping or agricultural water use.	No actions are planned.
Goal 5: Pollution Prevention and Waste Reduction		
Divert at least 50 percent of non-hazardous solid waste, excluding construction and demolition debris by fiscal year 2015.	BNL's non-hazardous solid waste recycling rate was approximately 62 in fiscal year 2013.	Planned actions include revising training to educate employee on recycling programs; conducting a study to test the efficiency of remanufactured toner cartridges; and soliciting ideas for partial or full funding of projects that minimize waste and prevent pollution.
Divert at least 50 percent of construction and demolition debris by fiscal year 2015.	BNL recycles 95 percent of construction, demolition, and woody debris.	Continue to send material to Construction & Demolition transfer station for sorting and recycling. Continue to convert concrete, stone, and brick debris into recycled concrete aggregate for reuse on site.
Goal 6: Sustainable Acquisition		
Ensure procurements meet requirements by including necessary provisions and clauses (Sustainable Procurements/Bio-based Procurements).	All contract actions for construction and custodial products met sustainable acquisition requirements in fiscal year 2013.	Performance in sustainable acquisition will be documented in the fiscal year 2014 Pollution Prevention Tracking and Reporting System and the Consolidated Energy Data Report. The performance for the purchase of bio-based products will be documented in the System for Award Management for fiscal year 2014.
Goal 7: Electronic Stewardship and Data Centers		
Ensure all data centers are metered to measure a monthly Power Utilization Effectiveness (PUE) of 100 percent by fiscal year 2015 (2013 status: 80 percent).	Initial PUE study indicated current PUE to be above 1.6.	BNL is working to install additional metering so that a more accurate PUE for each data center may be measured and monitored. The meter is expected to be completed in the third quarter of fiscal year 2014.
Achieve maximum annual weighted average PUE of 1.4 by fiscal year 2015 (2013 status: 80 percent).	Initial PUE study indicated current PUE to be above 1.6.	Once all meters are in place, PUE will be monitored to evaluate the course of action needed to meet the goal of 1.4.
Ensure 100% of eligible PCs, laptops, and monitors have power management actively implemented and in use by FY 2012	▪ LANDesk power management implemented on all suitable systems.	▪ Continue to assess if any additional systems can use the power management systems.
Goal 8: Renewable Energy		
20 percent of annual electricity consumption from renewable sources by fiscal year 2020 (2013 status: 7.5 percent).	BNL purchased 40 million kWh of renewable energy credits, which equals approximately 9 percent of the Laboratory's total usage of electric and thermal energy. The on site Long Island Solar Farm began operations November 2011, and in fiscal year 2013, provided 54 million kWh/year of clean renewable energy to Long Island.	Construction of the Research and Development solar array began in the fourth quarter of fiscal year 2013 and will continue in fiscal year 2014. A CHP study was completed in August 2013, and evaluation of the potential benefits is ongoing. Renewable energy credit purchases will continue, and the quantity will need to be significantly increased due to the 20 percent requirement.

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 2013.

2.3.4.3 Waste Management

As a byproduct of the world-class research it conducts, BNL generates a wide range of wastes. These wastes include materials common to many businesses and industries, such as office wastes (e.g., paper, plastic, etc.), aerosol cans, batteries, paints, and oils. However, the

Laboratory's unique scientific activities also generate "specialized" waste streams that are subject to additional regulation and special handling, including radioactive, hazardous, and mixed waste. BNL's Waste Management Facility (WMF), operated by the Environmental Protection Division (EPD), is responsible for collecting, storing, transporting, and managing the disposal of these specialized wastes. This modern facility was designed for handling hazardous, industrial, radioactive, and mixed waste and is comprised of two staging areas: a facility for hazardous waste and mixed waste (both hazardous and radioactive) in Building 855, regulated by RCRA, and a reclamation building for radioactive material in Building 865. The RCRA building is 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.

In 2013, BNL generated the following types and quantities of waste from routine operations:

- Hazardous waste: 3.1 tons
- Mixed waste: 100 ft^3
- Radioactive waste: 2,526 ft^3

Hazardous waste from routine operations in 2013 decreased from 2012 generation rates, as shown in Figure 2-1a. Mixed waste generation increased from 2012 rates, as shown in Figure 2-1b, and can be attributed to increased activities at the Collider Accelerator Department (CAD) (i.e., dispositioning of unneeded lead). As shown in Figure 2-1c, radioactive waste for routine operations decreased from 2012 rates, and can be attributed to normal fluctuations in routine operations. Routine operations are defined as ongoing industrial and experimental operations.

Wastes generated by remediation projects, facility decommissioning activities, or one-time events (e.g., lab clean-out) are considered non-routine. In 2013, BNL continued to reduce the inventory of legacy waste materials through laboratory cleanouts. Wastes from facility decommissioning activities included primarily debris and equipment from the former Hot Shop and Hot Laundry buildings. Other non-routine wastes included the disposal of lead-contaminated debris, lead shielding, and polychlorinated biphenyl (PCB) wastes.

Figures 2-1d through 2-1f show wastes generated from non-routine operations. Waste generation from these activities has varied significantly from year to year. This is expected, as various decommissioning and remedial actions are conducted.

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 national and DOE pollution prevention goals and policies, and represents an ongoing effort to make pollution prevention and waste minimization an integral part of BNL's operating philosophy.

Pollution prevention and waste reduction goals have been incorporated into the DOE contract with BSA, into BNL's ESSH Policy, the Performance Evaluation Management Plan associated with the Laboratory's operating contract with DOE, and BNL's SSP. 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"
- 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

Three Pollution Prevention proposals were funded in 2013, for a combined investment of approximately $6,000. The anticipated annual savings from these projects is estimated at $17,500, for an average payback period of approximately 4 months. 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 2013, 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 2013, these efforts resulted in more than $12.7 million in cost avoidance or savings and approximately 13.4 million pounds of materials being reduced, recycled, or reused annually.

In 2013, BNL's biggest pollution prevention project was the repurposing of its g-2 magnet. The magnet was shipped to Fermi National Accelerator Laboratory for the purpose of studying the properties of muons. The cost of moving this highly sensitive piece of equipment was $3 million, compared to the estimated $10 to $50 million to build a new one.

The Laboratory also has an active and successful solid waste recycling program, which involves all employees. In 2013, BNL collected approximately 160 tons of office paper for recycling. Cardboard, bottles and cans, construction debris, motor oil, scrap metals, lead, automotive 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 2013.

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. Through an annual maintenance program, conventional plumbing fixtures are replaced with low-flow devices.

