

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 2014, an EMS surveillance audit determined that BNL remains in conformance with the ISO 14001: 2004 Standard.

In 2014, the Laboratory continued its strong support of the BNL Pollution Prevention Program, which seeks ways to eliminate waste and toxic materials. Pollution prevention projects resulted in more than \$4.09 million in cost avoidance or savings and resulted in the reduction or reuse of approximately 35.5 million pounds of waste. Also in 2014, the BNL Pollution Prevention Program funded two new proposals, investing approximately \$9,000. Anticipated annual savings from these projects are estimated at approximately \$10,000, for an average payback period of slightly less than one year. 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 all 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 as 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 SAFETY 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, as a whole, 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 surveillance audit was conducted by auditors from NSF International Strategic Registrations in June 2014 (OHSAS 18001 results are not included in this report). The audit identified one nonconformance in BNL's Cultural Resource program involving tagging of artifacts that are part of the Historical Resource Identification Tag Program.

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 the Laboratory'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 the Laboratory's performance in 2014.

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 2014, 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 how they 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 2013c). 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 2014.

Table 2-1. EO 13514 Goals: Status Summary for Fiscal Year (FY) 2014.

DOE Goal	BNL Performance Status	BNL Planned Actions and Contributions
Goal 1: Greenhouse Gas (GHG) Reduction		
28 percent Scope 1 and 2 GHG reduction by FY 2020 from a FY 2008 baseline (2014 target: 19 percent).	<ul style="list-style-type: none"> The FY 2008 baseline was 205,628 MtCO_{2e}. In FY 2014, BNL's Scope 1 and 2 GHG emissions totaled 131,422 MtCO_{2e}—a decrease of 36.1 percent against the FY 2008 baseline. This total is in accordance with the Consolidated Energy Data Report. However, this value does not reflect adjustments by the Sustainable Performance Office for the Long Island Solar Farm (LISF). BNL estimates the total FY14 GHG value to be approximately 95,500 MtCO_{2e}. 	<ul style="list-style-type: none"> Continuing efforts in FY 2014 included hydropower, the Long Island Solar Farm (LISF), on-site photovoltaic (PV) research and development, Renewable Energy Credit (REC) purchases, and energy intensity reduction through the Utility Energy Services Contract (UESC) Phase I. A study was initiated to determine how a UESC could be used to finance a "right-sized" Combined Heat and Power (CHP) at BNL. Preliminary audits by two energy services companies (ESCOs) are underway for potential Phase II work.
13 percent Scope 3 GHG reduction by FY 2020 from a FY 2008 baseline (2014 target: 5 percent).	<ul style="list-style-type: none"> Overall, Scope 3 GHG emissions have been reduced by 13.58 percent from the FY 2008 baseline of 20,136 MtCO_{2e} to 17,401 MtCO_{2e} in FY 2014. Emissions specifically from employee business travel have increased by 2.2 percent from 8,800 MtCO_{2e} in FY 2008 to 8,995 MtCO_{2e} in FY 2014. 	<ul style="list-style-type: none"> Further improvements in metrics for measuring commuting GHG reductions. Expanding teleconferencing capabilities through the deployment of enhanced communication technologies during site-wide telephone replacement. Converting the current Rideshare website to a Commuter Choice website and adding new intranet links to other BNL web locations to expand visibility and accessibility. Identifying steps necessary to retrieve accurate counts of exempt and nonexempt monthly employees working 4-day, 40-hour and 9-day, 80-hour compressed work schedules, as well as the number of telework days from PeopleSoft HR time reporting records. Changing the standard allowable rental in domestic and foreign travel standard procedures from a mid-size to a compact vehicle.
Goal 2: Sustainable Buildings		
30 percent energy intensity BTU/GSF (British Thermal Units Per Gross Square Foot) reduction by FY 2015 from a FY 2003 baseline (2014 target: 27 percent).	<ul style="list-style-type: none"> BNL's FY 2014 energy intensity was 251,094 Btu/GSF. This level represents a cumulative reduction of 22.4 percent from the FY 2003 baseline of 323,780 Btu/GSF. UESC effort was 50 percent complete by the end of 2014. 	<ul style="list-style-type: none"> The Utility Energy Services Contract was awarded on October 22, 2013. Phase I implementation was approximately 50 percent complete as of late 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 UESC Phases and other planned initiatives include providing "free" cooling, improving the steam system, and CHP. Preliminary audits are underway. Presentations to BNL complexes and facility managers will begin in late fall 2015 to emphasize the importance of building temperature setback.
Energy Independence and Security Act Section 432 energy and water evaluations.	<ul style="list-style-type: none"> 100 percent completed within last 4 years. 	<ul style="list-style-type: none"> Green Energy Surveys are in process and on schedule. 25 percent of Laboratory buildings were surveyed by VFA in FY 2014. The reporting format has been revised to better emphasize potential energy projects.

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CHAPTER 2: ENVIRONMENTAL MANAGEMENT SYSTEM

Table 2-1. EO 13514 Goals: Status Summary for Fiscal Year (FY) 2014 (continued).

