

2010

Site Environmental Report

SUMMARY



The Long Island Solar Farm (LISF), a 32-megawatt photovoltaic (PV) array, is being built in the southeast corner of the Laboratory site. Construction began in October 2010 after agreements were finalized between BNL, BP Solar, the U.S. Department of Energy, and the Long Island Power Authority. With expected completion by the fall of 2011, it will be the largest solar plant in the Northeast region and will provide an unparalleled opportunity for research that will address many of the challenges facing the deployment of large-scale, grid-connected PV plants.

To supplement the research capabilities offered by the LISF, BNL is exploring the development of a Northeast Solar Energy Research Center (NSERC). The proposed center will offer research capabilities and field testing of solar technologies under actual northeastern weather conditions. The vision for NSERC is to provide a user facility with capabilities to address the major challenges facing the deployment and integration of sustainable solar energy resources, particularly in the northeastern United States, as a means of ensuring the nation's future energy security.



The Brookhaven National Laboratory 2010 Site Environmental Report is a public document that is distributed to various U.S. Department of Energy sites, local libraries, and local regulators and stakeholders. The report is available to the general public on the internet at <http://www.bnl.gov/ewms/ser/>. A summary of the report is also available and is accompanied by a compact disk containing the full report. To obtain a copy of the report or summary, please write or call:

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BROOKHAVEN NATIONAL LABORATORY

2010 SITE ENVIRONMENTAL REPORT SUMMARY

Preface	2
About Brookhaven National Laboratory	2
BNL Facilities and Operations	3
Major Scientific Facilities at BNL	4
Hydrology and Geology of the BNL Site	5
Research and Discoveries at BNL	6
BNL's Environmental Management System	7
BNL's Environmental Management Program	8
Pollution Prevention Program	8
Energy Management and Conservation	8
Water Conservation Program	9
Waste Management Program	10
Compliance Monitoring Program	10
Air Quality Program	11
Groundwater Protection Management	12
Water Quality Surveillance Program	14
Radiological Dose Assessment Program	14
Natural and Cultural Resource Management Program	16
Wildlife Programs at BNL	18
Cultural Resources Management Program	18
Communication and Community Involvement	19

PREFACE

Each year, Brookhaven National Laboratory (BNL) prepares an annual Site Environmental Report (SER) in accordance with U.S. Department of Energy (DOE) Order 231.1A, Environment, Safety and Health Reporting. The report is written to inform the public, regulators, employees, and other stakeholders of the Laboratory's environmental performance during the calendar year in review. Volume I of the SER summarizes environmental data; environmental management performance; compliance with applicable DOE, federal, state, and local regulations; and performance in restoration and surveillance monitoring programs.

Volume II of the SER, the Groundwater Status Report, also is prepared annually to report on the status and evaluate the performance of groundwater treatment systems at the Laboratory. Volume II includes detailed technical summaries of groundwater data and its interpretation, and is intended for internal BNL users, regulators, and other technically oriented stakeholders.

A brief overview of the information contained in Volume II is included in this summary under Groundwater Protection Program. BNL has prepared annual SERs since 1971 and has documented nearly all of its environmental history since the Laboratory's inception in 1947.

Both reports are available in print and as downloadable files on the BNL website at <http://www.bnl.gov/ewms/ser/>.

An electronic version on compact disc is distributed with each printed report.

This summary provides a general overview of Volume 1, and is distributed with a compact disc containing the full report.



Long Island Sound

Brookhaven
National
Laboratory

Satellite photo showing location of BNL. The small circle is the Relativistic Heavy Ion Collider, known as RHIC.

New Jersey

ABOUT BROOKHAVEN NATIONAL LABORATORY

Established in 1947, BNL is a multi-program national laboratory managed for DOE's Office of Science by Brookhaven Science Associates, a partnership formed by Stony Brook University and Battelle Memorial Institute. For more than 60 years, the Laboratory has played a lead role in the DOE Science and Technology mission. BNL manages its world-class scientific research with particular sensitivity to environmental issues and community concerns. The Laboratory's motto, "Exploring Life's Mysteries...Protecting its Future," and its Environmental, Safety, Security, and Health Policy reflect the commitment of BNL's management to fully integrate environmental stewardship into all facets of its mission and operations.

The Laboratory's Environmental, Safety, Security, and Health (ESSH) Policy makes clear BNL's commitments to environmental stewardship, the safety of its employees, and the security of the site. Specific environmental commitments in the policy include compliance, pollution prevention, cleanup, community outreach, and continual improvement.

The ESSH Policy is posted throughout the site, on the BNL website at <http://www.bnl.gov/ESQH/ESSH.asp>, and is included in all training programs for new employees, guests, and contractors.

BNL's broad mission is to produce excellent science and advanced technology in a safe and environmentally sound manner with the cooperation, support, and involvement of its scientific and local communities. The fundamental elements of the Laboratory's role in support of DOE's strategic missions are:

- To conceive, design, construct, and operate complex, leading-edge, user-oriented research facilities in response to the needs of DOE and the international community of users
- To carry out basic and applied research in long-term, high risk programs at the frontier of science
- To develop advanced technologies that address national needs and to transfer them to other organizations and to the commercial sector
- To disseminate technical knowledge, to educate future generations of scientists and engineers, to maintain technical currency in the nation's workforce, and to encourage scientific awareness in the general public

BNL is located near the geographical center of Suffolk County, Long Island, 60 miles east of New York City. The Laboratory's 5,265-acre site is located in the Town of Brookhaven, the largest township (both in area and population) in Suffolk County. The Laboratory is one of the five largest, high-technology employers on Long Island, with approximately 3,000 employees that include scientists, engineers, technicians, and administrative personnel. More than 75 percent of BNL employees live and shop in Suffolk County. In addition, BNL annually hosts an estimated 4,000 visiting scientists, more than 30 percent of whom are from New York State universities and businesses. The visiting scientists and sometimes their families, as well as visiting students, reside in apartments and dormitories on site or in nearby communities.

BNL strengthens Long Island's position as a center of innovation in energy, life sciences, and other fields crucial to the growth of the state's economy. With a budget of over \$650 million, the Laboratory also has a significant economic impact on the state. In fiscal year 2010, employee salaries, wages and fringe benefits accounted for over \$357 million of its total annual budget. In addition, a report for fiscal year 2009 showed that the economic output generated by the Laboratory and its visitors during that period amounted to \$704 million and created 5,400 jobs—5,190 of them on Long Island. Supporting local and state businesses whenever possible, BNL also spent \$212 million on goods and services in fiscal year 2009 (\$75.2 million in New York State). It is estimated that between 2010 and 2014, the Laboratory will generate, on an average annual basis, \$947 million in economic output and 7,092 jobs throughout the state.

BNL FACILITIES AND OPERATIONS

Most of the Laboratory's principal facilities are located near the center of the site. The developed area is approximately 1,800 acres:

- 500 acres originally developed by the Army (as part of Camp Upton) and still used for offices and other operational buildings
- 200 acres occupied by large, specialized research facilities
- 550 acres used for outlying facilities, such as the Sewage Treatment Plant, housing facilities, and fire breaks
- 400 acres of roads, parking lots, and connecting areas
- 200 acres under development for the Long Island Solar Farm

Environmental, Safety, Security, and Health Policy

Brookhaven National Laboratory

This document is a statement of BNL's ESSH policy. BNL is a world leader in scientific research and strives to demonstrate excellence in protecting people, property, and the environment.

I expect every employee, contractor, and guest to take personal responsibility for adhering to the following principles:

ENVIRONMENT

We protect the environment, conserve resources, and prevent pollution.

SAFETY

We maintain a safe workplace and we plan our work and perform it safely. We take responsibility for the safety of ourselves, coworkers, and guests.

SECURITY

We protect people, property, information, computing systems, and facilities.

HEALTH

We protect human health within our boundaries and in the surrounding community.

COMPLIANCE

We achieve and maintain compliance with applicable ESSH requirements.

COMMUNITY

We maintain open, proactive, and constructive relationships with our employees, neighbors, regulators, DOE, and our other stakeholders.

CONTINUAL IMPROVEMENT

We continually improve ESSH performance.

In addition to my annual review of BNL's progress on ESSH goals and adherence to this policy, I invite all interested parties to provide me with input on our performance relative to this policy, and the policy itself.

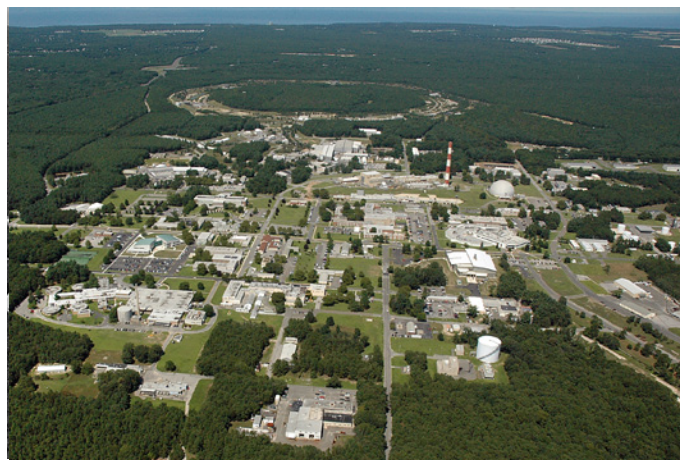
Signed: September 6, 2006
Sam Aronson, Director

The balance of the site, approximately 3,400 acres, is mostly wooded and represents the native pine barrens ecosystem.

The major scientific facilities at BNL are briefly described below. All of the research and support facilities must undergo periodic environmental reviews as part of BNL's Environmental Management Program.