The Laboratory's 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 14-year trend of water consumption. Total water consumption in 2013 was approximately 1.2 million gallons less than in 2012. This decrease can be attributed to water conservation efforts and less water used for cooling. In each of the past 5 years, the water consumption total was approximately half the 1999 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 and implementing cost-effective, energy-efficient projects; monitoring energy use and utility bills; and assisting in obtaining the least expensive energy sources possible. The group is responsible for developing, implementing, and coordinating BNL's energy management efforts and assisting DOE in meeting the energy and sustainability goals in EO 13514; DOE Order 436.1, Departmental Sustainability; and the Secretary's initiatives. The Laboratory's SSP addresses all aspects of the DOE energy, water, transportation and other sustainability goals.

BNL has more than 4 million square feet of building space. Many scientific experiments at the Laboratory use particle beams generated and accelerated by electricity, with the particles controlled and aligned by large electromagnets. In 2013, BNL used approximately 271 million kilowatt hours (kWh) of electricity, 128,000 gallons

of fuel oil, 16,000 gallons of propane, and 619 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 is historically used whenever each respective fuel is least expensive. However, given the current price disparity between natural gas and oil, BNL will continue to purchase natural gas over oil, further reducing greenhouse gas emissions (GHG). Additional information on natural gas and fuel oil use can be found in Chapter 4.

BNL continues to participate 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. BNL 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. In 2013, this scheduling reduced the electric demand at the Laboratory by 25 MW, saving approximately $1.5 million in electric costs and helping to maintain the

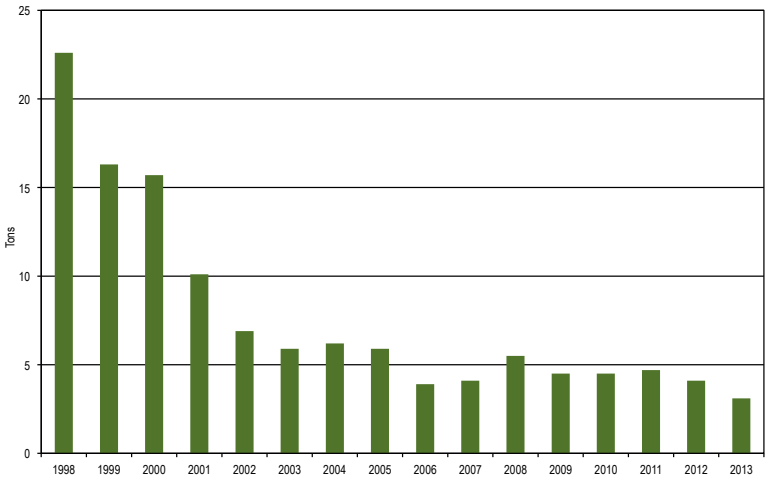

Figure 2-1a. Hazardous Waste Generation from Routine Operations, 1998 – 2013.

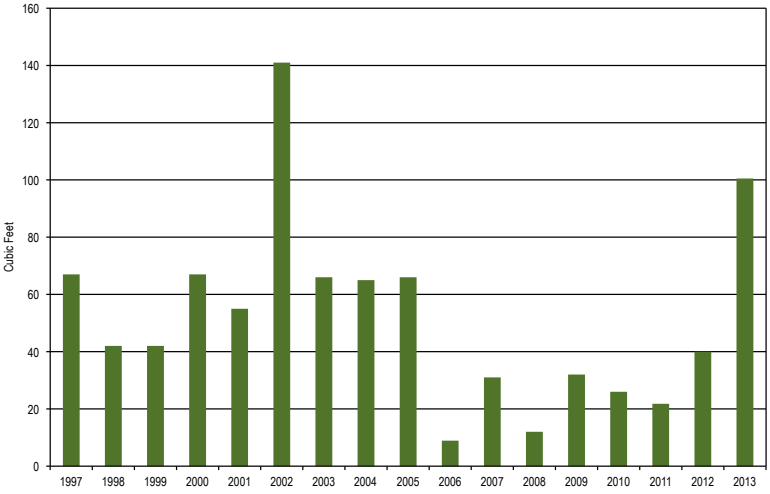

Figure 2-1b. Mixed Waste Generation from Routine Operations, 1998 – 2013.

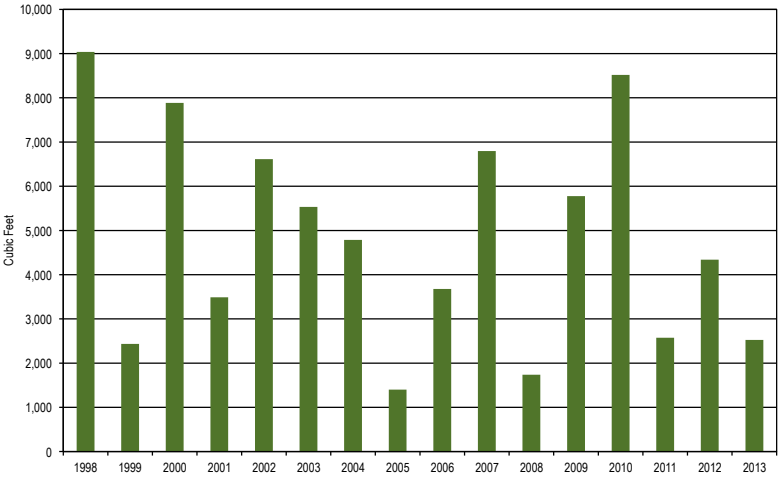

Figure 2-1c. Radioactive Waste Generation from Routine Operations, 1998 – 2013.

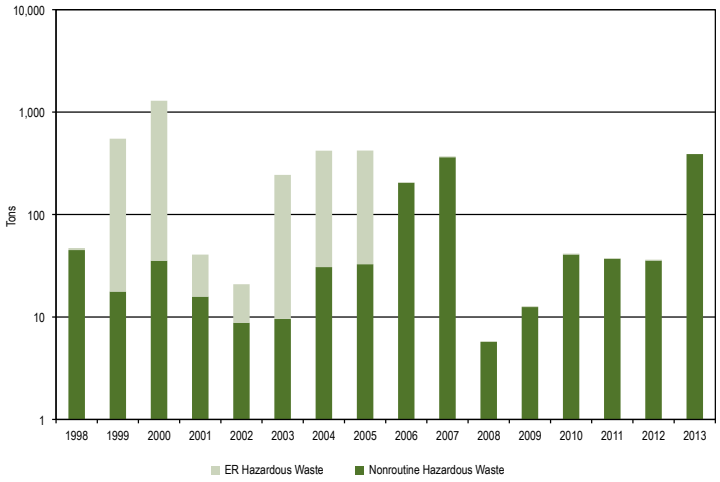

Figure 2-1d. Hazardous Waste Generation from ER and Nonroutine Operations, 1998 – 2013.