DOE Goal	BNL Performance Status	BNL Planned Actions and Contributions
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). (2014 status: 90 percent and 75 percent, respectively).	<ul style="list-style-type: none"> ▪ The status of individual building metering is as follows: electric: 97 percent; natural gas: 100 percent; steam: 85 percent; and chilled water: 100 percent. ▪ 17 Ethernet-based Power Quality meters were installed throughout the Laboratory. ▪ 5 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 ▪ Advanced potable water metering has been installed in the Interdisciplinary Science Building-1. ▪ A new chilled water meter for Data Center 515 has been installed and is operating. 	<ul style="list-style-type: none"> ▪ Additional meter installations are on-going. ▪ The Laboratory is investigating the need for additional sub-meters for and IT loads that are not on the uninterruptable power circuits. A potential project to relocate/consolidate BNL data centers provides an opportunity to improve data center performance and metering.
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.	<ul style="list-style-type: none"> ▪ Unless uneconomical, all roof replacements are designed and constructed in accordance with the requirements for cool roofs. 	<ul style="list-style-type: none"> ▪ Roof repairs and replacements will be performed at Buildings 510, 624, and 725. Meeting the cool roof requirements will be performed during the design phase.
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 (HPSB) by FY 2015 (2014 target: 13 percent).	<ul style="list-style-type: none"> ▪ The Modernization Project Office continues to make progress towards the 15 percent requirement. At the end of FY 2014, BNL is 85 percent HPSB compliant for 10 buildings that will not achieve Leadership in Energy and Environmental Design (LEED) certification. ▪ Tasks completed in FY 2014 include HPSB upgrades at Building 599, re-evaluation of Building 98 for HPSB compliance, and the commencement of the roof replacement at Building 438. 	<ul style="list-style-type: none"> ▪ Complete remaining work to meet the 15 percent milestone. Activities include Building 860 RTU and duct replacement, Building 98 miscellaneous tasks, remaining retro commissioning, and finalization of procedure and policy changes.
All new construction, major renovations, and alterations of buildings greater than 5,000 gross square feet must comply with Guiding Principles.	<ul style="list-style-type: none"> ▪ All recently completed projects obtained LEED certifications 	<ul style="list-style-type: none"> ▪ HPSB requirements will be included in the conceptual design for the Building 725 renovation.
Efforts to increase regional and local planning coordination and involvement.	<ul style="list-style-type: none"> ▪ BNL continues to investigate public transportation and increased carpool ridership. ▪ Local renewable energy is supported through the Long Island Solar Farm and the Northeast Solar Energy Research Center. ▪ Natural resource activities include measuring the impact of large-scale solar installations. 	<ul style="list-style-type: none"> ▪ The Laboratory will continue to support federal and local efforts to reduce reliance on petroleum by establishing a working group to reduce single occupancy vehicles and examining alternate work schedules in FY 2015. ▪ The Laboratory will implement the deer management program and re-deploy tick management techniques in FY 2015. ▪ The Laboratory will continue to host conferences and attend meetings to promote the BNL's renewable energy strategies in FY 2015.
Goal 3: Fleet Management		
10 percent annual increase in fleet alternative fuel consumption by FY 2015 relative to a FY 2005 baseline (2014 target: 136 percent cumulative since 2005).	<ul style="list-style-type: none"> ▪ Based on Fleet Automotive Statistical Tool (FAST) data, the total annual alternative fuel consumption is: <ul style="list-style-type: none"> -FY 2012: 36,416 gas gallon equivalent (gge) -FY 2013: 43,563 gge -FY 2014: 51,449 gge 	<ul style="list-style-type: none"> ▪ BNL plans to convert to General Services Administrative (GSA) leasing, which will replace older gasoline vehicles with alternative fuel vehicles.

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Table 2-1. EO 13514 Goals: Status Summary for Fiscal Year (FY) 2014 (continued).

DOE Goal	BNL Performance Status	BNL Planned Actions and Contributions
2 percent annual reduction in fleet petroleum consumption by FY 2020 relative to a FY 2005 baseline (2014 status: 18 percent cumulative since 2005).	<ul style="list-style-type: none"> Based on FAST data, the total annual petroleum consumption is: <ul style="list-style-type: none"> -FY 2012: 80,418 gge -FY 2013: 71,865 gge -FY 2014: 61,110 gge 	<ul style="list-style-type: none"> BNL plans to convert to GSA leasing, which will replace older gasoline vehicles with alternative fuel vehicles.
100 percent of light duty vehicle purchases consist of alternative fuel vehicles (AFV) by FY 2015 and thereafter (75 percent by FY 2000-2015).	<ul style="list-style-type: none"> All purchases are alternative fuel vehicles where available. 	<ul style="list-style-type: none"> GSA leasing can provide 100 percent of light duty vehicles as alternative fuel vehicles.
Goal 4: Water Use Efficiency and Management		
26 percent potable water intensity (gallons per gross square foot) reduction by FY 2020 from a FY 2007 baseline (2014 target: 14 percent).	<ul style="list-style-type: none"> Annual water use intensity has decreased from 101.2 gallons per gross square foot to 89.1 gallons per gross square foot, an 11.9 percent water usage reduction since base year 2007. 	<ul style="list-style-type: none"> The Laboratory will continue to implement BNL's Water Management Plan. New construction and renovation will utilize water-efficient processes and plumbing fixtures to conserve water. Increased science activities that involve accelerator cooling due to using cooling tower evaporation are expected to increase water use.
20 percent water consumption (gallons) reduction of industrial, landscaping, and agricultural (ILA) water by FY 2020 from a FY 2010 baseline (2014 target: 8 percent).	<ul style="list-style-type: none"> No permanent landscaping or agricultural water use. 	<ul style="list-style-type: none"> 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 FY 2015.	<ul style="list-style-type: none"> Over the past 13 years, BNL's annual diversion rate of non-hazardous solid waste has been above the 50 percent baseline level prescribed by the Executive Order, ranging between 54 percent and 68 percent. During FY 2014, the recycling rate was approximately 66 percent. 	<ul style="list-style-type: none"> BNL will continue to divert non-hazardous solid waste at or above the 50 percent baseline level, as well as focus on educating employees on the Laboratory's recycling programs. Continuing with past tradition, the P2 Program will also solicit ideas for partial or full funding of projects that minimize waste or help prevent pollution.
Divert at least 50 percent of construction and demolition debris by FY 2015.	<ul style="list-style-type: none"> BNL recycles 95 percent of construction, demolition, and woody debris. 	<ul style="list-style-type: none"> Construction materials will continue to be sent to the Construction & Demolition (C&D) transfer station for sorting and recycling. Concrete, stone, and brick demolition debris will continue to be converted into recycled concrete aggregate (RCA) via a concrete crusher.
Goal 6: Sustainable Acquisition		
Procurements meet requirements by including necessary provisions and clauses in 95 percent of applicable contracts.	<ul style="list-style-type: none"> The requirement for Sustainable Acquisition are incorporated into all of BNL's Terms and Conditions issued by the Property and Procurement Division. 	<ul style="list-style-type: none"> The following actions are planned for FY15 and beyond: (1) develop awareness training for green products for Material Coordinators; (2) provide technical assistance and education to the Laboratory community on the use and availability of green products and services; (3) increase communication on Sustainable Acquisition through Lessons Learned and success stories; and (4) continue to modify the Laboratory's E-Procurement (E-Pro) system to increase green purchasing.
Goal 7: Electronic Stewardship and Data Centers		
All data centers are metered to measure a monthly Power Utilization Effectiveness (PUE) of 100 percent by FY 2015 (2014 status: 90 percent).	<ul style="list-style-type: none"> Initial PUE study indicated current PUE to be above 1.6. Additional electric meters and one new chilled water meter installed in FY 2014. Continued effort to identify and install additional metering so that a more accurate PUE for each data center may be measured and monitored. 	<ul style="list-style-type: none"> BNL is investigating the need for additional sub-meters for any IT loads that are not on the uninterruptible power circuits.

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Table 2-1. EO 13514 Goals: Status Summary for Fiscal Year (FY) 2014. (concluded).