MAJOR SCIENTIFIC FACILITIES AT BNL

- **Alternating Gradient Synchrotron (AGS).** The AGS is a particle accelerator used to propel protons and heavy ions, such as gold or iron, to high energies for physics research. The Linear Accelerator (Linac) serves as a proton injector for the AGS Booster.
- **AGS Booster.** The AGS Booster is a circular accelerator used for physics research and radiobiology studies. It receives either a proton beam from the Linac or heavy ions from the Tandem Van de Graaff and accelerates these before injecting them into the AGS ring for further acceleration. The Booster also serves as the energetic heavy ion source for the NASA Space Radiation Laboratory, which is used to simulate the harsh cosmic and solar radiation environment found in space.
- **Center for Functional Nanomaterials (CFN).** The CFN provides state-of-the-art capabilities for the fabrication and study of nanoscale materials, with an emphasis on atomic-level tailoring to achieve desired properties and functions. The overarching scientific theme of the CFN is the development and understanding of nanoscale materials that address the nation's challenges in energy security.
- **Linear Accelerator (Linac) and Brookhaven Linac Isotope Producer (BLIP).** The Linac provides beams of polarized protons for the AGS and RHIC. The beam is also used to produce radioisotopes for research and medical imaging at the BLIP. The BLIP is one of the nation's key production facilities for radioisotopes, which are crucial to clinical nuclear medicine. The BLIP also supports research on new diagnostic and therapeutic radiopharmaceuticals.
- **National Synchrotron Light Source (NSLS).** The NSLS uses a linear accelerator and booster synchrotron as an injection system for two electron storage rings that provide intense light spanning the electromagnetic spectrum from the infrared through x-rays. The properties of this light and the 80 specially designed experimental stations, called beamlines, allow scientists to perform a large variety of experiments.
- **National Synchrotron Light Source II (NSLS-II).** The NSLS-II, currently under construction, will be a new state-of-the-art medium energy electron storage ring designed to deliver world-leading intensity and brightness, and will produce x-rays more than 10,000 times brighter than the current NSLS.
- **Relativistic Heavy Ion Collider (RHIC).** The RHIC is a world-class scientific research facility. The RHIC accelerator drives two intersecting beams of heavy ions or protons head-on to form subatomic collisions. What physicists learn from these collisions may help us understand more about why the physical world works the way it does, from the smallest subatomic particles, to the largest stars.
- **Tandem Van de Graaff and Cyclotrons.** The Tandem Van de Graaff accelerators are used to bombard materials with ions for manufacturing and testing purposes, and to supply RHIC with heavy ions. The cyclotrons are used for the production of radiotracers for use in Positron Emission Tomography (PET) and Magnetic Resonance Imaging (MRI) studies.



Aerial photograph of the BNL site.

Although the current NSLS has been continually updated since its commissioning in 1982, the practical limits of its performance have been reached. To continue advances, construction of the NSLS-II, conceived as the next generation synchrotron light source, began in 2008 (see description above). To help meet the critical scientific challenges of our energy future, scientists will focus on research at the nanoscale. The NSLS-II will also enable scientists to focus on some of the nation's most important scientific challenges, including clean and affordable energy, molecular electronics, and high-temperature superconductors.

The 32 megawatt Long Island Solar Farm (LISF), featured on the cover and currently under construction at BNL, will be the largest solar photovoltaic (PV) electric generating plant in the Northeast region. When completed, the LISF will help Long Island to be less reliant on fossil fuel driven power generation and help meet peak load demands, particularly in the summer during increased air conditioning use. The LISF will also become one of the most studied solar installations, as it will be a focal point of a planned Northeast Solar Energy Research Center (NSERC) at the Laboratory. This research center will offer research capabilities and field testing of solar technologies under actual northeast climatic and weather conditions. Research will include work done at the LISF, as well as a dedicated research array for testing solar panel modules, inverters, and other equipment being developed for the solar energy industry.

In addition to the major scientific facilities at BNL, additional facilities, briefly described below, support BNL's science and technology mission by providing basic utility and environmental services.

- **Central Chilled Water Plant.** This plant provides chilled water sitewide for air conditioning and process refrigeration via underground piping. The plant has a large refrigeration capacity and reduces the need for local refrigeration plants and air conditioning.
- **Central Steam Facility (CSF).** This facility provides high-pressure steam for facility and process heating sitewide. Either natural gas or fuel oil can be used to produce the steam, which is conveyed to other facilities through underground piping. Condensate is collected and returned to the CSF for reuse, to conserve water and energy.
- **Fire Station.** The Fire Station houses six response vehicles. The BNL Fire Rescue Group provides on-site fire suppression, emergency medical services, hazardous material response, salvage, and property protection.
- **Major Petroleum Facility (MPF).** This facility provides reserve fuel for the CSF during times of peak operation. With a total capacity of 2.3 million gallons, the MPF primarily stores No. 6 fuel oil. The 1997 conversion of CSF boilers to burn natural gas as well as oil has significantly reduced the Laboratory's reliance on oil as a sole fuel source when other fuels are more economical.
- **Sewage Treatment Plant (STP).** This plant treats sanitary and certain process wastewater from BNL facilities prior to discharge into the Peconic River, similar to the operations of a municipal sewage treatment plant. The plant has a design capacity of 3 million gallons per day. Effluent is monitored and controlled under a permit issued by the New York State Department of Environmental Conservation (NYSDEC).
- **Waste Management Facility (WMF).** This facility is a state-of-the-art complex for managing the wastes generated from BNL's research and operations activities. The facility was built with advanced environmental protection systems and features, and began operation in December 1997.
- **Water Treatment Plant (WTP).** The potable water treatment plant has a capacity of 5 million gallons per day. Potable water is obtained from five on-site wells. Three wells located along the western boundary of the site are treated at the WTP with a lime-softening process to remove naturally occurring iron and sodium hypochlorite for bacterial control. The plant is also equipped with dual air-stripping towers to ensure that volatile organic compounds (VOCs) are at or below New York State drinking water standards. Two wells located along the eastern section of the developed site are treated by the addition of sodium hydroxide to increase the pH of the water to make it less corrosive and by the addition of sodium hypochlorite to control bacteria. BNL's potable water met all drinking water standards in 2010.

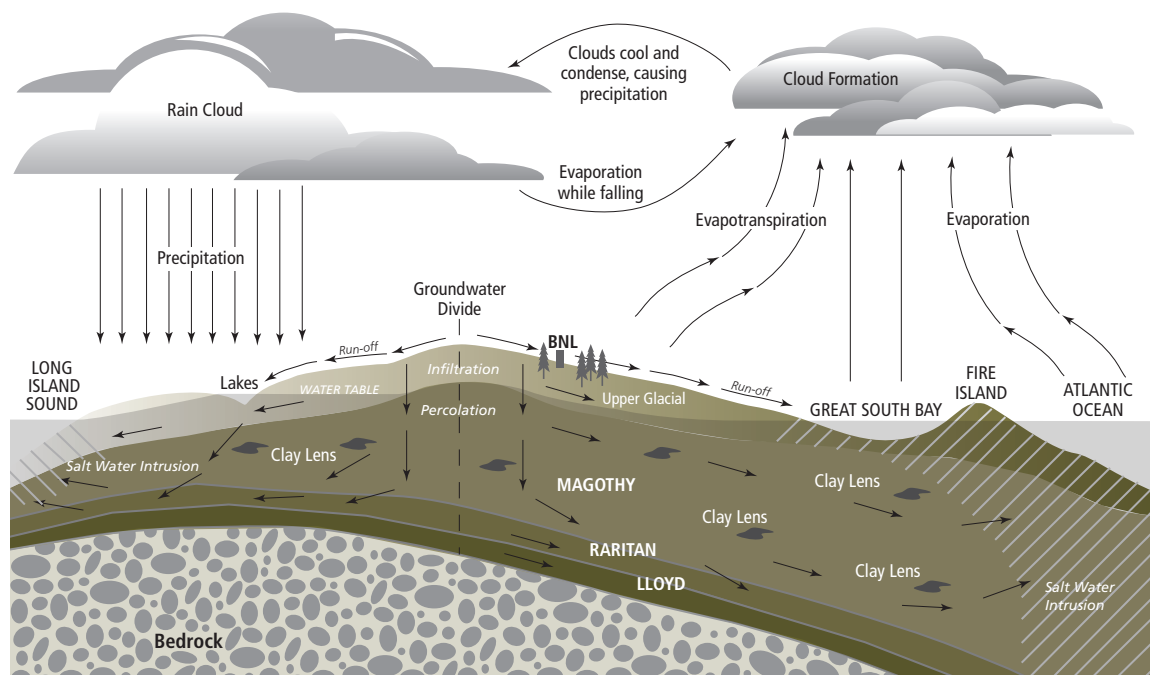
Further information about all of BNL's facilities can be found at http://www.bnl.gov/bnlweb/about_BNL.asp

HYDROLOGY AND GEOLOGY OF THE BNL SITE

BNL is situated on the western rim of the shallow Peconic River watershed. The marshy areas in the northern and eastern sections of the site are part of the headwaters of the Peconic River. The Peconic River both recharges to, and receives water from, the underlying Upper Glacial aquifer. In times of sustained drought, the river water recharges to the groundwater; with normal to above-normal precipitation, the river receives water from the aquifer. Long Island's

aquifer system is one of 73 sole source aquifers in the nation recognized under the aquifer protection program authorized by the U.S. Safe Drinking Water Act. This groundwater system is the primary source of drinking water for both on- and off-site private and public supply wells.

The site is located within a defined deep-flow recharge zone for Long Island. Precipitation and surface water that recharge within this zone have the potential to replenish



Precipitation Cycle in the Area of Brookhaven National Laboratory

the Magothy and Lloyd aquifer systems lying below the Upper Glacial aquifer. It has been estimated that up to two-fifths of the recharge from rainfall moves into the deeper aquifers. The extent to which groundwater on site contributes to deep-flow recharge has been confirmed through the use of an extensive network of shallow and deep wells installed at BNL and surrounding areas.