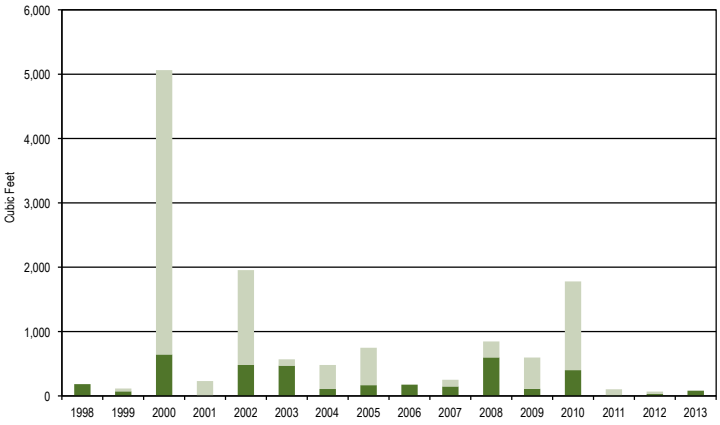

Figure 2-1e. Mixed Waste Generation from ER and Nonroutine Operations, 1998 – 2013.

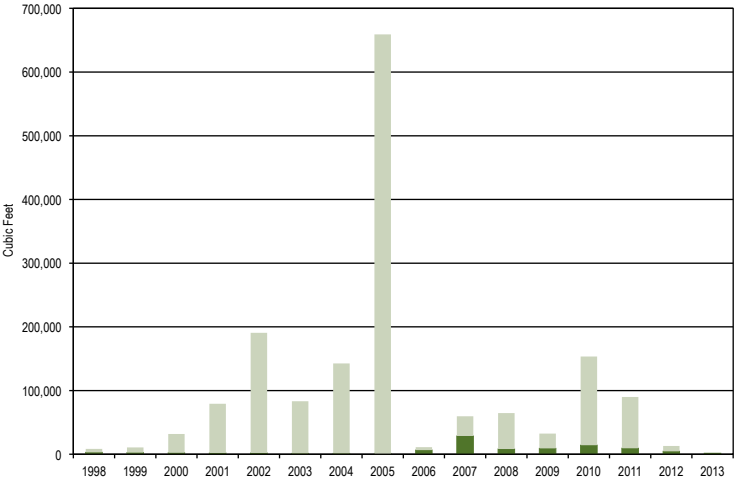

Figure 2-1f. Radioactive Waste Generation from ER and Nonroutine Operations, 1998 – 2013.

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 $26.8 million in 2013. The Laboratory will continue to seek alternative energy sources to meet its future energy needs, support federally required "green" initiatives, and reduce energy costs. Further, BNL's energy supply now includes approximately 118 million kWh of clean, renewable hydropower (received through the LISF).

In 2011, BP Solar completed construction of the Long Island Solar Farm (LISF) on DOE/BNL property. The array is currently the largest solar photovoltaic (PV) array (32 MW) in the Northeast and spans 195 acres with 164,000 panels. BNL worked extensively with LIPA, BP Solar, the State of New York, and other organizations to evaluate the site and develop the project, with LIPA purchasing the output through a 20-year Power Purchase Contract. The estimated annual output of 44 million kWh results in an avoidance of approximately 31,000 tons of carbon per year over its 30- to 40-year life span. The actual output for the first 3 operational years was an average of 52 million kWh/year, substantially above the estimated annual average value. As an outcome of constructing this large array on site, the Laboratory is developing

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

Waste Description	Type of Project	Pounds Reduced, Reused, Recycled or Conserved in 2013	Waste Type	Potential Costs for Treatment and Disposal	Cost of Recycle, Prevention	Estimated Cost Savings	Project Description Details
g-2 Magnet	Reuse	1,700,000	Metal/Scientific Equipment	$0	$3,000,000	$10,000,000	Collider Accelerator shipped its g-2 electromagnet to Fermi National Accelerator Laboratory. Cost estimates for building this piece of equipment from scratch range from 10-50 million dollars.
Mobile Fuel Oil Tank	Spill Prevention	N/A	Oil Spills	$7,000	$3,000	$5,000	Purchased a mobile fuel trailer for use with the satellite boilers; cost-shared project with the Utilities Group.
Lab Cleanouts	Chemical Disposal	600	Lab Chemicals	$15,000	$2,500	$12,500	Hired an experienced summer intern to aid the Waste Management Representative of the Biological Sciences buildings with chemical cleanouts.
Replacement of Small PCB Capacitors	Substitution	N/A	PCB	$4,000	$4,000	$0	Collider Accelerator Department removed and replaced 50 small capacitors containing PCBs and also removed an additional 25 capacitors containing PCBs from obsolete equipment.
Replacement of X-Ray Film Processing with Chemiluminicent Imaging	Substitution	835	Hazardous and Industrial Liquid Wastes	$27,000	$5,500	$179,000	Cost savings reflect: labor, waste disposal, and items (such as film) which will no longer need to be purchased.
Motion Sensors for Building 725	Energy Conservation	N/A	Greenhouse Gas/ Energy Conservation	N/A	$0	$6,000	Installation of motion sensored lighting in hall-ways, restrooms, and conference rooms in Building 725 during 2011.
LED Lighting in 490 Conference Room	Energy conser-vation	N/A	Greenhouse Gas/ Energy Conservation/ Manpower	$2,940	$0	$3,710	(40) 65-Watt incandecent bulbs were replaced with LED bulbs in Building 490 during 2011; sav-ings of $1190/yearr in energy costs and $2520/ yearr in manpower costs.
Motion Sensors for Building 820	Energy Conservation	N/A	Greenhouse Gas/ Energy Conservation	N/A	$0	$1,650	Installation of motion sensored lighting in Physics research area of Building 820.
Alkaline Batteries	Recycling	174	Industrial Waste	$10	$0	$10	150 pounds of alkaline batteries were collected and sent for recycling.
BioDiesel Tank, E-85, CNG	Alternative Fuels	0	Greenhouse Gas/ Energy Conservation	$0	$0	$0	BNL is utilizing alternative fuels to operate main-tainance vehicles.
Motion Sensors for Labs*	Energy Conservation	N/A	Greenhouse Gas/ Energy Conservation	N/A	$0	$5,817	Installation of motion detector lighting in common areas of Buildings 490 and 463.