DOE Goal	BNL Performance Status	BNL Planned Actions and Contributions
Core data centers maximum annual weighted average PUE of 1.4 by FY 2015 (2014 status: 1.5 percent).	<ul style="list-style-type: none"> The most recent evaluation of the main data center calculates the PUE at 1.79 for FY 2014. The small data center in Building 459 had a PUE of 2.1. 	<ul style="list-style-type: none"> A potential project to relocate/consolidate BNL data centers provides an opportunity to improve data center performance and metering.
Power Management - 100 percent of eligible PCs, laptops, and monitors with power management actively implemented and in use by FY 2012.	<ul style="list-style-type: none"> All systems in the BNL domain that are capable of power management have the setting enabled. 	<ul style="list-style-type: none"> BNL will continue to evaluate the feasibility of extending this desktop computer-power management policy to other operating systems.
Electronic Stewardship - 95% of eligible electronics acquisitions meet EPEAT standards	<ul style="list-style-type: none"> In FY 2014, the contract governing the procurement of printers, laptops, and desktop computers ordered through the BNL E-Procurement system required that they have an EPEAT "Gold" certification. 	<ul style="list-style-type: none"> The Laboratory will continue to require that all printers, laptops, and desktop computers ordered through the E-Procurement System have an EPEAT "Gold" certification.
Goal 8: Renewable Energy		
20 percent of annual electricity consumption from renewable sources by FY 2020 (2014 target: 7.5 percent).	<ul style="list-style-type: none"> 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 FY 2013, provided 52 million kWh/year of clean renewable energy to Long Island. The on-site NSERC solar array became operational in May 2014. Once fully built, the annual output is estimated at approximately 7000,000 kWh. 	<ul style="list-style-type: none"> A commercial evaluation of the 2013 CHP/biomass study was initiated in FY 2014 to further determine the viability of CHP at BNL; it will be completed in early 2015. REC purchases will continue and the quantity will need to be significantly increased due to the 20 percent requirement.

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 2014, BNL generated the following types and quantities of waste from routine operations:

- Hazardous waste: 4.3 tons
- Mixed waste: 96 ft3
- Radioactive waste: 3,261 ft3

Hazardous waste from routine operations in 2014 increased from 2013 generation rates, as shown in Figure 2-1a. This was not attributed

to any one source, but rather due to small increases in generation throughout the Laboratory. Mixed waste generation remained relatively steady from 2013 rates, as shown in Figure 2-1b. As shown in Figure 2-1c, the radioactive waste quantity for routine operations increased from 2013 rates, which is primarily attributed to increased operations at the BNL's accelerator facilities. 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 cleanouts) are considered non-routine. In 2014, BNL continued to reduce the inventory of legacy waste materials through laboratory cleanouts. Wastes from facility decommissioning activities included some remaining debris and equipment from the former Hot Shop and former Brookhaven Medical Research Reactor (BMRR). 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.

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 2014, 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 2014, these efforts resulted in more than \$4.09 million in cost avoidance or savings and approximately 35.5 million pounds of materials being reduced, recycled, or reused annually. BNL's biggest pollution prevention project in 2014 was the kickoff of the Utility Energy Services Contract (UESC), which included energy-efficient lighting, new building controls and commissioning, and an energy-efficient chiller project.

The Laboratory also has an active and successful solid waste recycling program, which involves all employees. In 2014, BNL collected approximately 150 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.

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 2014 was approximately 3 percent higher than in 2013. This minor increase can be attributed to an increase in process cooling that utilize cooling towers. In each of the past 9 years, the water consumption total was approximately half the 1999 total—a reduction of nearly a half-billion gallons per year.

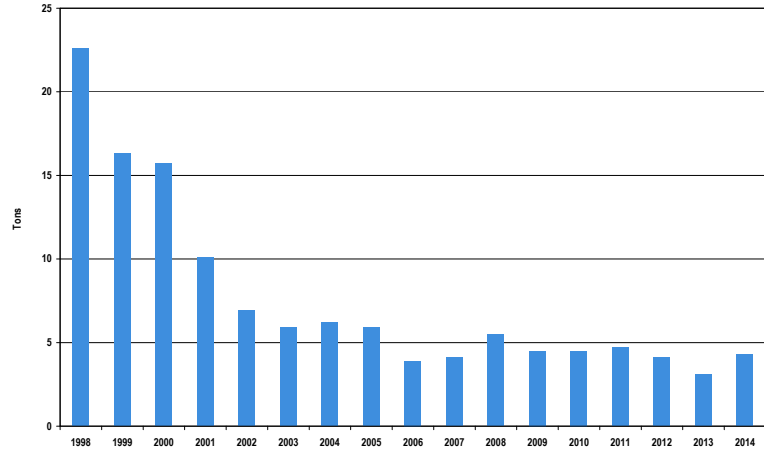


Figure 2-1a. Hazardous Waste Generation from Routine Operations, 1998 – 2014.

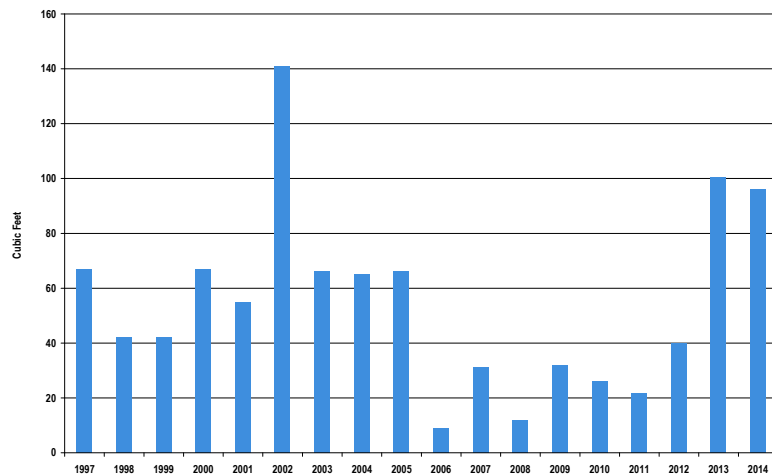


Figure 2-1b. Mixed Waste Generation from Routine Operations, 1998 – 2014

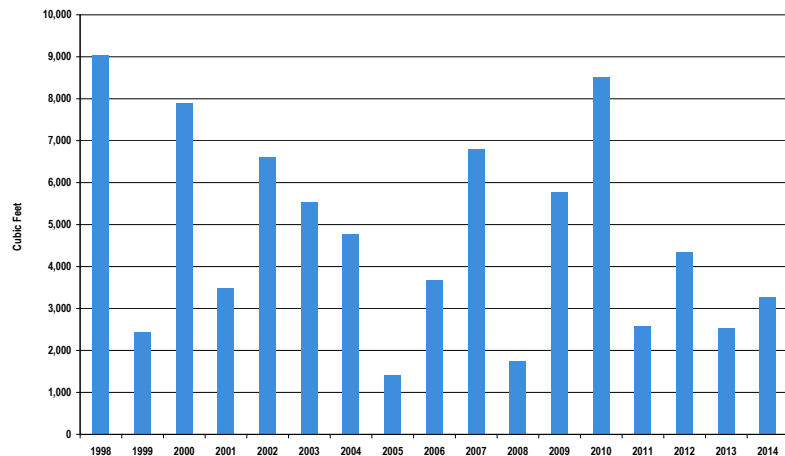


Figure 2-1c. Radioactive Waste Generation from Routine Operations, 1998 – 2014.