During 2010, the Laboratory used approximately 1.37 million gallons of groundwater per day to meet potable water needs and heating and cooling requirements. Approximately 75 percent of the water pumped from BNL supply wells is returned to the aquifer through on-site recharge basins and permitted discharges to the Peconic River. Under normal hydrologic conditions, most of the water discharged to the river recharges to the Upper Glacial aquifer before leaving the site. Human consumption, evaporation (cooling tower and wind losses), and sewer line losses account for the remaining 25 percent. An additional 4.05 million gallons of groundwater are pumped each day from remediation wells. The water is treated to remove contaminants and then returned to the aquifer by way of recharge basins or injection wells.

RESEARCH AND DISCOVERIES AT BNL

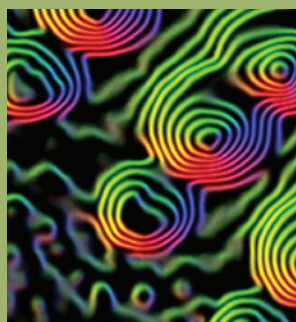
The Laboratory is one of the nation's—and the world's—leading research institutions. Seven Nobel Prize-winning discoveries have been made at BNL (<http://www.bnl.gov/bnlweb/history/nobel/>). In the last 60 years, Brookhaven scientists have made many discoveries, developments, inventions, and innovations. Further information can be found at http://www.bnl.gov/bnlweb/research_list.asp.

The Laboratory's mission for the coming decade focuses on three broad areas: (1) advancing fundamental research in nuclear and particle physics to gain a deeper understanding of matter, energy, space, and time; (2) applying photon sciences and nanomaterials research to energy problems of critical importance to the nation; and (3) performing cross-disciplinary research to understand the relationship between climate change, sustainable energy, and the Earth's ecosystems.

Scientific Discoveries and Research in Environment Sciences

- Response of plants and trees to radiation exposure
- Metal hydrides for better hydrogen storage in fuel cells
- Building and studying of demonstration houses with alternative-energy and energy-saving features

- Invention of better, cleaner, more efficient oil burners and devices to aid clean and efficient oil burning
- Development of chemically inert tracers and detectors to track the environmental impact of power plants
- Better, safer, more convenient natural gas storage options for alternative-fuel vehicles
- Facilities that allow studies of environmental technologies and phenomena: polymers used to clean up oil spills, examination of sandstone porosity for more efficient oil-field exploration, and the effect of cosmic radiation on tissue
- Large-scale studies of the effect of increased carbon dioxide on ecosystems
- Oceanographic studies of plankton populations to gauge ocean health and climate change potential and research into the cause of mysterious "brown tide" algae blooms
- Harnessing natural bacteria to clean up environmental pollution and purify crude oil
- Studies of air pollution, including smog and particulates
- Computer models of atmospheric radiation (important for climate change), groundwater movement, and energy use impact in developing nations
- New techniques for encapsulating hazardous waste for storage and disposal, including glass, plastic and concrete



BNL's energy research will draw on our considerable scientific expertise and leverage our world-class facilities to help reduce the carbon footprint of our energy economy.



Nanomaterials research at BNL seeks to refine materials used in electricity generation — like photovoltaics.



BNL is well-suited to address some of the most challenging scientific questions related to achieving a sustainable future.



BNL researchers are investigating methods to make plant matter easier to convert into energy.

BNL'S ENVIRONMENTAL MANAGEMENT SYSTEM

The Laboratory's Integrated Safety Management System (ISMS) integrates management of the environment (i.e., environmental protection and pollution prevention), safety, and health issues into all work planning. BNL's ISMS contributed to BNL being the first Laboratory under the DOE Office of Science to achieve registration under both the International Organization for Standardization (ISO) 14001 Standard (for the Laboratory's Environmental Management System) and the Occupational Safety and Health Assessment Series (OHSAS) 18001 Standard (for the Laboratory's Safety and Health Program). 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.



An Environmental Management System (EMS) was established at BNL in 2001 to ensure that environmental issues are systematically identified, controlled, and monitored. The Laboratory's EMS also provides mechanisms for responding to changing environmental conditions and requirements, reporting on environmental performance, and reinforcing continual environmental improvement. Annual independent audits, which are required to maintain the registrations, are conducted to validate that these standards are being maintained and to identify evidence of continual improvement. In 2010, an EMS recertification audit determined that the Laboratory continues to conform to these standards. Seventeen noteworthy practices were noted and there were no non-conformances, marking the first time BNL has achieved this level of success.

The planning requirements of the ISO 14001 Standards 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.

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.

Executive Order 13514, Federal Leadership in Environmental, Energy, and Economic Performance, sets sustainability goals for federal agencies and focuses on improving their environmental, energy, and economic performance. In addition, all governmental facilities are 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 direct the future of BNL's EMS program, and have already been incorporated into BNL's SSP.

BNL'S ENVIRONMENTAL MANAGEMENT PROGRAM

BNL's Environmental Management Program consists of several Laboratory-wide and facility-specific environmental monitoring and surveillance programs. These programs identify potential pathways of public and environmental exposure, and evaluate the impacts Laboratory activities may have on the environment. A brief overview of BNL's environmental programs and a summary of performance for 2010 follows. A full discussion for each program can be found in the full report on compact disc in the back of this Summary.

POLLUTION PREVENTION PROGRAM

BNL's Pollution Prevention (P2) Program reflects the national and DOE pollution prevention goals and policies, and represents an ongoing effort to make pollution prevention and waste minimization an integral part of the Laboratory's operating philosophy. The overall goal of the P2 Program is to create a systems approach that integrates pollution prevention and waste minimization, resource conservation, recycling, and affirmative procurement into all planning and decision making.

An important function of the P2 Program is to seek funding to implement pollution prevention projects. Three P2 proposals were funded in 2010, for a combined investment of approximately \$30,400. The anticipated annual savings from these projects is estimated at \$20,800, for an average payback period of approximately 1.5 years. The BNL P2 and recycling programs have achieved significant reductions in waste generated by routine operations. This continues a positive trend and is further evidence that pollution prevention planning is well integrated into the Laboratory's work planning process.

The implementation of pollution prevention opportunities, recycling programs, and conservation initiatives has significantly reduced both waste volumes and management costs on site. In 2010, these efforts resulted in more than \$1.9 million in cost avoidance or savings and approximately 9.2 million pounds of materials being reduced, recycled, or reused annually.

The Laboratory also has an active and successful solid waste recycling program, which involves all employees. In 2010, BNL collected more than 174 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.

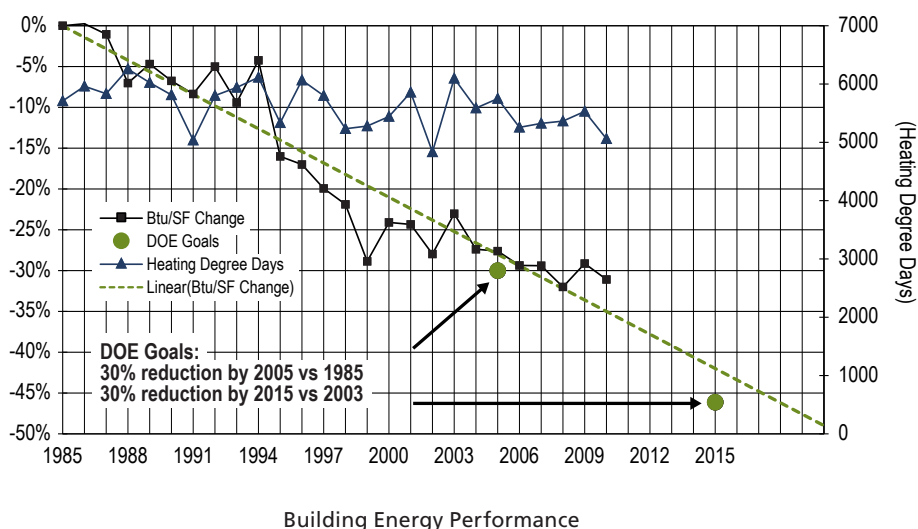
ENERGY MANAGEMENT AND CONSERVATION

Since 1979, BNL's Energy Management Group has been working to reduce energy use and costs by identifying cost-effective,

energy-efficient projects; monitoring energy use and utility bills; and assisting in obtaining the least expensive energy sources possible. The group is responsible for developing, implementing, and coordinating BNL's Energy Management Plan and assisting DOE in meeting the energy goals in Executive Order 13514 and the Secretary's Transformational Energy Action Management (TEAM) initiatives.

The Laboratory has more than 4 million square feet of building space. In 2010, BNL used approximately 272 million kilowatt hours (kWh) of electricity, 0.68 million gallons of fuel oil, 25,000 gallons of propane, and 537 million cubic feet of natural gas. Due to market conditions, fuel oil and natural gas were used whenever each respective fuel was least expensive. However, wherever possible, BNL purchases natural gas over oil to help reduce greenhouse gas emissions.

BNL is a participant in the New York Independent System Operator (NYISO) Special Case Resource Program, which is an electric load reduction curtailment program. Through this program, the Laboratory has agreed to reduce electrical demand during critical days throughout the summer when NYISO expects customer demand to meet or exceed the available supply. In return, BNL receives a rebate for each megawatt reduced on each curtailment day. The Laboratory continues to keep electric loads at a minimum during the summer, by scheduling some operations during cooler weather to avoid peak demand periods. This scheduling allowed the Laboratory to save \$2.5 million in elec-



tric costs in 2010 and greatly helps maintain the reliability of the Long Island Power Authority (LIPA) electric system to meet all of its users' needs.

BNL also maintains a contract with the New York Power Authority (NYPA) that resulted in an overall cost avoidance of \$24.5 million in 2010. In addition, NYPA has agreed to provide 15 MW of low-cost hydropower to BNL for a period of up to 15 years. Estimated savings are approximately \$8 million per year. The hydropower will help stabilize electric rates and keep them competitive with other DOE Laboratories.