(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 2013	Waste Type	Potential Costs for Treatment and Disposal	Cost of Recycle, Prevention	Estimated Cost Savings	Project Description Details
"Bio Circle Cleaner" Parts Washer	Substitution	640	Hazardous Waste	$10,000	$0	$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	$40,944	$0	$40,944	Empty aerosol cans are recycled as scrap, rather then sent to the Waste Management Division as hazardous waste. Eight units (Facilities & Operations=5, Collidar Accelerator=1, National Snchrotron Light Source=1, Basic Energy Sciences=1) each handle 66 lbs. of hazardous waste.
Electronic Reuse	Reuse	2,400	E-Waste	$6,000	$0	$6,000	BNL tracks electronic equipment and takes a reuse credit for transfer of equipment to another user.
Building Demolition Recycling	Recycling	10,000,000	Industrial Waste	$448,700	$25,000	$423,700	On-site demolition products (steel and concrete) are segregated, recycled, and reused.
System One Parts Washer	Substitution	1,280	Hazardous Waste	$12,000	$0	$12,000	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.
Animal Bedding Conveying System	Composting	78,000	Low-Level Radiological Waste	$1,002,456	$0	$1,002,456	Animal bedding material is no longer sent to the sanitary sewer. It is now conveyed to a dumpster that is emptied and composted at the stump dump. The sanitary sludge was previously sent out as low-level radiological waste.
Lead Acid Batteries	Recycling	4,280	Universal Waste	$29,207	$0	$29,207	Avoids hazardous waste disposal costs for approximately 40 lbs. of lead per battery.
Cooling Tower Chemicals	Source Reduction	6,000	Industrial Waste	$12,000	$0	$12,000	Ozone water treatment units were installed on cooling towers at the National Space Radiation Laboratory (Building 957), the Special Ejection Magnet (Building 912A) and the Relativistic Heavy Ion Collider Reseach Facility (Building 1004) 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.

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

Waste Description	Type of Project	Pounds Reduced, Reused, Recycled or Conserved in 2013	Waste Type	Potential Costs for Treatment and Disposal	Cost of Recycle, Prevention	Estimated Cost Savings	Project Description Details
Blasocut Machining Coolant	Recycling/ Reuse	45,200	Industrial Waste	$119,244	$0	$128,844	Central Shops Division operates a recycling system that reclaims Blasocut machining coolant and supplies it Laboratory-wide. In 2013, 5,650 gallons (45,200 lbs.) of Blasocut lubricant were recycled. Recycling involves aeration, centrifuge, and filtration and avoids cost of disposal as industrial waste and an avoided cost of buying 12 drums of concentrate ($800/drum) and 113 empty drums for shipping ($50/drum).
Fluorescent Bulbs	Recycling	13,540	Universal Waste	$473,900	$20,000	$453,900	Fluorescent bulbs are collected and sent to a recycling facility under the Universal Waste exemption rule.
Used Motor Oil	Energy Recovery	12,400	Industrial Waste	$32,426	$0	$32,426	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 2013, they collected 1,550 gallons of oil at no charge to BNL, which avoided the costs for disposal and 31 shipping drums ($50/drum).
Office Paper	Recycling	320,260	Industrial Waste	$16,814	$0	$23,219	Cost avoidance based on $105/ton for disposal as trash, plus $40/ton.
Cardboard	Recycling	193,360	Industrial Waste	$10,151	$0	$12,568	Cost avoidance based on $1055/ton for disposal as trash, plus $25/ton revenue.
Electronic Waste	Recycling	45,620	Industrial/Universal Waste	$114,050	$0	$134,112	Cost avoidance based on $105/ton for disposal as trash, plus $900/ton revenue.
Metals	Recycling	347,164	Industrial Waste	$18,226	$0	$170,897	Cost avoidance based on $105/ton for disposal as trash, plus $900/ton revenue.
Bottles/Cans	Recycling	32,920	Industrial Waste	$1,728	$0	$1,728	Cost avoidance based on $105/ton for disposal as trash.
Construction Debris	Recycling	608,360	Industrial Waste	$31,939	$0	$15,817	Cost avoidance based on $52/ton difference for disposal as trash.
	TOTALS	13,413,561		$2,435,735	$3,060,000	$12,723,505	

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

a solar research program that will look at impacts of climate change on large utility-scale PV systems, as well as research and development for solar power storage and inverter efficiencies. The Federal Energy Management Program (FEMP) recognizes the importance of the efforts of BNL and the DOE Brookhaven Site Office to host the LISF, and are providing credit toward BNL's SSP renewable energy goal.

In addition, the Laboratory has nearly completed the installation of the first phase of the 1 MW solar PV array for additional research. The 500 kW phase one array is estimated to become operational in the summer of 2014. The remaining 500 kW is expected to be completed in 2015-2016.

To reduce energy use and costs at non-research facilities, several additional activities were undertaken by the BNL Energy Management Group in 2013:

- *NYPA Power Contract*: Second full year of a 10-year contract that includes 15 MW of renewable (nearly zero GHG) hydropower. This contract is estimated to save in excess of $26 million per year compared to prevailing energy rates, with an option to renew for an additional 5 years. Actual savings for FY 2013 were $26.8 million.
- *DOE Sustainability Initiative*: The Energy Management Group continues to provide substantial support to the Federal/DOE-wide Sustainability Initiative, and has created a BNL Sustainability Leadership Team. The team is developing a formal site-wide sustainability program beyond DOE requirements, participates in one of three subcommittees for DOE on sustainability initiatives, and provides numerous evaluations and estimates on energy use, GHG, renewable energy, and energy-efficiency options.
- *Substantial Progress on Several Initiatives included in BNL's 2013 SSP*: New electric and steam meter installations; funding for energy conservation initiatives; new energy-efficient lighting installed in parking lots and offices; the purchase of Renewable Energy Credits (RECs) in meeting BNL's SSP goal; and training various parties on energy conservation initiatives.
- *Utility Energy Services Contract (UESC)*: Major support to DOE/BHSO in developing a UESC, which included a preliminary audit, completion of a follow-on Investment Grade Audit (IGA), and completion of the UESC contract terms and requirements. A contract was awarded in late October 2013 and construction began in late December. The UESC scope currently includes energy-efficient lighting, new building controls and commissioning, and an energy-efficient chiller project. The project is expected to be completed in July 2015.
- *Energy Conservation*: Energy and water evaluations are completed for 25 percent of the site each year. Cost-effective projects are identified and proposed for funding, as appropriate.
- *High Performance Sustainability Buildings (HPSB)*: Substantial completion of various energy and water conservation projects to achieve compliance in the EPA Portfolio Manager program. BNL is currently on target to substantially meet the HPSB goal.
- *Renewable Energy*: Continued project support for the LISF Project and the Research and Development (R&A) solar PV array (part of NSERC), and annual purchases of Renewable Energy Credits (REC's) to meet targeted goals.
- *Central Chilled Water Facility (CCWF)-Phase II*: The CCWF Phase-II project was completed in 2011 and is now providing chilled water to BNL buildings and processes such as the National Synchrotron Light Source (NSLS) and the data center, using modern energy-efficient chillers. The CCWF utilizes a 3.2 million gallon chilled water storage tank that is used to reduce peak electric demand by producing and storing chilled water during the night.
- *Natural Gas Purchase Contract*: BNL is currently saving approximately $7 million per year compared to oil and $500k compared to purchasing directly from National Grid.
- *Energy Savings*: 25 MW of demand is rescheduled each year to avoid coinciding with the utility summer peak, saving

Table 2-3. BNL Recycled Program Summary, 2002-2013.