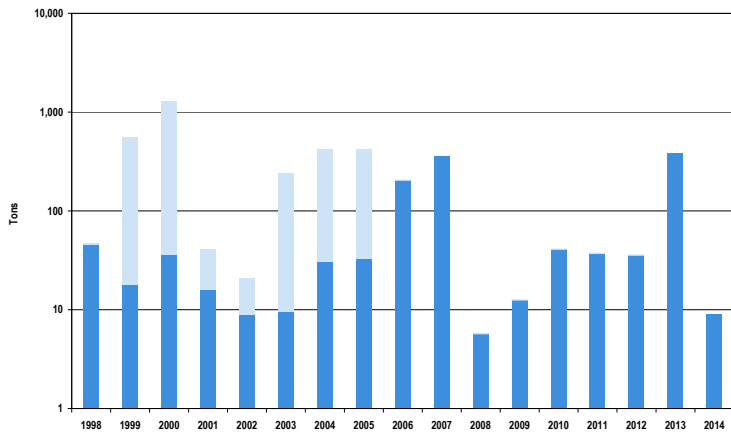


Figure 2-1d. Hazardous Waste Generation from ER and Nonroutine Operations, 1998 – 2014.

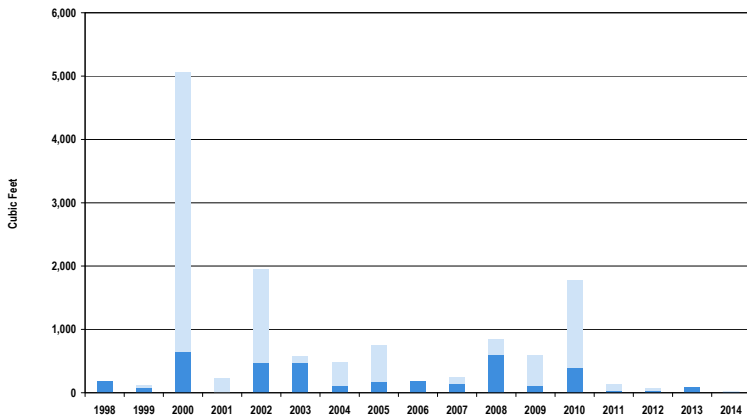


Figure 2-1e. Mixed Waste Generation from ER and Nonroutine Operations, 1998 – 2014.

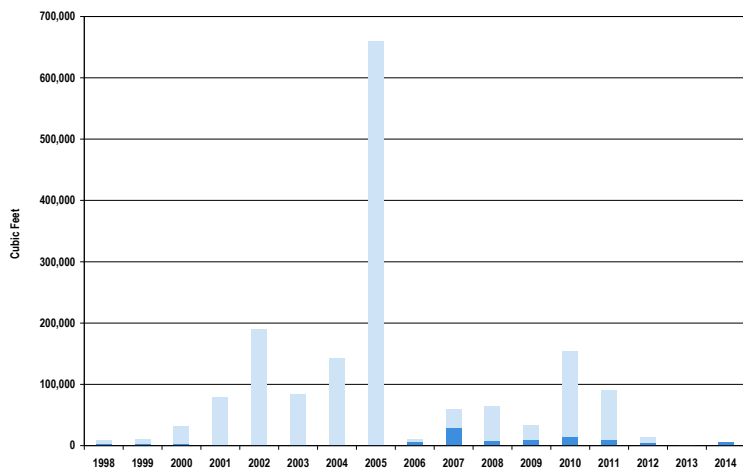


Figure 2-1f. Radioactive Waste Generation from ER and Nonroutine Operations, 1998 – 2014.

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 4.9 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 2014, BNL used approximately 291 million kilowatt hours (kWh) of electricity, 102,000 gallons of fuel oil, 19,000 gallons of propane, and 670 million ft³ 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 price disparity between

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
Utility Energy Service Contract (UESC)*	Greenhouse Gas Reduction and Energy Conservation	15,448,400	Greenhouse Gas	0	750,000	1,380,000	UESC includes: installed energy efficient lighting and controls in 17 buildings; energy management control upgrades in 9 buildings; and installation of an energy-efficient 1,250 ton electric centrifugal chiller at the Chilled Water Facility.
Refurbished Cafeteria Food Waste Disposal Area	Recycling	200	Recyclables	N/A	4,500	N/A	New countertops and posters were incorporated into the BNL Cafeteria food waste disposal area. The countertops do not allow food trays to be thrown in the trash and the posters indicate what product goes in each disposal opening.
Once Thru Cooling	Water Conservation	7,188,480	Water	\$0	\$0	\$1,000	Replaced a once thru cooling system with a closed loop system supplied by the Chilled Water Plant.
Replacement of X-Ray Film Processing with Chemiluminescent Imaging	Substitution	835	Hazardous and Industrial Liquid Wastes	\$0	\$5,500	\$179,000	Cost savings reflect labor savings, waste disposal savings, and items (such as film) which will no longer need to be purchased.
Motion Sensors for Building 725	Energy Conservation	N/A	Greenhouse Gas and Energy Conservation	N/A	\$0	\$6,000	Installation of motion-sensored lighting in hallways, restrooms, and conference rooms in Building 725 during 2011.
LED Lighting in 490 Conference Room	Energy Conservation	N/A	Greenhouse Gas, Energy Conservation, Manpower	\$0	\$0	\$3,710	(40) 65-Watt incandescent bulbs were replaced with LED bulbs during 2011. Savings = \$1190/year in energy costs and \$2520/year in man-power costs.
Motion Sensors for Building 820	Energy Conservation	N/A	Greenhouse Gas and Energy Conservation	N/A	\$0	\$1,650	Installation of motion-sensored lighting in Physics research area of Building 820.
Sewage Sludge	Publicly Owned Treatment Works (POTW)	3,000	Low-Level Radiological Waste (LLRW)	\$0	\$12,000	-\$12,000	Radiological constituents were eliminated from within the Sewage Treatment Facility and the sludge is now sent to a POTW.
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 and Energy Conservation	\$0	\$0	\$0	BNL is utilizing different alternative fuels to operate maintenance vehicles.
Motion Sensors for labs*	Energy Conservation	N/A	Greenhouse Gas and 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	\$43,872	\$0	\$43,872	Empty aerosol cans are recycled as scrap, rather than sent to the Waste Management Division as hazardous waste. Eight units (F&O=5; CA=1; NSLS=1; BES =1) each handle 66 lbs. of hazardous waste.
Electronic Reuse	Reuse	20,991	E-Waste	\$52,478	\$0	\$52,478	BNL tracks electronic equipment and takes a reuse credit for transfer of equipment to another user.
Building Demolition Recycling	Recycling	11,000,000	Industrial Waste	\$464,935	\$25,000	\$459,935	On-site demolition products (steel and concrete) are segregated, recycled, and reused.
System One Parts Cleaner	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	20,000	Low-level Radiological Waste (LLRW)	\$427,680	\$0	\$427,680	Animal bedding material is no longer sent to 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 LLRW.
Lead Acid Batteries	Recycled	2,720	Universal Waste	\$19,889	\$0	\$19,889	Avoids hazardous waste disposal costs for approximately 40 lbs. of lead per battery.
Short Half-Life Waste - CA	Decay in Storage	73	Radioactive Waste	\$28,908	\$0	\$28,908	During 2014, 11 boxes of filters from Buildings 914 and 919 (77 ft3) were managed in accordance with BNL decay-in-storage requirements, rendering the wastes eligible for volumetric release.
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 Research 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.