In 2010, construction of the Long Island Solar Farm (LISF) began on site. The 32 MW of solar photovoltaics (PV) is being developed for LIPA and financed by BP Solar. The array will span 195 acres and will result in an avoidance of approximately 31,000 tons of carbon per year over its 30- to 40-year life span. As an outcome of constructing this large array at BNL, BP Solar and the Laboratory will be developing a solar research program (planned research is discussed on Page 4). The DOE Office of Science, the Brookhaven Site Office, and BNL are working with the Federal Energy Management Program to explore the possibility of taking credit for the siting of this large array towards BNL's Site Sustainability Plan.

All Federal agencies must apply energy conservation measures and 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 fiscal year 2006 to fiscal year 2015. Other pending requirements have set even more stringent requirements, including renewable energy and reducing transportation fuels that go significantly beyond the previous goal of a 30 percent reduction by 2005, compared to 1985. As shown on the chart on the previous page, BNL's energy use per square foot in 2010 was over 30 percent less than in 1985 and 11 percent less than in 2003.

To reduce energy use and costs at non-research facilities, other activities were also undertaken in 2010. Some of these activities included:

- Participating in DOE's Sustainability Initiative on energy use, greenhouse gas emissions, renewable energy, and energy efficiency options
- Substantial progress on several initiatives in BNL's Site Sustainability Plan, including new electric and steam meter installations, development of a temperature setback policy, funding requests for energy conservation initiatives, the purchase of Renewable Energy Credits (RECs), initiation of a steam recharge program, and the selection of an Energy Services Company for BNL's Utility Energy Services Contract
- Supported the development of a methodology to initiate an Energy Savings Performance Contract/Utility Energy Services Contract

- Helped expand the capabilities of BNL's Chilled Water Facility
- Negotiated a natural gas purchase contract, estimated to save \$2 million compared to oil and \$300K compared to purchasing natural gas directly from National Grid
- Installation of energy-efficient lighting

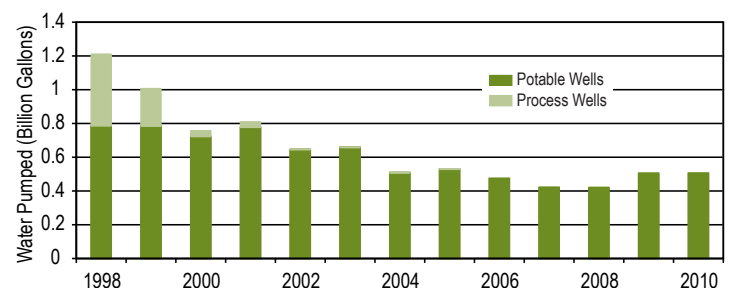
Due to continued conservation efforts, overall facilities energy usage for 2010 was reduced, saving over \$1.3 million. In addition, approximately 24,000 gasoline gallon equivalents of natural gas were used in place of gasoline for the Laboratory's vehicle fleet.

BNL continues to work on its Site Sustainability Plan for energy, transportation, and water management. The plan includes strategies, energy costs, and indicators and goals, including energy use/square foot and an overall carbon reduction of 28 percent. The plan will also document the Laboratory's efforts to reduce energy use and costs to the lowest cost-effective levels.

The Laboratory continues to seek alternative energy sources to meet its future energy needs, support federally required "green" initiatives, and reduce energy costs wherever possible.

WATER CONSERVATION PROGRAM

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. The goal is to reduce the consumption of potable water and reduce the possible impact of clean water discharges on BNL's Sewage Treatment Plant operations. The slight rise in water consumption in 2010, as shown in the figure below, was due to increased research and the associated increase in evaporation cooling. During the past 5 years, water consumption at the Laboratory was less than half the 1998 total—a reduction of nearly a half-billion gallons per year.



BNL Water Consumption Trend

WASTE MANAGEMENT PROGRAM

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

Collecting, storing, transporting, and disposing of waste generated at the Laboratory is the responsibility of BNL's Waste Management organization. Key to the management of wastes generated is the Waste Management Facility. This modern facility was designed for handling hazardous, industrial, radioactive, and mixed waste and is comprised of three staging areas: a facility for hazardous waste, regulated by the Resource Conservation and Recovery Act (RCRA); a mixed-waste building for material that is both hazardous and radioactive; and a reclamation building for radioactive material. The RCRA and mixed-waste buildings are managed under a permit issued by the New York State Department of Environmental Conservation. 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. In 2010, work continued to consolidate both mixed and hazardous wastes in Building 855.

COMPLIANCE MONITORING PROGRAM

BNL has an extensive program in place to ensure compliance with all applicable environmental regulatory and permit requirements. The Laboratory must comply with more than 100 sets of federal, state, and local environmental regulations, numerous site-specific permits, 16 equivalency permits for the operation of 14 groundwater remediation systems, and several other binding agreements. Instances of noncompliance are reported to regulatory agencies and corrected expeditiously.

In 2010, emissions of nitrogen oxides, carbon monoxide, and sulfur dioxide from BNL's Central Steam Facility were all within permit limits. There was a single opacity excursion noted for Boiler 7, which occurred during boiler startup and is discussed under Air Quality Program on the following page.

Approximately 1,180 pounds of ozone-depleting refrigerants were recovered from refrigeration equipment and fire extinguisher systems for reuse by other DOE facilities or federal agencies. These reductions included the disposition of eight cylinders of Halon 1301 in tanks, Halon 1211 in cylinders, and portable extinguishers. These materials will be saved for on-site reuse or transferred to storage for shipment to the Department of Defense Ozone Depleting Substances Reserve.

Routine inspections conducted during the year found no significant instances of noncompliance; however, the State of Utah issued BNL a Notice of Violation and a fine of



\$5,000 in July for a shipment of mixed waste received at Energy Solutions in Utah that contained higher than expected levels of alpha-emitting isotopes, resulting in a violation of their license.

Monitoring of the Laboratory's potable water supply showed that all drinking water quality requirements were met in 2010. Most of the liquid effluents discharged to surface water and groundwater met applicable State Pollutant Discharge Elimination System (SPDES) permit requirements; however, three minor excursions occurred during the year and were reported to the New York State Department of Environmental Conservation (NYSDEC) and the Suffolk County Department of Health Services (SCDHS). Groundwater monitoring at BNL's Major Petroleum Facility continued to demonstrate that current oil storage and transfer operations are not affecting groundwater quality.

Three excursions of permit limits for waste water discharges in 2010 included: two for elevated levels of iron and one for the amount of nitrogen discharged to the Peconic River from the Sewage Treatment Plant. Increased aeration and the addition of lime to the Sewage Treatment Plant process returned the levels of iron to less than permit levels. Total nitrogen (calculated in pounds per day) exceeded the daily maximum limit in June. Discharges in the remaining months were within permit limits.

In 2010, the Laboratory completed a Quantification and Removal study to identify and quantify controllable sources of metals being discharged to the Sewage Treatment Plant, as required by BNL's 2009 SPDES permit. The study results were shared with the community and regulatory agencies and a decision was made to proceed with diverting the Sewage Treatment Plant effluent from the Peconic River to local recharge basins was finalized.

The Laboratory continues to reduce the number and severity of spills on site. In 2010, there were 15 reportable spills of petroleum products, antifreeze, or chemicals. While the total number of spills increased by three from 2009, the severity of releases was less. All releases were cleaned up to the satisfaction of NYSDEC.

Twelve external environmental inspections were conducted at the Laboratory in 2010 by federal, state, and local agencies that oversee BNL activities:

- NYSDEC did not conduct a formal inspection of the Laboratory's air compliance program, however, a NYSDEC inspector was present during an annual relative accuracy test audit of the continuous emissions monitoring system at the Central Steam Facility.
- NYSDEC conducted its annual inspection of the Major Oil Storage Facility. No issues were identified with any of the larger tanks at the Central Steam Facility, however, five conditions were identified at some of the smaller satellite fuel storage tanks. These included the need to properly prepare and paint a small section of piping, affixing the correct color coding at two waste oil storage tanks, ensuring that all satellite tanks had the required identification labeling at or near the gauge/fill port, repairing the remote high level and interstitial leak detector alarms for a tank, and the need to install a tank level gauge or alarm at the remote fill-port for another tank. Most conditions were corrected and the remaining conditions were addressed in 2011.
- NYSDEC conducted an inspection of the Chemical Bulk Storage facilities; no issues were identified.
- NYSDEC and the Environmental Protection Agency conducted annual Resource Conservation and Recovery Act (RCRA) inspections; both inspections found BNL operations to be in compliance with requirements.
- NYSDEC performed an annual surveillance inspection of the Laboratory's Sewage Treatment Plant; two recommendations for improved operations were noted.
- SCDHS collected samples and conducted its annual inspection of the BNL potable water system. Several maintenance items, such as painting, were noted as deficiencies. Also noted were requirements for standby power for Building 624, a ventilation fan in the chlorine storage room, and availability of safety equipment in the caustic storage room. All deficiencies are being addressed.
- SCDHS conducted quarterly inspections of the Laboratory's Sewage Treatment Plant to evaluate operations and sample the effluent; no performance or operational issues were identified.
- SCDHS inspected several of the SPDES-regulated outfalls and collected samples; minor issues were identified, including improved storm water controls for the National Synchrotron Light Source II construction site.

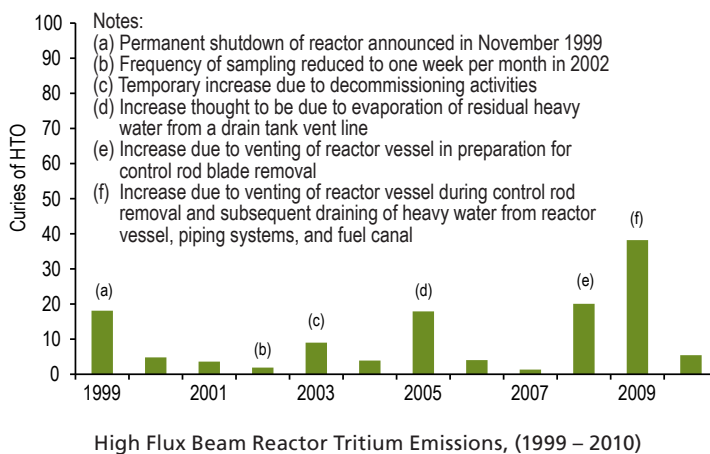
Each year, several DOE assessments and inspections are performed at BNL. In 2010, the DOE Brookhaven Site Office and the DOE Chicago Office evaluated the Laboratory's Spill Prevention Control and Countermeasures plan and the Environmentally Preferable Purchasing program. The assessment found BNL's documents to be in accordance with federal requirements. In addition, several recommendations for plan improvements were presented and will be addressed in the plan update in 2011.