Recycled Material	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Mixed paper	209	177	183	194	184	185	157	121	175	183	138	160
Cardboard	157	176	179	143	135	121	147	152	141	126	100	97
Bottles/Cans	19	23	22	22.1	27.7	24.4	19.6	23.7	24	22.5	18	16.5
Tires	3.5	12.3	11	12.8	32.5	19.9	34.5	15.5	10.1	9.2	10	7.1
Construction debris	304	334	367	350	297	287	302	312	416	256	380	304
Used motor oil (gallons)	1,920	3,920	3,860	4,590	2,780	2,020	1,500	1,568	1,700	1,145	1,585	1,550
Metals	48	193	128	559	158	382	460	91	131	84	228	174
Automotive batteries	6.3	4.6	5	4.6	5.5	2.5	2.7	4	1.6	2.1	2	2.1
Printer/Toner cartridges (units)	449	187	105	0	0	0	3,078	1,251	4,132	4,186	4,100	11,233
Fluorescent bulbs (units)	25,067	13,611	12,592	7,930	11,740	25,448	36,741	10,223	8,839	20,220	8,752	13,540
Blasocut coolant (gallons)	8,180	5,030	6,450	3,890	3,970	2,432	3,340	3,810	4,830	5,660	5,610	5,650
Antifreeze (gallons)	0	165	325	0	0	0	0	0	0	0	700	822
Tritium exit signs (each)	28	181	142	0	0	0	0	0	0	18	0	0
Smoke detectors (each)	40	0	0	0	0	0	0	0	0	0	0	0
Road base	2,016	0	2,666	0	0	0	0	0	0	0	0	0
Electronic reuse	0	0	0	0	0	0	16.3	11.4	12	11.6	3.2	1
Scrap electronics	0	0	0	6.1	70.3	40.5	48.9	17	16.7	19.9	30.9	23
Animal Bedding (composted)	0	0	0	0	6.3	19.6	42	41	52	54	3.3	39
Tyvek (lbs)	0	0	0	0	0	0	0	84	60	92	105	0
Metals (building demolition)	8	23	11	6	35	0	0	0	0	0	0	20
Concrete (building demolition)	891	590	3,000	328	5,505	6,175	0	0	4,050	0	0	5,000
Other construction and debris (building demolition)	790	388	1,200	157	818	0	0	0	0	0	0	0

Notes: All units are tons, except where noted.

over $1.5 million in electricity charges. In addition, work continues in the replacement of aging, inefficient T-40 fluorescent lighting fixtures with new, high efficiency T-8 lighting fixtures (200 to 300 fixtures are typically replaced annually), saving tens of thousands of kWhs each year and reducing costs by several thousand dollars.

Due to continued conservation efforts, overall facilities energy usage for FY 2013 was approximately 8.8 percent less than in FY 2003, saving $930,000. In addition, approximately 16,207 gasoline gallon equivalents (gge) of natural gas were used in place of gasoline for the Laboratory's vehicle fleet.

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, as well as the Energy Independence and Security Act (EISA) of 2007, 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 FY 2006-FY 2015. Further, EO 13514 and associated orders have set even more stringent requirements, including increased use of renewable energy and reductions in transportation fuels that go significantly beyond the previous goal of a 30 percent reduction by FY 2015, compared to FY 1985.

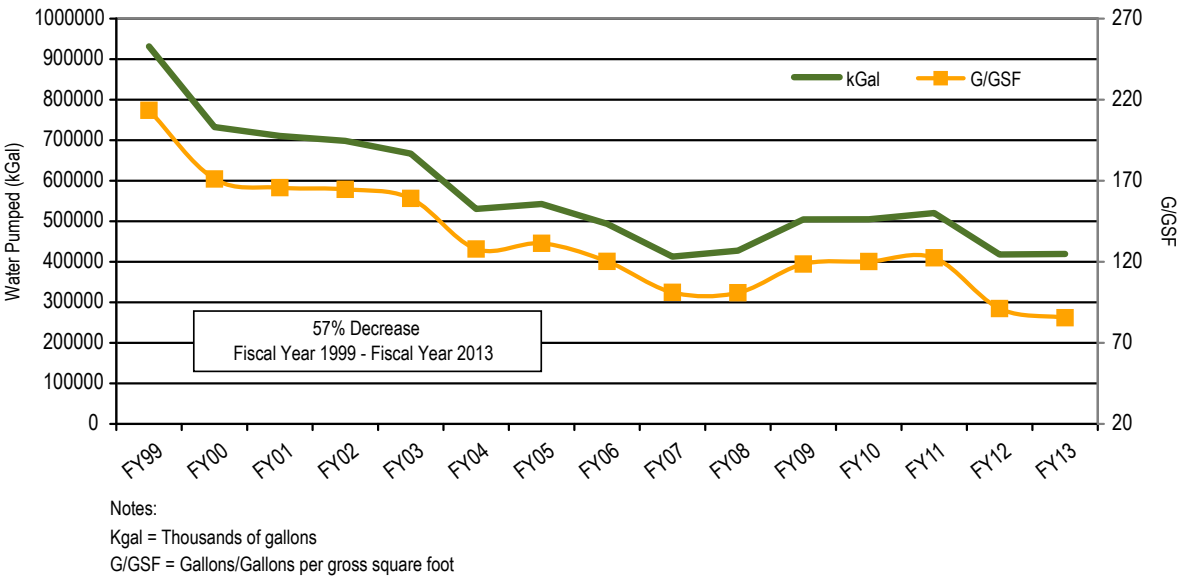


Figure 2-2. Annual Potable Water Use, 1999-2013.

As shown in Figure 2-3, BNL's energy use per square foot in 2013 was 30 percent less than in FY 1985 and 8.8 percent less than in FY 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

Through its Natural Resource Management Plan (BNL 2011), 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 (BNL 2013a) was 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.