(continued on next page)

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

Waste Description	Type of Project	Pounds Reduced, Reused, Recycled or Conserved in 2013	Waste Type	Potential Costs for Treatment and Disposal	Cost of Recycle, Prevention	Estimated Cost Savings	Project Description Details
Blasocut Machining Coolant	Recycled/ Reused	38,800	Industrial Waste	\$109,730	\$0	\$119,330	Central Shops Division operates a recycling system that reclaims Blasocut machining coolant and supplies it Laboratory-wide. In 2014, 4,850 gallons (38,800 lbs.) of Blasocut lubricant were recycled. Recycling involves aeration, centrifuge, and filtration. This avoids the cost of disposal as industrial waste and an avoided cost of buying 12 drums of concentrate (\$800/drum) and 97 empty drums for shipping (\$50/drum).
Fluorescent Bulbs	Recycled	19,807	Universal waste	\$1,010,157	\$20,000	\$990,157	Fluorescent bulbs are collected and sent to a recycling facility under the Universal Waste exemption rule.
Used Motor Oil	Energy Recovery	2,000	Industrial Waste	\$40,840	\$0	\$40,840	Used motor oil from the motor pool and the on-site gas station is given to Strebels Laundry Service to fire their boilers. In 2014, they collected 2,000 gallons of oil at no charge to BNL, which avoided the costs for disposal and 40 shipping drums (\$50/drum).
Office Paper	Recycled	300,000	Industrial Waste	\$15,750	\$0	\$19,500	Cost avoidance based on \$105/ton for disposal as trash, plus \$40/ton revenue.
Cardboard	Recycled	155,160	Industrial Waste	\$8,146	\$0	\$12,025	Cost avoidance based on \$1,055/ton for disposal as trash, plus \$25/ton revenue.
Electronic Waste	Recycled	58,500	Industrial and Universal Waste	\$146,250	\$0	\$155,025	Cost avoidance based on \$105/ton for disposal as trash, plus \$900/ton revenue.
Metals	Recycled	511,150	Industrial Waste	\$26,835	\$0	\$103,508	Cost avoidance based on \$105/ton for disposal as trash, plus \$900/ton revenue.
Bottles/Cans	Recycled	34,200	Industrial Waste	\$1,796	\$0	\$1,796	Cost avoidance based on \$105/ton for disposal as trash.
Construction Debris	Recycled	701,100	Industrial Waste	\$36,808	\$0	\$18,229	Cost avoidance based on \$52/ton difference for disposal as trash.
TOTALS				\$2,488,083	\$817,000	\$4,092,357	

* The UESC is a 10-year contract with a projected life of 20 years. The 10-year annual payments were divided over 20 years to normalize the savings. This contract ends September 1, 2023

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 sometimes receives a rebate for each megawatt reduced on each curtailment day. BNL strives to keep electric loads at a minimum during the summer by scheduling operations at the Relativistic Heavy Ion Collider (RHIC) to avoid peak demand periods. In 2014, this scheduling reduced the electric demand at the Laboratory by 25 MW, saving approximately \$1.7 million in electric costs and helping to maintain the reliability of the Long Island Power Authority (LIPA) electric system to meet all of its users' needs. BNL also maintains a contract with the New York Power Authority (NYPA) that resulted in an overall cost avoidance of \$25.3 million in 2014.

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 includes approximately 120 million kWh of clean, renewable energy credits (RECs) received through the Long Island Solar Farm (LISF).

In 2011, BP Solar completed construction of the 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 three operational years was an average of 54 million kWh/year, substantially above the estimated annual average value. As an outcome of constructing this large array on site, the Laboratory has developed a solar research program that looks at impacts of climate change on large utility-scale PV systems, as well for 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 provides credit toward BNL's SSP renewable energy goal.

In May 2014, the Laboratory completed the installation of the first phase of the 1 MW solar PV array for additional research. The 500 kW phase one array is currently generating approximately 520,000 kWh/year of electricity. The remaining 500 kW is expected to be completed in 2016-2017.

To reduce energy use and costs at non-research facilities, several additional activities were undertaken by the BNL Energy Management Group in 2014:

- *NYPA Power Contract:* Third 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 2014 were \$25.3 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 has developed 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 annual SSP:* New electric and steam meter installations; funding for energy conservation initiatives; new energy-

Table 2-3. BNL Recycled Program Summary, 2000-2014.