BNL also conducted a programmatic self-assessment on

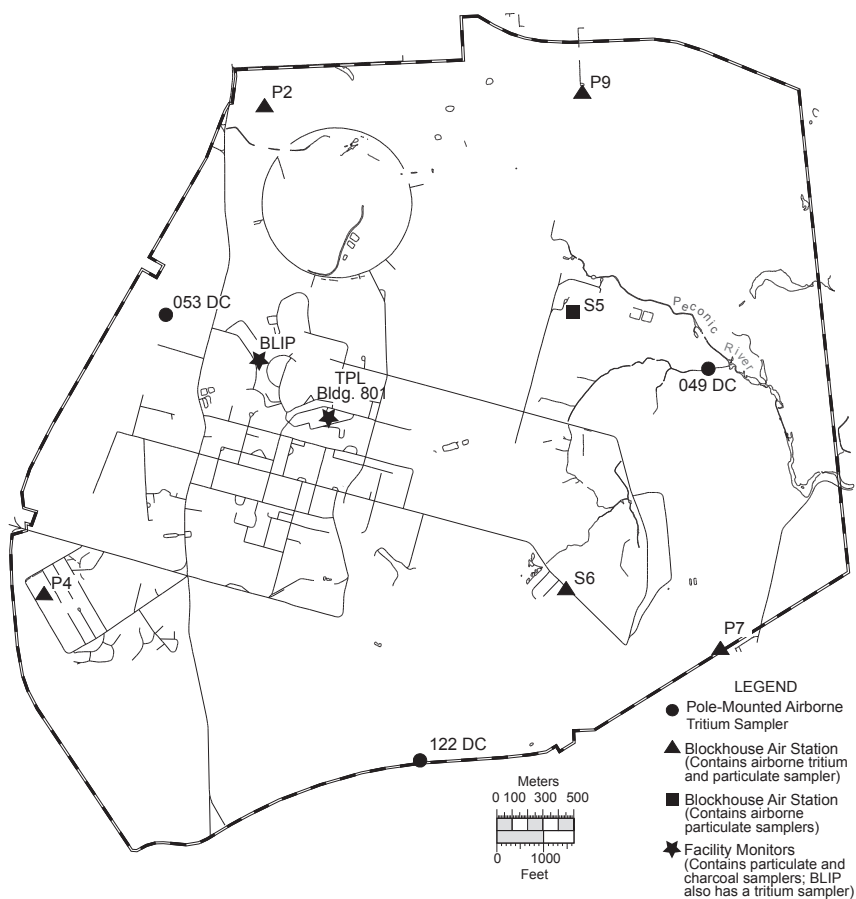
several aspects of its environmental management program. The self-assessment focused on requirements related to energy and water conservation, pollution prevention, and pesticide management. Fourteen noteworthy practices and four minor non-conformances were noted. A causal analysis was performed and a corrective action plan was prepared to address the issues.

AIR QUALITY PROGRAM

BNL monitors radioactive emissions at three facilities on site to ensure compliance with the requirements of the Clean Air Act. During 2010, Laboratory facilities released a total of 6,066 curies of short-lived radioactive gases. Environmental Protection Agency regulations require continuous monitoring of all sources that have the potential to deliver an annual radiation dose greater than 0.1 mrem to a member of the public; all other facilities capable of delivering any radiation dose require periodic confirmatory monitoring. BNL has one facility that is continuously monitored, the Brookhaven Linear Isotope Producer (BLIP). Oxygen-15 (half-life: 122 seconds) and carbon-11 (half-life: 20.48 minutes) emitted from the BLIP constituted more than 99.9 percent of radiological air emissions on site in 2010. The combined emissions were approximately 3.4 times higher than 2009 levels due to operation at much higher energy levels.



Monitoring was also conducted at one other active facility, the Target Processing Laboratory (TPL), and one inactive facility, the High Flux Beam Reactor (HFBR). Releases from the TPL in 2010 continued to be very small (0.0101 μ Ci). Lower tritium emissions from the HFBR (as shown in the figure above) in 2010 were due to decontamination and decommissioning (D&D) activities in preparation for long-term facility maintenance. From 2002–2008, emissions from the HFBR facility were monitored via air sampling at a frequency of one week per month. The monitoring frequency was increased to bi-weekly in 2009 to better account for changes in tritium emissions during planned D&D activities, and this frequency continued in 2010.



BNL On-Site Ambient Air Monitoring Stations

The Laboratory conducts ambient radiological air monitoring to verify local air quality and assess possible environmental and health impacts from BNL operations. Air monitoring stations around the perimeter of the site measure tritium and gross alpha and beta airborne activity. Results for 2010 continue to demonstrate that on-site radiological air quality is consistent with off-site measurements and with results from locations in New York State that are not located near radiological facilities.

Various state and federal regulations governing nonradiological releases require facilities to conduct periodic or continuous emissions monitoring to demonstrate compliance with emission limits. The Central Steam Facility (CSF) is the only BNL facility that requires monitoring. Two of the four boilers at the CSF, specifically 6 and 7, are equipped with continuous emission monitors to measure opacity and nitrogen oxide (NO_x) emissions. Opacity levels cannot exceed 20 percent, except for one 6-minute period per hour of not more than 27 percent opacity. In 2010, there were no exceedances of the NO_x emission standards for either boiler, no excess opacity measurements recorded in Boiler 6, and one excess opacity reading for Boiler 7. This isolated excess opacity reading was the result of an electrical anomaly that caused the air supply fan to trip during an unexpected shutdown. Past changes in the sequence of the soot blowing for both boilers have been successful in eliminating most

soot blowing opacity exceedances from either boiler.

Because natural gas prices were lower than residual fuel oil prices throughout the year, BNL used natural gas to supply roughly 90 percent of the heating and cooling needs of the Laboratory's major facilities during 2010. As a result, annual facility emissions of particulate matter, nitrogen oxides, and sulfur dioxide were at their lowest levels in the last decade.

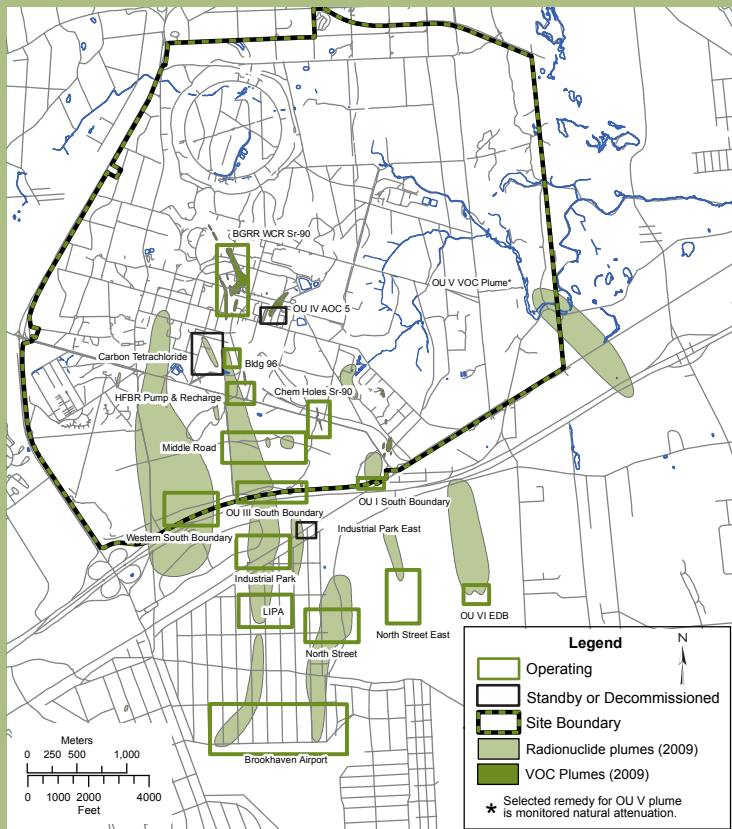
GROUNDWATER PROTECTION PROGRAM

BNL's extensive groundwater monitoring well network is used to evaluate progress in restoring groundwater quality, to comply with regulatory permit requirements, to monitor active research and support facilities, and to assess the quality of groundwater that enters and exits the site. The Laboratory monitors research and support facilities where there is a potential for environmental impact, as well as areas where past waste handling practices or accidental spills have already degraded groundwater quality. In 2010, the Laboratory collected groundwater samples from 789 on- and off-site monitoring wells during 1,732 individual sampling events.