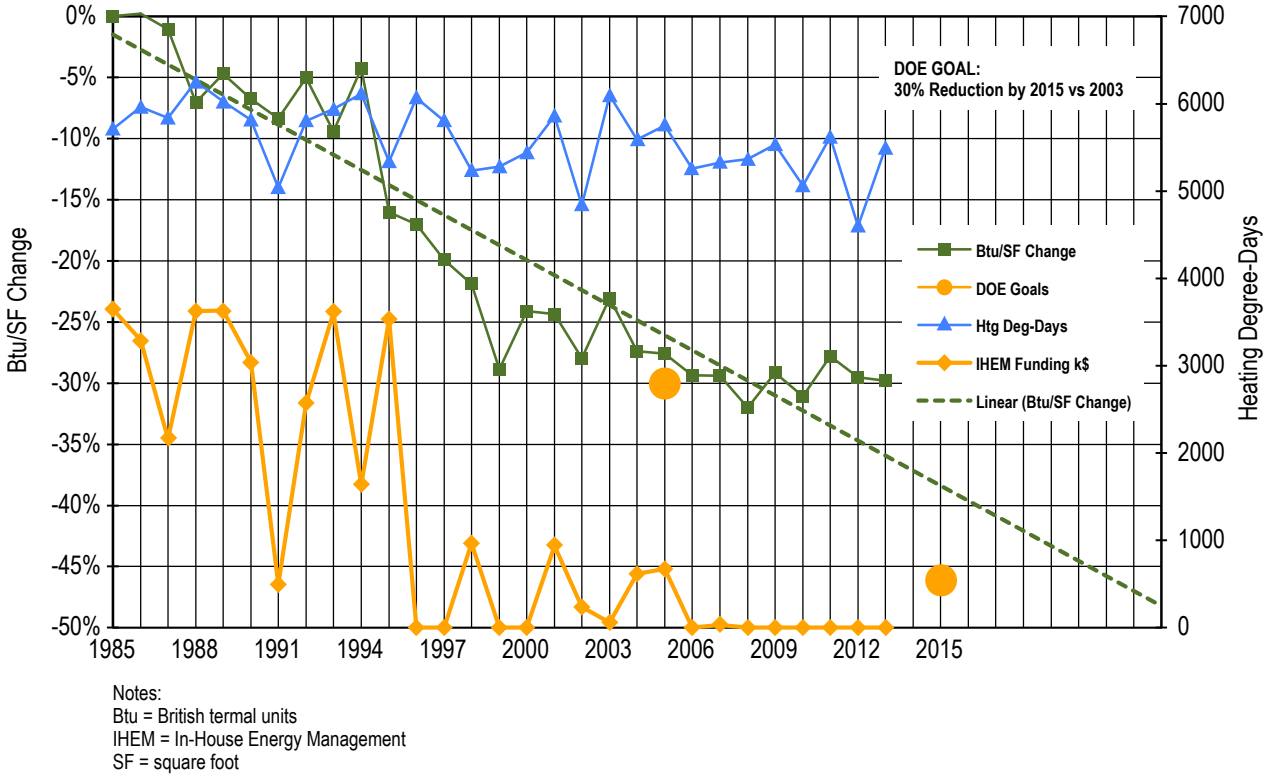
2.3.4.8 Environmental Restoration

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 34 other Long Island sites, 15 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). 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 alternative
- Issue a Record of Decision (ROD), which is the remedy/corrective action agreed to by DOE, EPA, and NYSDEC



Notes:
Btu = British termal units
IHEM = In-House Energy Management
SF = square foot

Figure 2-3. BNL Building Energy Performance, 2013 (Btu/SF Change Percent vs. Baseline Years).

- Perform the Remedial Design/Remedial Action, which includes final design, construction specifications, and carrying out the remedy selected

In 2013, BNL's 14 active groundwater treatment systems removed approximately 183 pounds of volatile organic compounds and 1.3 mCi of strontium-90 (Sr-90) from the sole source aquifer. Following approval from the regulators; four groundwater treatment systems were shut down and placed in an operationally-ready stand-by mode; one treatment system was partially decommissioned; and a new extraction well was installed for the Middle Road Treatment System. Also in 2013, long-term surveillance and maintenance (S&M) of the Laboratory's Brookhaven Graphite Research Reactor and the High Flux Beam Reactor continued. In accordance with the ROD, demolition of HFBR stack will be completed prior to 2020.

Post-cleanup monitoring of Peconic River surface water, sediment, fish, and wetland vegetation continued in 2013, and the results are reported in Chapter 6 of this report. Monitoring and control of invasive species was performed at three Peconic wetland areas that were remediated in 2011. This monitoring will continue through 2014 to satisfy federal requirements.

The groundwater systems operate in accordance with the Operations and Maintenance (O&M) manuals, while the Peconic and surface soil cleanup areas are monitored via the Soil and Peconic River Surveillance and Maintenance (S&M) Plan (BNL 2013c). 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.

2.4 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 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

In support of BNL's EMS commitment to communication and community involvement, the Community, Education, Government and Public Affairs (CEGPA) Directorate develops best-in-class communications, science education, government relations, and community involvement programs that advance the science and science education missions of the Laboratory (BNL 2005). CEGPA contributes to public understanding of science and enhances the value of the Laboratory as a community asset and ensures that internal and external stakeholders are properly informed and have a voice in decisions of interest and importance to them. CEGPA also works to maintain relationships with BNL employees, key stakeholders, neighbors, elected officials, regulators, and other community members to provide an understanding of the Laboratory's science and operations, including environmental stewardship and restoration activities, and to incorporate community input into BNL's decision-making process.

To facilitate stakeholder input, CEGPA's Stakeholder Relations Office participates in or conducts on- and off-site meetings which include discussions, presentations, roundtables, and workshops. Stakeholder Relations staff attend local civic association meetings, canvass surrounding neighborhoods, conduct Laboratory tours, and coordinate informal information sessions and formal public meetings, which are held during public comment periods for environmental projects. BNL's Internal Communications Office manages programs to increase internal stakeholder awareness, understanding, and support of Laboratory initiatives, fosters two-way communications, and updates internal stakeholders on BNL priorities, news, programs, and events.

2.4.2.1 Communication Forums

To create opportunities for 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 their staff, regulators, and other government agencies on environmental and operational issues, as well as scientific discoveries and initiatives.
- The Community Advisory Council (CAC), established by BNL in 1998, advises Laboratory management primarily on environmental, health, and safety issues related to BNL that are of importance to the community. The CAC is composed of 27 member organizations and individuals representing civic, education, employee, community, environmental, and health interests. The CAC sets its own agenda in cooperation with the Laboratory and meets monthly. The CAC is one of the primary ways the Laboratory keeps the community informed. Meetings

are open to the public and are announced in the monthly community e-newsletter, *LabLink*, on the BNL homepage calendar and on the Community Relations website. An opportunity for public comment is provided at each meeting and organizations interested in participating on the CAC are encouraged to attend meetings and make their interest known.