Recycled Waste *	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Mixed paper	336	246	209	182	185	193	184	177	151	127	174	186	142	160	150
Cardboard	132	127	157	176	179	143	135	121	147	152	141	126	100	97	78
Bottles/Cans	19.5	29.3	19	23	22	22.1	27.7	24.4	19.6	23.7	24	22.5	18	16.5	17.1
Tires	0		3.5	12.3	11	12.8	32.5	19.9	34.5	15.5	10.1	9.2	10	7.1	7.6
Construction debris	243	289	304	334	367	350	297	287	302	312	416	256	380	304	351
Used motor oil (gallons)	3,296	3,335	1,920	3,920	3,860	4,590	2,780	2,020	1,500	1,568	1,700	1,145	1,585	1,550	2,000
Metals	534	44	48	193	128	559	158	382	460	91	131	84	278	174	256
Automotive batteries	2.2	4.8	6.3	4.6	5	4.6	5.5	2.5	2.7	4	1.6	2.1	2	2.1	1.4
Printer/Toner cartridges (units)	n/a	363	449	187	105	0	0	0	3,078	1,251	4,132	4,186	4,100	11,233	2,174
Fluorescent bulbs (units)	5,874	17,112	25,067	13,611	12,592	7,930	11,740	25,448	36,741	10,223	8,839	20,220	15,727	13,540	19,807
Blasocut coolant (gallons)	n/a	n/a	8,180	5,030	6,450	3,890	3,970	2,432	3,340	3,810	4,830	5,660	5,610	5,650	4,850
Antifreeze (gallons)	n/a	n/a	0	165	325	0	0	0	0	0	0	0	700	822	0
Tritium exit signs (each)	n/a	n/a	28	181	142	0	0	0	0	0	0	18	0	0	0
Smoke detectors (each)	n/a	n/a	40	0	0	0	0	0	0	0	0	0	0	0	0
Road base	n/a	n/a	2,016	0	2,666	0	0	0	0	0	0	0	0	0	0
Electronic reuse	n/a	n/a	0	0	0	0	0	0	16.3	11.4	12	11.6	3.2	1.4	10.5
Scrap electronics	n/a	n/a	0	0	0	6.1	70.3	40.5	48.9	17	16.7	19.9	30.9	23	29.3
Animal Bedding (composted)	n/a	n/a	0	0	0	0	6.3	19.6	42	41	52	54	3.3	30	10
Tyvek (lbs)	n/a	n/a	0	0	0	0	0	0	0	84	60	92	105	0	0
Demolition Projects															
Metals	n/a	n/a	8	23	11	6	35	0	0	0	0	0	60	90	0
Concrete	n/a	n/a	891	590	3,000	328	5,505	6175	0	0	4,050	0	4,050	3,500	4,000
Construction and debris	n/a	n/a	790	388	1,200	157	818	0	0	0	0	0	0	0	0

Notes: All units are tons, except where noted.

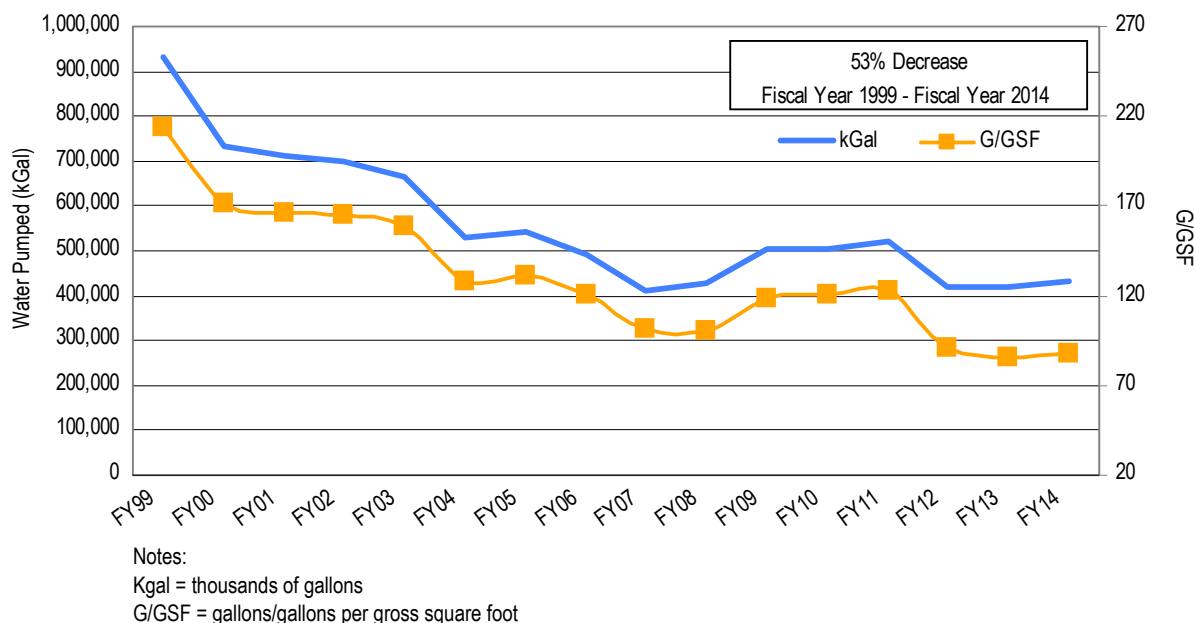


Figure 2-2. Annual Potable Water Use, 1999-2014.

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):** Continued support to DOE/BHSO in developing and implementing 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 planned work 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 was approximately 50 percent completed at the end of 2014 and is expected to be completed in June 2015. The environmental benefits of this UESC include: electrical savings of 3,549,114 kWh/year; fuel savings of 89,541 mmBtu/year; greenhouse gas reduction of 7,022 MTCO_{2e}; and a building energy intensity reduction of 11 percent.
- **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 meet or exceed 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 II (NSLS-II) 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 \$7.1 million per year compared to oil and \$400k compared to purchasing directly from National Grid.
- **Energy Savings:** 25 MW of demand is rescheduled each year to avoid coincid-