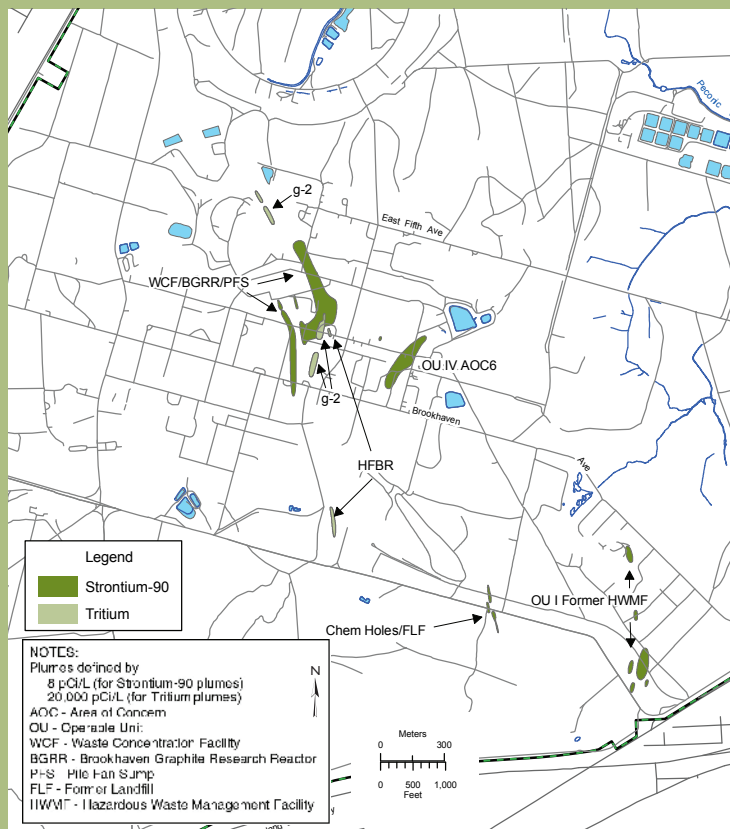
Under the environmental surveillance program, ten active research and support facilities were monitored during 2010. Although no new impacts to groundwater quality have been discovered since 2001, groundwater quality continues to be impacted from past releases at two facilities: the former g-2 experiment within the Alternating Gradient Synchrotron (AGS) facility and the on-site Upton service station.

Tritium continues to be detected at concentrations above the 20,000 pCi/L drinking water standard in wells monitoring the g-2 source area, with a maximum concentration of 76,000 pCi/L. Data indicate that tritium levels appear to be related to the flushing of residual tritium from the deep vadose zone following significant natural periodic fluctuations in the local water table. As a result of natural radioactive decay and dispersion in the aquifer, the g-2 tritium plume is breaking up into discrete segments. In 2010, the highest tritium concentration in the downgradient portion of the plume was 37,300 pCi/L. Concentrations of tritium in the BLIP facility surveillance wells have been less than the 20,000 pCi/L drinking water standard since 2006. These results indicate that the engineered stormwater controls are effectively protecting the activated soil shielding, and that the amount of residual tritium in the deep vadose zone is diminishing.

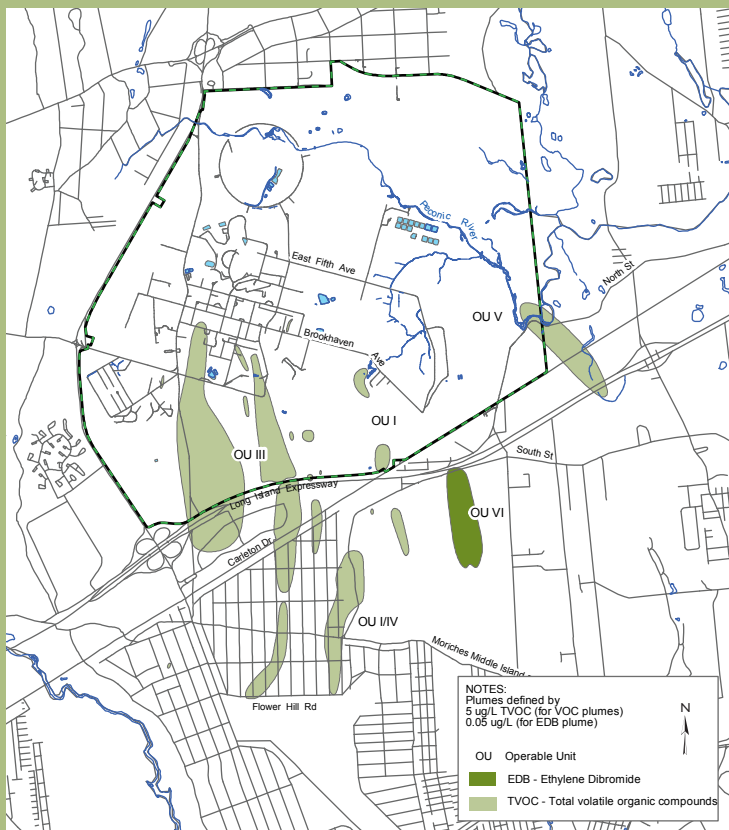
At the Upton service station, volatile organic compounds associated with historical petroleum and solvent spills



Locations of BNL Groundwater Remediation Systems.



Extent of Radionuclide Plumes On Site.



Extent of Volatile Organic Compound Plumes.

continue to be detected in the groundwater at concentrations above the applicable drinking water standard. The levels of volatile organic compounds are expected to decrease over time by means of natural attenuation.

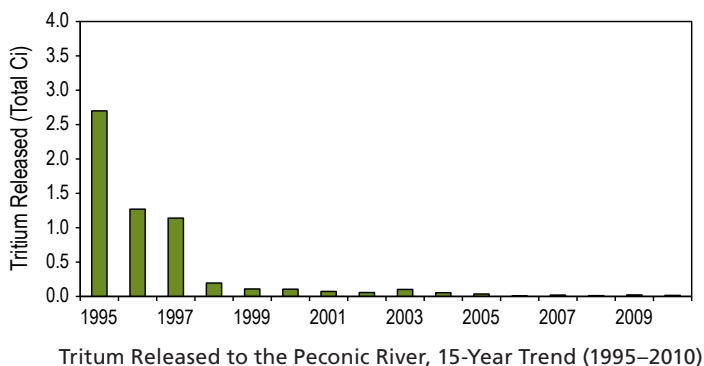
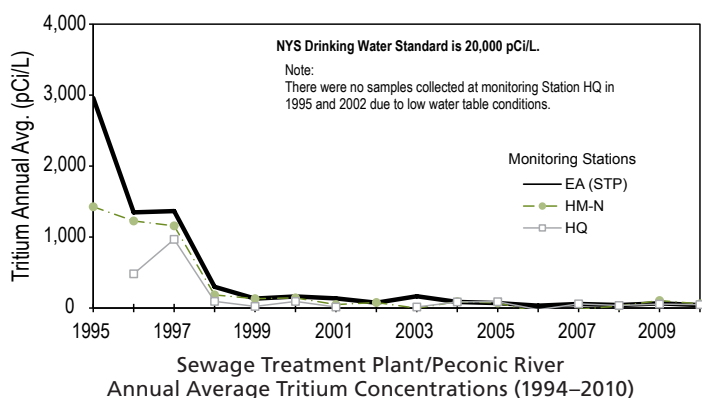
The primary mission of the Laboratory's Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) groundwater program is to operate and maintain groundwater treatment systems and prevent additional groundwater contamination from migrating off site. During 2010, BNL continued to make significant progress in restoring groundwater quality with the removal of approximately 183 pounds of volatile organic compounds and approximately 1.7 mCi of strontium-90 with the treatment of more than 1.8 billion gallons of groundwater. To date, 6,553 pounds of volatile organic compounds have been removed from the aquifer, and noticeable improvements in groundwater quality are evident in the Operable Unit (OU) I South Boundary, OU III South Boundary, OU III Industrial Park, OU III Industrial Park East, OU III North Street, OU IV, Building 96, and Carbon Tetrachloride areas. OU areas are designated as part of the CERCLA program to identify known or potential source areas of contamination. Also to date, two of the treatment systems have removed approximately 23 mCi of strontium-90 from the groundwater.

A comprehensive Groundwater Status Report, which is Volume II of the Site Environmental Report, is issued annually and details the results of groundwater samples collected to monitor the environmental remediation efforts, the effectiveness of the treatment systems, and environmental surveillance of current BNL experiments and operations. The full report can be found on the compact disc in the back of this Summary.

WATER QUALITY SURVEILLANCE PROGRAM

BNL discharges treated wastewater into the headwaters of the Peconic River via the Laboratory's Sewage Treatment Plant (STP), and non-contact cooling water and storm water runoff to groundwater via recharge basins. Some wastewater may contain very low levels of radiological, organic, or inorganic contaminants. Monitoring, pollution prevention, and careful operation of treatment facilities ensure that these discharges comply with all applicable requirements and that the public, employees, and the environment are protected.

To assess the potential impact of discharges on the water quality of the Peconic River, surface water monitoring is conducted at several locations upstream and downstream of the STP discharge. The Carmans River, located to the west of BNL, is monitored as a geographical control location for comparative purposes, as it is not affected by Laboratory operations.