- Monthly teleconference calls are held with parties to the Laboratory's Interagency Agreement and other federal, state, and local regulators to keep them up-to-date on project status. The calls also provide the opportunity to gather input and feedback and to discuss emerging environmental findings and initiatives.
- The Stakeholder Relations Office website is used to host links to the CAC webpage, which contains meeting agendas and past meeting presentations and minutes. Stakeholder Relations also manages several outreach programs that provide opportunities for stakeholders to become familiar with the Laboratory's facilities and research projects. Outreach programs include:
  - *Tour Program*: Opportunities to learn about BNL are offered to college, university, professional, and community groups. Tour groups visit the Laboratory's scientific machines and research facilities and meet with scientists who conduct research. Agendas are developed to meet the interests of the groups, and may include sustainability and environmental stewardship issues. Tours were provided for more than 2,250 visitors in 2013.
  - *The Speakers' Bureau*: Speakers are provided for educational institutions and community organizations, such as Rotary Clubs, civic organizations, school assemblies, and professional societies, to update them on Laboratory research and operations accomplishments, including environmental stewardship.
  - *Summer Sundays*: Held on four Sundays each summer, these open houses enable the public to visit BNL science facilities, experience hands-on activities, and learn about research projects and environmental stewardship programs. In 2013, more than 6,000 visitors participated in the program.

The Laboratory participates in various outreach events throughout the year that include festivals, workshops, BNL's Earth Day celebration, the Long Island Earth Summit, the Long Island Green Infrastructure Conference, Long Island Regional Economic Development Council, and the Suffolk County Planning Federation Conference. Brown bag lunch meetings for employees are held periodically and cover topics of interest, including project updates, newly proposed initiatives, wildlife management concerns, and employee benefits information.

BNL's Media & Communications Office issues press releases to news and media outlets and the Internal Communications Office publishes electronic and prints weekly employee newsletters–*Brookhaven This Week* and *The Brookhaven Digest*–that are geared toward employees with email access and those who do not have direct access to a computer. Also, a Director's Office web-based publication, *Monday Memo*, is issued bi-weekly to employees and focuses on administrative topics important to the Laboratory population.

The Laboratory maintains an informative website at *www.bnl.gov*, where these publications, as well as extensive information about BNL's science and operations, past and present, are posted. In addition, employees and the community can subscribe to the Laboratory's e-mail news service at *https://lists.bnl.gov/mailman/listinfo/bnl-announce-1*. Community members who have questions or comments can "Let us know" by clicking on the link found under "Listening to you" on the Stakeholder Relations Office website at *www.bnl.gov/stakeholder/*. Community members can also subscribe to the monthly e-newsletter, *LabLink*, found on the Stakeholder Relations webpage at *www.bnl.gov/lablink. LabLink*, which keeps the community informed about happenings at BNL, explains the science behind Laboratory research, and invites subscribers to educational and cultural events.

2.4.2.2 Community Involvement in Cleanup Projects

In 2013, BNL shared information with stakeholders on several environmental projects:

- *Environmental Assessment (EA) for the Management of the White-tailed Deer Population at BNL*: Deer management has been identified as a need at BNL for more than a decade. In working toward management of the deer population on site, BNL has held information sessions, polled its employees, and discussed the issue with regulatory and resource agencies. Several strategies for deer management were evaluated and a preferred alternative, *Integrated Wildlife Damage Management*, was selected. The CAC and BER received updates at their February meetings and a Notice of a Completed EA with a "Finding of No Significant Impact" was published in Long Island's *Newsday* on March 21, 2013.
- *New York State Department of Environmental Conservation Title V Facility Permit Renewal*: BNL manages a number of facilities which are subject to federally enforceable regulatory requirements. Among the more significant is the Central Steam Facility which operates four boilers. Two of the boilers are subject to new source performance standards (NSPS) Subpart DB requirements and are equipped with continuous emissions monitoring systems. Other regulated sources include a paint spray booth and two on-site gasoline refueling facilities. A Notice of Completed Application was published in *Newsday* on October 16, 2013 that provided the public with an opportunity to review and comment on the permit renewal application.
- *Modification of BNL's State Pollutant Discharge Elimination System (SPDES) Permit*: As part of the Wastewater Treatment Modification Project that began in 2009, BNL proposed to eliminate the discharge of its Sewage Treatment Plant effluent to the Peconic River and instead redirect the treated effluent to nearby groundwater recharge basins. A Notice of Complete Application was published in *Newsday* on November 21, 2013. Effluent limits and monitoring requirements were added to the draft permit, and the public was given 30 days to review and comment.

In addition to the projects outlined above, stakeholders were updated on the progress of other environmental cleanup projects, additional initiatives, and health and safety issues via mailings and briefings and presentations given at CAC and BER meetings. These topics included:

- *2011 Annual Groundwater Update*: The CAC received a presentation on the highlights of the annual report in January 2013. Details on the status and effectiveness of the groundwater treatment systems was provided, including an update on the new treatment system installed for the Building 452 Freon-11 plume.
- *Natural Resource Management Update*: The status of the Deer Management Plan and the schedule for implementing it, the 4-poster tick control devices, impacts from the spring 2012 wildfire, and Super Storm Sandy impacts were discussed during a February presentation to the CAC. Information from monitoring the populations of other wildlife found on site was also provided. There was also a brief discussion on the progress of the restoration of the Peconic River following the 2011 completion of the supplemental cleanup.
- *Wastewater Treatment Modification Project*: The CAC received an update on the design and construction status of this ongoing project, which will remove the Sewage Treatment Plant outfall from the Peconic River and re-direct the treated effluent to new groundwater recharge basins.
- *Ticks and Tick Borne Disease Awareness*: Because Suffolk County has a very high Lyme disease case rate, the Laboratory provided the CAC with a presentation on the risks of Lyme and other tick borne diseases, in June. Information was provided on reducing the risk of being bitten, how to remove a tick, and how to recognize the symptoms of tick borne illnesses.
- *Groundwater Treatment System Modification*: In September, an update was given to