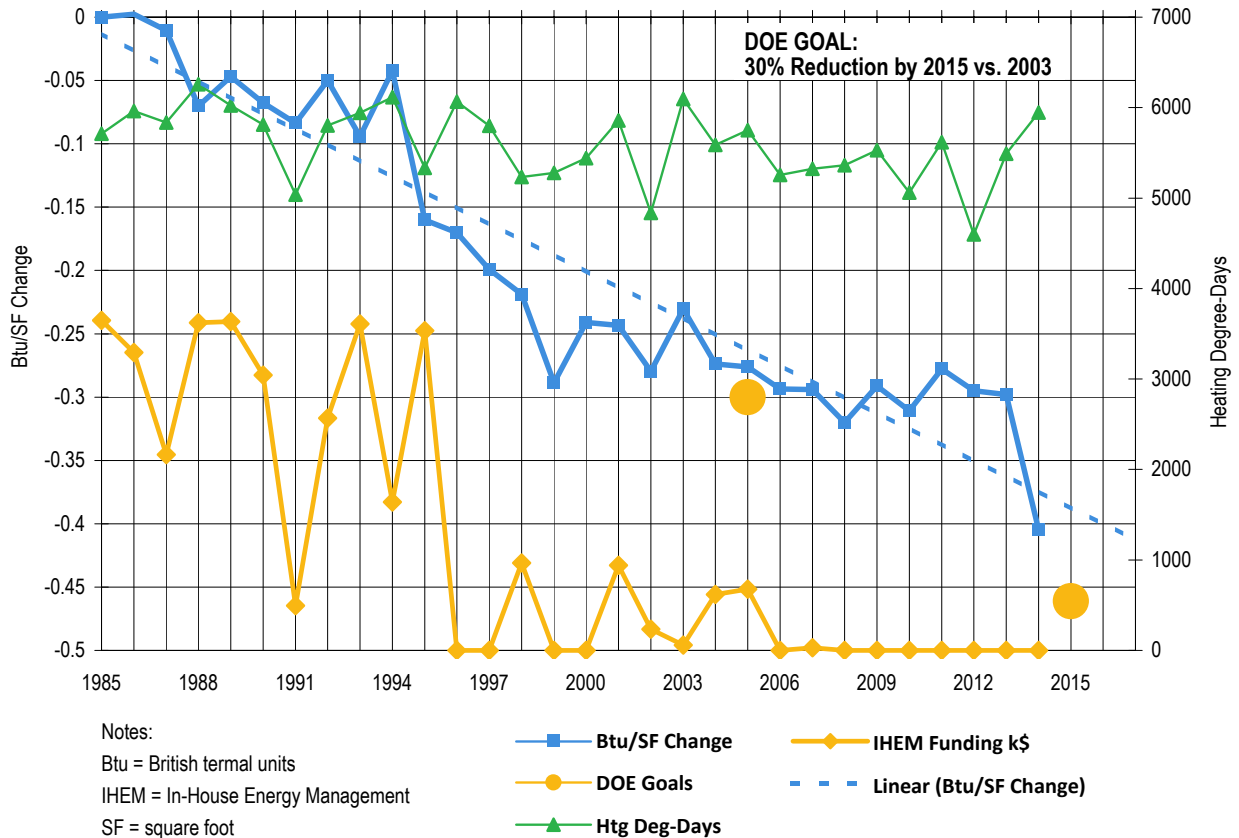


Figure 2-3. BNL Building Energy Performance, 2014 (Btu/SF Change Percent vs. Baseline Years).

ing with the utility summer peak, saving over \$1.7 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 2014 was approximately 22.6 percent less than in FY 2003, saving \$2.7 million. In addition, approximately 61,000 gasoline gallon equivalents (gge) gas alternative fuels 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.

As shown in Figure 2-3, BNL’s energy use per square foot in 2014 was 30 percent less than in FY 1985 and 22.6 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 27 other Long Island sites, 12 of which are in Suffolk County.

Each step of the CERCLA cleanup process is reviewed and approved by DOE, EPA, and NYSDEC, under an Interagency Agreement (IAG). 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.
- Perform the Remedial Design/Remedial Action, which includes final design, construction specifications, and carrying out the remedy selected.

In 2014, BNL's 12 active groundwater treatment systems removed approximately 143 pounds of volatile organic compounds (VOCs) and 1.2 mCi of strontium-90 (Sr-90) from the sole source aquifer. Following approval from the regulators, the North Street East Treatment System was shut down and placed in an operationally-ready stand-by mode in June 2014. The North Street Treatment system was placed back into operational mode due to a rebound in VOC concentrations. In addition, two new groundwater extraction wells were installed for the Industrial Park Treatment System. Also in 2014, long-term surveillance and maintenance (S&M) of the Laboratory's Brookhaven Graphite Research Reactor (BGRR) and the High Flux Beam Reactor (HFBR) continued. In accordance with the ROD, demolition of the HFBR stack will be completed prior to 2020.

Post-cleanup monitoring of Peconic River surface water, sediment, fish, and wetland vegetation continued in 2014, 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 continued through 2014, resulting in the meeting of all 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 2013b). 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 Operable Unit (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 External Affairs and Stakeholder Relations (EASR) Office 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). EASR 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. EASR also works to maintain relationships with BNL employees and external stakeholders that include neighbors, business leaders, elected officials, and regulators 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, EASR'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. In addition, EASR 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 its 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, 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 the Laboratory that are of importance to the community. The CAC is comprised of 27 member organizations and individuals representing civic, education, employee, community, environmental, business, and health interests. The CAC sets its own agenda in cooperation with BNL and meets monthly, except for July and August. 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 Stakeholders 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 to discuss 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 2014.
 - *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 2014, more than 5,000 visitors participated in the program.
 - *PubSci*: BNL's new quarterly science café and conversation series where the Laboratory's distinguished scientists appear at public venues to discuss cutting-edge

topics and research in an informal setting. During 2014, science-interested community members and BNL researchers discussed science topics that included the "Building Blocks of Matter," "Exploring the Huge Impacts of the Ultra Small," and "Illuminating the Secret Structures of the Atomic World."

- *ScienceOnScreen*: A new partnership program with the Huntington Cinema Arts Centre that gives BNL scientists an opportunity to present classic, cult, or documentary movies that serve as a "jumping-off" point to discuss their research began in 2014 with a showing of "Particle Fever," a film documenting the hunt for the Higgs boson. The program, supported by a grant from the Coolidge Corner Theatre Foundation with major support from the Alfred P. Sloan Foundation, will continue in 2015.

The Laboratory participates in various outreach events throughout the year that include festivals, workshops, BNL's Earth Day celebration, 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 publishes weekly employee newsletters—*Brookhaven This Week* and *The Brookhaven Digest*. In addition, the Director's Office web-based publication, the *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

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Table 2-4. Summary of BNL 2014 Environmental Restoration Activities.

Project	Description	Environmental Restoration Actions
Soil Projects	Operable Unit (OU) I/II/III/VII	<ul style="list-style-type: none"> Performed monitoring and maintenance of institutional controls for cleanup areas.
Groundwater Projects	OU III/V/VI	<ul style="list-style-type: none"> Continued operation of 10 groundwater treatment systems that remove volatile organic compounds (VOCs), and two systems that remove strontium-90 (Sr-90). Following approval from the regulatory agencies, the Industrial Park East treatment system was decommissioned in 2014. Following regulatory approval, the North Street East treatment system was shut down and placed in operationally-ready stand-by mode. Installed new extraction wells to address deeper VOC contamination in the Industrial Park area. 143 pounds of VOCs and 1.2 mCi of Sr-90 were removed during the treatment of 1.3 billion gallons of groundwater. Since the first groundwater treatment system started operating in December 1996, approximately 7,276 pounds of VOCs and 29.9 mCi of Sr-90 have been removed, while treating over 23 billion gallons of groundwater. Collected and analyzed approximately 1,514 sets of groundwater samples from 631 monitoring wells. Installed 67 temporary wells and collected multiple samples from each location. Continued monitoring the g-2 tritium plume using temporary and permanent monitoring wells.
Peconic River	OU V	<ul style="list-style-type: none"> Continued long-term post-cleanup monitoring of Peconic River surface water and sediment. Fish collection was performed in 2013; next collection will be in 2015. Completed monitoring and maintenance of invasive species at three excavated sediment locations within the Peconic River.
Reactors	Brookhaven Graphite Research Reactor (BGRR)	<ul style="list-style-type: none"> Continued long-term surveillance and maintenance, including the replacement of 76 windows on the second and third floor former offices.
	High Flux Beam Reactor (HFBR)	<ul style="list-style-type: none"> Continued long-term surveillance and maintenance.
	Stack (Building 705)	<ul style="list-style-type: none"> Continued long-term surveillance and maintenance.
	Brookhaven Medical Research Reactor (BMRR)	<ul style="list-style-type: none"> Continued surveillance and maintenance activities.
Buildings 810/811	Radiological Liquid Processing Facility *	<ul style="list-style-type: none"> Performed routine surveillance and maintenance of the facility. The Environmental Protection Division continued utility isolation at Building 811 in preparation for demolition and removal of contaminated soil and concrete in 2015.
Building 801	Inactive Radiological Liquid Holdup Facility	<ul style="list-style-type: none"> Performed routine surveillance and maintenance of the facility.
Building 650	Inactive Radiological Decon Facility *	<ul style="list-style-type: none"> Performed routine surveillance and maintenance of the facility.