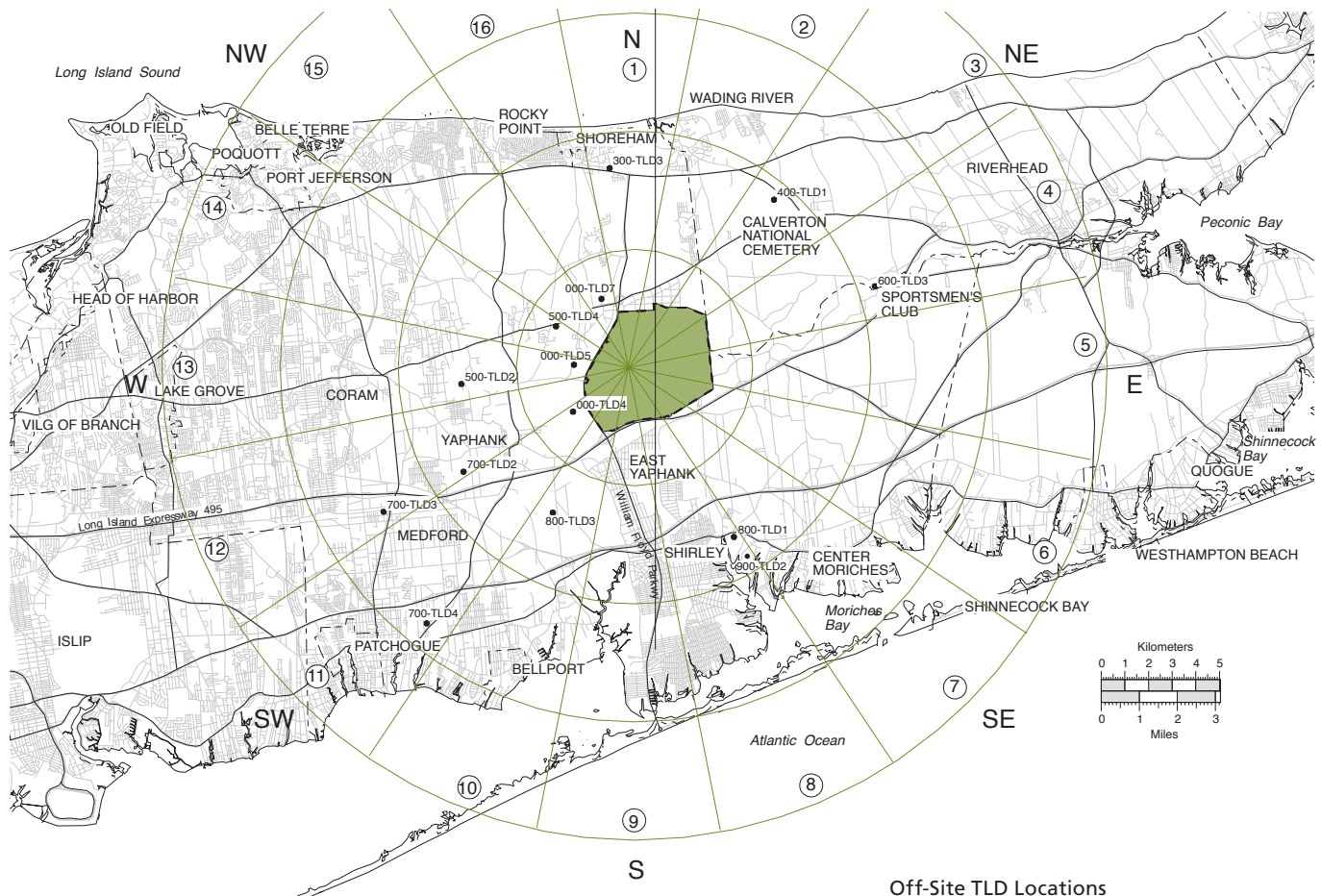
In 2010, the average gross alpha and beta activity levels in the STP discharge were well below New York State Drinking Water Standards (NYS DWS). Tritium detected at the STP originates from either High Flux Beam Reactor (HFBR) sanitary system releases, or from small, infrequent batch releases that meet BNL discharge criteria from other facilities. Although the HFBR is no longer operating, tritium continues to be released from the facility at very low concentrations due to off-gassing. To minimize the quantity of tritium released to the STP, efforts have been made to capture most of the air compressor condensate collected in the equipment areas of the structure. In 2010, tritium was detected once in the STP effluent at a concentration just above the minimum detectable activity (370 pCi/L vs. 310 pCi/L) and with high uncertainty (> 50 percent). The concentration detected is less than 2 percent of the NYS DWS. Analysis of the STP effluent and the Peconic River continued to show no detection of cesium-137, strontium-90, or other gamma-emitting nuclides attributable to BNL operations.

The STP is also monitored for nonradiological contaminants. In 2010, nonradiological monitoring of the STP effluent showed that, except for isolated incidents of non-compliance, organic, and inorganic parameters were within State Pollutant Discharge Elimination System effluent limitations or other applicable standards, and no volatile organic compounds were detected.

Discharges to recharge basins are sampled throughout the year for analyses of gross alpha and beta activity, gamma-emitting radionuclides, and tritium. Each recharge basin is a permitted point-source discharge under the Laboratory's SPDES permit. In 2010, there were no reported gamma-emitting nuclides attributable to BNL operations in any discharges to recharge basins, and tritium was not detected above method detection limits in any of the surface water samples taken. Inorganic data from Peconic River samples demonstrate that elevated amounts of most metals are associated with natural sources.

RADIOLOGICAL DOSE ASSESSMENT PROGRAM

BNL routinely assesses its operations to ensure that any potential radiological dose to members of the public, BNL workers, visitors, and the environment is "As Low As Reasonably Achievable" (ALARA). The potential radiological dose is calculated as the largest possible dose to a hypothetical Maximally Exposed Individual (MEI) at the BNL site boundary. For dose assessment purposes, the pathways include direct radiation exposure, inhalation, ingestion, immersion, and skin absorption. Radiological dose assessments at the Laboratory have consistently shown that the effective dose equivalent from all operations is well below the Environmental Protection Agency (EPA) and DOE regulatory dose limits for the public and the environment.



Off-Site TLD Locations

The dose impact from all BNL activities in 2010 was comparable to natural background radiation levels.

To measure direct radiation from Laboratory operations, 49 thermoluminescent dosimeters (TLDs) are placed on site and 14 TLDs are placed in surrounding communities (see map above). An additional nine TLDs are placed in a lead-shielded container for use as reference and control TLDs for comparison purposes. In 2010, the average dose from all TLDs showed there was no additional contribution to on- and off-site locations from BNL operations.

The annual on-site external dose from all potential sources in 2010, including cosmic and terrestrial radiation, was 66 ± 12 mrem (660 ± 120 μ Sv), and the annual off-site external dose was 61 ± 11 mrem (610 ± 110 μ Sv). The effective dose to the MEI from air emissions was 9.20×10^{-1} mrem (9.2 μ Sv). The ingestion pathway dose was estimated as 4.9 mrem (49 μ Sv) from consumption of deer meat and 0.11 mrem (1.1 μ Sv) from consumption of fish caught in the vicinity of the Laboratory. The total dose to the MEI from all pathways was estimated as 5.93 mrem (59 μ Sv). The dose from the air inhalation pathway attributable to BNL operations was less than 1 percent of EPA's annual regulatory dose limit of 10 mrem (100 μ Sv) and the total dose was less than 6 percent of DOE's annual dose limit of 100 mrem (1,000 μ Sv) from all pathways. Doses to aquatic and terrestrial biota were also evaluated and found to be

well below regulatory limits.

As a part of the National Emission Standards for Hazardous Air Pollutants (NESHAPs) review process at BNL, any source that has the potential to emit radioactive materials is evaluated for regulatory compliance. In 2010, the following radiological sources were evaluated for potential contribution to the overall site dose:

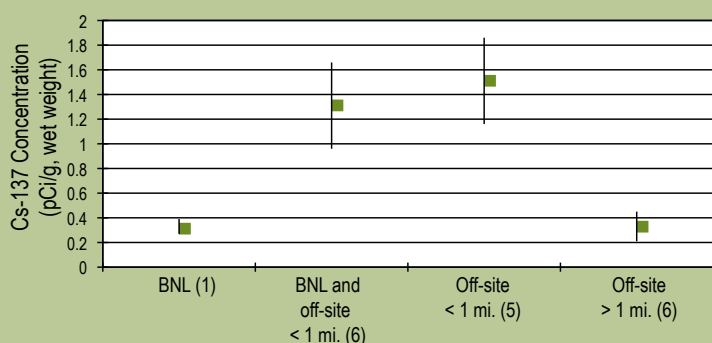
- Remediation work at Buildings 704 and 802 included dismantling and removing structures, systems, components, ducts, filter house inlets, resin beds, plenums, pipes, asphalt, and the soil below the overall footprint of the two buildings. The effective dose equivalent to the MEI from this project was estimated to be 1.68×10^{-2} mrem/year. Filter sample results showed no measurable activity above the natural background radiation.
- A NESHAP evaluation was completed for the demolition of the Building 705 stack once used to discharge effluents from the Brookhaven Graphite Research Reactor (BGRR) and to ventilate equipment and rooms in Building 801. The effective dose to the MEI was estimated to be 5.35×10^{-5} mrem/year. The stack remediation work was postponed by DOE until a later date, most likely prior to 2020, and a new method for the demolition will be proposed and reviewed under the NESHAP program at that time.

- The diffuse/fugitive losses due to forced circulation in the National Synchrotron Light Source (NSLS-II) were evaluated to demonstrate compliance with the annual limit of 10 mrem to the members of the public from DOE facility operations. The total dose to the MEI resulting from future NSLS-II operations was estimated to be $2.32\text{E-}04$ mrem/year. The potential dose is below the 10 mrem/year annual limit specified in 40 CFR 61, subpart H, and well below the EPA 0.1 mrem/year limit.
- In March 2010, an alarm sounded at the Brookhaven Linear Isotope Producer (BLIP) when irradiated targets were being removed from the hot cell and abnormally high radiation levels (40-70 $\mu\text{R}/\text{hour}$) were measured in the vicinity above the natural background radiation of 10-13 $\mu\text{R}/\text{hour}$. It was determined to be caused by a negative lapse rate in air dispersion during early mornings and late evenings.
- The BLIP facility released 1,741 Ci of carbon-11 and 4,320 Ci of oxygen-15 while operating over a period of

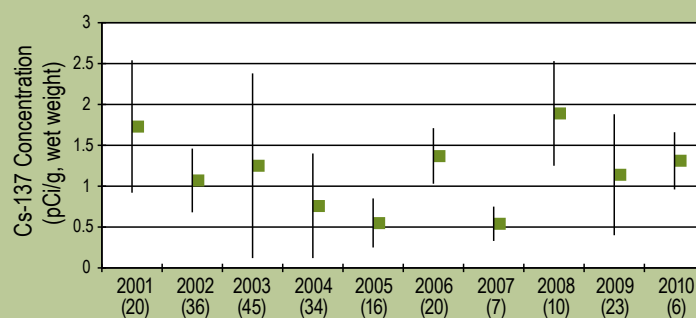
26 weeks in 2010. In addition, a small quantity ($3.31\text{E-}04$ C) of tritiated water vapor from activation of the targets' cooling water was also released. The effective dose equivalent to the MEI was estimated to be 0.92 mrem (9.2 μSv) in a year from BLIP operations.