Table 2-4. Summary of BNL 2013 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.
Groundwater Projects	OU III/V/VI	▪ Continued operation of 11 groundwater treatment systems that remove volatile organic compounds (VOCs),two systems that remove strontium-90 (Sr-90), and a pump and recharge system for tritium. ▪ Following approval from the regulatory agencies, four treatment systems were shut down and placed in an operationally-ready stand-by mode. One system was partially decommissioned in 2013 following approval from the regulators. ▪ Began operation of a new extraction well to address deeper VOC contamination in the vicinity of Middle Road. ▪ 183 pounds of VOCs and 1.3 mCi of Sr-90 were removed during the treatment of 1.4 billion gallons of groundwater. Since the first groundwater treatment system started operating in December 1996, approximately 7,133 pounds of VOCs and 28.7 mCi of Sr-90 have been removed, while treating over 22 billion gallons of groundwater. ▪ Collected and analyzed approximately 1,702 sets of groundwater samples from 653 monitoring wells. ▪ Installed several temporary wells and collected multiple samples from each location, including in the Industrial Park, to determine the extent of deeper VOC contamination and the need for an additional extraction well(s). ▪ Monitoring of the OU V VOC plume concluded. ▪ Continued monitoring the g-2 tritium plume using temporary and permanent monitoring wells.
Peconic River	OU V	▪ Performed year 8 of long-term post-cleanup monitoring of Peconic River surface water and sediment. ▪ Fish collection was performed in 2013; next collection will be in 2015. ▪ Continued monitoring and maintenance of invasive species at three excavated sediment locations within the Peconic River.
Reactors	Brookhaven Graphite Research Reactor (BGRR)	▪ Continued long-term surveillance and maintenance.
	High Flux Beam Reactor (HFBR)	▪ Continued long-term surveillance and maintenance.
	Stack (Building 705)	▪ Continued long-term surveillance and maintenance.
	Brookhaven Medical Research Reactor (BMRR) (Project managed by EPD)	▪ Continued surveillance and maintenance activities.
Buildings 810/811	Radiological Liquid Processing Facility (Project managed by EPD)	▪ Performed routine surveillance and maintenance of the facility. ▪ EPD removed and shipped the last of the 20,000 gallon tanks from the facility for disposal. ▪ EPD emptied and decontaminated Building 810 for use as a propylene glycol recycling facility.
Building 801	Inactive Radiological Liquid Holdup Facility (Project managed by EPD)	▪ Performed routine surveillance and maintenance of the facility.
Building 650	Inactive Radiological Decon Facility (Project managed by EPD)	▪ Performed routine surveillance and maintenance of the facility.

Note:
EPD = Environmental Protection Division

the CAC on deeper contamination found on site in the vicinity of the OU III Middle Road VOC plume. The deeper contamination would not be captured with the existing extraction wells so a new, deeper well was drilled and will be tied into the existing treatment system.

- *Peconic River Monitoring*: The CAC and BER were provided with the results from sampling the water column and fish in the river. The sampling results for mercury and methyl mercury found in the water column was similar to past data. However, the results for the average mercury levels found in the fish sampled on site were higher than expected. The higher levels were attributed to the sampling a small number of larger and older fish.
- *The 2012 Site Environmental Report*: In November, the CAC received a presentation on the Laboratory's environmental impact for the previous year.
- *2012 Annual Groundwater Update*: A complete review of the Laboratory's groundwater treatment systems was provided to the CAC in December. The systems that have reached their capture goals were discussed and the status of the Building 96 VOC plume source area and the Building 452 Freon-11 plume was given. Detailed cross-section maps of several of the plumes were shown and the reduction in size of the plumes that has occurred over time was highlighted.

Working closely with the community, employees, elected officials, and regulatory agency representatives, DOE and BNL continue to openly share information on issues, projects, and programs and welcome all input and feedback offered.

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 436.1, *Departmental Sustainability*, BNL prepares an Environmental Monitoring Plan (BNL 2012), 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 2013 there were 7,880 sampling events of groundwater, potable water, precipitation, air, plants and animals, soil, sediment, and discharges under the Environmental Monitoring Program. Specific sampling 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 quality comply with regulatory and permit limits issued under the federal Clean Air Act, Clean Water Act, Oil Pollution Act, SDWA, and the New York State equivalents. Included in compliance monitoring are the following:

- *Air emissions monitoring* is conducted at reactors (no longer in operation), accelerators, and other radiological emission sources, as well as the Central Steam Facility (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: 12 under BNL's SPDES Permit, and 12 under equivalency permits issued to the Environmental Restoration Program for groundwater treatment systems. As required by permit conditions, samples are collected daily, weekly, monthly, or quarterly and monitored for organic, inorganic, and radiological parameters. Monthly discharge monitoring reports (DMRs) that provide analytical results and an assessment of compliance for that reporting period are filed with the NYSDEC. 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 Waste Management Facility. 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 SDWA, which is administered by SCDHS.

2.4.3.2 Restoration Monitoring

The Environmental Restoration Program operates and maintains groundwater treatment systems to remediate contaminant plumes both

Table 2-5. Summary of BNL 2013 Sampling Program Sorted by Media.

Environmental Media	No. of Sampling Events(a)	Purpose
Groundwater	2,815 (b)	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	41	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 184 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)	116	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	16	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	250	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	341 ES/C 50 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.
Fauna	84	Fish and deer are monitored to assess impacts on wildlife associated with past or current BNL operations. See Chapter 6 for further detail.

(continued on next page)

Table 2-5. Summary of BNL 2013 Sampling Program Sorted by Media *(concluded).*

Environmental Media	No. of Sampling Events(a)	Purpose
Flora	28	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	51	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	715	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	1,030	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 SER Volume II, Groundwater Status Report, for further details.
Vehicle Monitor Checks	102	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.
State Pollutant Discharge Elimination System (SPDES)	437	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.
Flow Charts	618	Flowcharts are exchanged weekly as part of BNL's SPDES permit requirements to report discharge flow at the recharge basin outfalls.
Floating Petroleum Checks	109	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	744	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)	109	To ensure that the concentrations of contaminants reported in the Site Environmental Report are accurate, additional quality assurance 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	**7,880**	The total number of sampling events includes all samples identified in the Environmental Monitoring Plan (BNL 2013), 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 65 temporary wells; many of which are used to collect multiple samples at different depth intervals.
C = Compliance
ER = Environmental Restoration (CERCLA)
ES = Environmental Surveillance

on and off site. BNL maintains an extensive network of groundwater monitoring wells to verify the effectiveness of the remediation effort. Modifications to groundwater remediation systems are implemented, as necessary, based upon a continuous evaluation of monitoring data and system performance. Additionally, surface water, sediment and fish sampling is conducted to verify the effectiveness of the Peconic River cleanup efforts. Peconic River monitoring is coordinated with the Surveillance Monitoring Program to ensure completeness and to avoid any duplication of effort.

Details on the Peconic River monitoring program are provided in Chapter 6, and details on groundwater monitoring and restoration program are provided in Chapter 7 and SER Volume II, *Groundwater Status Report*.

2.4.3.3 Surveillance Monitoring

Pursuant to DOE Order 436.1, *Departmental Sustainability*, 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 and 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 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.*

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 and audits have consistently observed a high level of management involvement, commitment, and support for environmental protection and the EMS. For more than 60 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.

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