“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 some of the science behind Laboratory research, and invites subscribers to educational and cultural events.

2.4.2.2 Community Involvement in Cleanup Projects

In 2014, BNL updated stakeholders on the progress of 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:

- *Natural Resources Program*: In January and October, the CAC received updates on the BNL’s natural resources, including: the status of the flora and fauna on site, deer management and the 4-Poster tick control system, deer and fish sampling, bat surveys, intern projects, and research at the LISF. The CAC was also provided with a preview of the 2014 sampling data from the Peconic River and the path forward was discussed with regulators.
- *Environmental Cleanup Program*: In March, the CAC received a comprehensive presentation on the significant progress made over the past 20 years toward cleanup of the BNL site. The 32 Areas of Concern under the Superfund program were reviewed, as well as a timeline for cleanup objectives and those that have been met were discussed. The costs to date, approximately \$567M, work in progress, and lessons learned were also discussed.
- *FHWMF Perimeter Soils*: In April and November, the CAC was given an update on the final phase of cleanup of soils contaminated as a result of historical operations at the Former Hazardous Waste Management Facility (FHWMF).
- *History of the BNL Site*: In April, the CAC received a historical overview of the transition of the site from a World War I Army training camp to a multi-purpose national laboratory.
- *2013 Site Environmental Report*: In September, the CAC received a presentation on the Laboratory’s environmental impact for the previous year. Updates on the BNL’s EMS and opportunities for improvement, pollution prevention projects implemented during the year, waste generation, and energy management and conservation were discussed. Air and water quality monitoring results were provided, and the radiological dose assessment was explained.
- *Wastewater Treatment Modification Projects*: In November, the CAC received an update on the transition of the Sewage Treatment Plant outfall from discharging to the Peconic River to newly constructed groundwater recharge basins, as well as effluent sampling of mercury concentrations.
- *2013 Groundwater Status Report*: The CAC received a presentation on the highlights of the annual report including the current status of treatment systems and VOC remediation. Details on the shutdown of the North Street East system and the status of the Deep VOC characterization, new extraction wells, and the Building 452 Freon-11 treatment system were provided.

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 welcomes all input and feedback offered from the community.

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 2014), 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 2014 there were 6,489 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 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

Table 2-5. Summary of BNL Sampling Program Sorted by Media, 2014.

Environmental Media	No. of Sampling Events(a)	Purpose
Groundwater	1,737 (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	99	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	55 ES 191 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)	126	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	18	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	228	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	353 ES/C 47 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	67	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 Sampling Program Sorted by Media, 2014. (concluded).

Environmental Media	No. of Sampling Events(a)	Purpose
Flora	16	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	160	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	380	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	1,269	Samples are collected from groundwater treatment systems and as long-term monitoring after remediation completion under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program. The Laboratory has 14 operating groundwater treatment systems. See discussion in Chapter 7.
Vehicle Monitor Checks	44	Materials leaving the Laboratory pass through the on-site vehicle monitor that detects if radioactive materials are present. Any radioactive material discovered is properly disposed of through the Waste Management Program. The vehicle monitor is checked on a daily basis.
State Pollutant Discharge Elimination System (SPDES)	415	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	612	Flowcharts are exchanged weekly as part of BNL's SPDES permit requirements to report discharge flow at the recharge basin outfalls.
Floating Petroleum Checks	106	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	500	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)	66	To ensure that the concentrations of contaminants reported in the Site Environmental Report are accurate, additional samples are collected. These samples detect if contaminants are introduced during sampling, transportation, or analysis of the samples. QA/QC samples are also sent to the contract analytical laboratories to ensure their processes give valid, reproducible results.
Total number of sampling events	6,489	The total number of sampling events includes all samples identified in the Environmental Monitoring Plan (BNL 2014), 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) Also includes sampling events from temporary wells.

C = Compliance

ES = Environmental Surveillance

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 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 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. BNL 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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REFERENCES AND BIBLIOGRAPHY

- BNL 2005. *Community Involvement Policy and Plan*. Brookhaven National Laboratory, Upton, NY.
- BNL 2011. *Natural Resource Management Plan for Brookhaven National Laboratory*. BNL-71870-2003. Brookhaven National Laboratory, Upton, NY.
- BNL 2013a. *Cultural Resource Management Plan for Brookhaven National Laboratory*. BNL-100708-2013. Brookhaven National Laboratory, Upton, NY. May 2013.
- BNL 2013b. *Brookhaven National Laboratory Soil and Peconic River Surveillance and Maintenance Plan*. Brookhaven National Laboratory, Upton, NY. March 2013.
- BNL 2013c. *Groundwater Protection Contingency Plan—Response to Unexpected Monitoring Results*. Environmental Monitoring Procedure EM-SOP-309. Brookhaven National Laboratory, Upton, NY. August 2013.
- BNL 2014. *Environmental Monitoring Plan 2015 Update*. Brookhaven National Laboratory, Upton, NY.
- DOE Order 436.1, 2011. *Departmental Sustainability*. U.S. Department of Energy, Washington, DC. May 2, 2011.
- Executive Order 13514, 2009. *Federal Leadership in Environmental, Energy, and Economic Performance*. US Department of Energy, Washington, DC. October 5, 2009.
- Executive Order 13423, 2009. *Strengthening Federal Environmental, Energy and Transportation Management*. U.S. Department of Energy, Washington, DC. January 24, 2007.
- ISO 2004. ISO 14001, *Environmental Management Systems – Specification with Guidance for Use*. First Edition. International Organization for Standardization. Geneva, Switzerland.