NATURAL AND CULTURAL RESOURCE MANAGEMENT PROGRAM

The BNL Natural Resource Management Program was designed to promote stewardship of the natural resources found on site and to integrate natural resource management and protection with the Laboratory's scientific mission. The goals of the program include protecting and monitoring the ecosystem, conducting research, and communicating with the public, stakeholders, and staff members regarding environmental issues. Precautions are taken to protect and enhance habitats and natural resources at BNL. Activities to eliminate or minimize negative effects on sensitive or



Notes: Averages are shown for samples collected at BNL, on site and off site within 1 mile, off site but within 1 mile of the boundary, and off site greater than 1 mile from the boundary. Numbers in parentheses indicate the number of samples in that data set. All values are presented with a 95% confidence interval. Cs-137 = Cesium-137



Notes: Averages are shown for samples collected at BNL, and within 1 mile. Numbers in parentheses indicate the number of samples in that data set. All values are presented with a 95% confidence interval. Cs-137 = cesium-137

Comparison of Cesium-137 Average Concentrations in Deer Meat, 2010

Ten-Year Trend of Cesium-137 Concentrations in Deer Meat



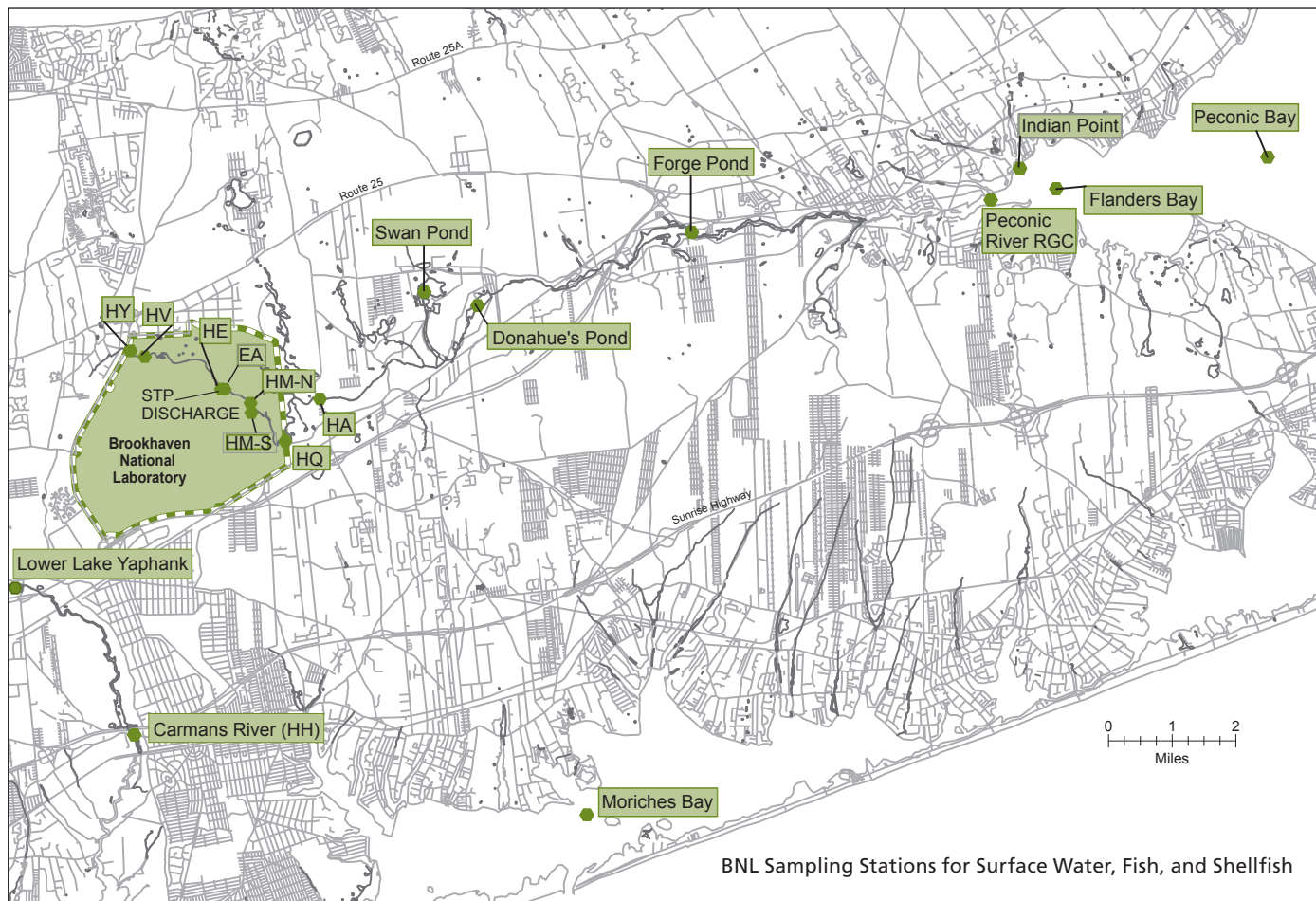
Eastern Hognose Snake (*Heterodon platyrhinos*).



Banded Sunfish (*Enneacanthus obesus*). This fish was released immediately after the photo was taken.



Eastern Tiger Salamander (*Ambystoma t. tigrinum*).



critical species (such as the eastern tiger salamander, eastern hognose snake, and banded sunfish) are incorporated into procedures or into specific programs or project plans. Restoration efforts continue to remove pollutant sources that could contaminate habitats. In some cases, habitats are enhanced to improve survival or increase populations. The Laboratory also monitors and manages other wildlife populations, such as white-tailed deer and Canada geese.

BNL conducts routine monitoring of flora and fauna to assess the impact, if any, of past and present activities on the Laboratory's natural resources. Generally, deer sampled on site contain higher concentrations of cesium-137 (Cs-137) than deer sampled from more than 1 mile off site. This is most likely because deer on site consume small amounts of contaminated soil and graze on vegetation growing in soil where elevated Cs-137 levels are known to exist. The maximum on-site concentration in 2010 from a single deer found on site was 0.31 pCi/g, wet weight (see figures on previous page). The wet weight concentration is before a sample is dried for analysis, and is the form most likely to be consumed. The single sample was 9.6 times lower than the highest level reported in 2009, and is much lower than the highest level ever reported (1996). The New York State Department of Health has formally reviewed the potential public health risk associated with elevated levels

of Cs-137 in on-site deer and determined that neither hunting restrictions or formal health advisories are warranted. Testing of deer bones for strontium-90 (Sr-90) indicated background levels. Sr-90 is present in the environment at background levels as a result of worldwide fallout from nuclear weapons testing. BNL continues to test for Sr-90 in bone to develop baseline information on this radionuclide and its presence in local white-tailed deer.

In collaboration with the New York State Department of Environmental Conservation Fisheries Division, BNL maintains an ongoing program for collecting and analyzing fish from the Peconic River and surrounding freshwater bodies. In 2010, Cs-137 was detected at low levels in all but 13 samples from the Peconic River system and appears to be declining compared with historic values. The cleanup of both on-and off-site portions of the Peconic River have already removed approximately 88 percent of Cs-137 in the sediment that was co-located with mercury. Natural decay is expected to result in further decreases.

Nonradiological analysis of fish in 2010 showed that all concentrations for metals are considered safe and do not pose any health risks to humans or other animals that may consume fish. Due to its known health risk, mercury is the metal of most concern. In general, a trend of decreasing mercury content downstream from BNL's Sewage Treatment Plant

(STP) is evident. Pesticide analysis in fish was discontinued in 2008, since several years of sampling detected pesticides in only a few fish far off site. Polychlorinated biphenyl (PCB) analysis in fish was also discontinued off site, but continued to be performed for fish on site. One fish sample tested positive for PCBs. Historically, PCBs have been found in both fish and sediment at BNL and periodically at other locations in the Peconic River. The cleanup of the Peconic River has removed most PCBs within the sediments on site.

Annual sampling of sediment and vegetation in the Peconic River and a control location on the Carmans River was also conducted in 2010. Cs-137 was not detected in any on-site aquatic vegetation samples, but was detected at levels near the detection level at off-site locations. Low levels of Cs-137 were also detected in sediments at off-site locations. Metals analysis conducted indicated metals at background levels and many are common in the environment.

Under the Peconic River remediation project, sediment from the Peconic River was remediated to remove mercury and associated contaminants from the river. Sampling results for 2010 identified three small areas with mercury concentrations greater than the cleanup goal of 2.0 mg/kg. The three areas have now been cleaned up. Routine sediment sampling was also conducted in 2010. Twenty-nine of the 30 sediment samples collected met the cleanup goal, and one sample had a concentration of 4.7 mg/kg. Five supplemental samples were then collected within the surrounding area and all were substantially lower than the cleanup goal.

Water column sampling for mercury and methyl mercury was performed at 22 Peconic River sampling locations, the STP, and one reference location on the Connetquot River in 2010. The general trend of total mercury in water samples decreased with increasing distance downstream from the STP. Methyl mercury concentrations increased slightly from the STP to the BNL site border and then decreased gradually with increasing distance downstream of the BNL site border until reaching the historic range of concentrations for the Connetquot River reference station.

On-site sampling of garden vegetables in 2010 did not detect any Cs-137 in vegetables, but was detected in soils at a very low level and is consistent with historical background levels.

Wildlife Programs

The Laboratory sponsors a variety of educational and outreach activities involving natural resources. These programs are designed to help participants understand the ecosystem and to foster interest in science. Wildlife programs are conducted at BNL in collaboration with DOE, local agencies, colleges, and high schools. Ecological research is also conducted on site to update the current natural resource inventory, gain a better understanding of the ecosystem, and guide management planning. In 2010, BNL's Environmental

Protection Division hosted 16 interns and one faculty member who worked on a variety of projects, some of which include: soil microbial studies of Pine Barrens soils, insect folivory, pollination distribution surveys in the area of the Long Island Solar Farm, soil chemistry, nitrogen in soils, microbial and vegetation surveys, and wetland health.

Cultural Resource Management Program

The goal of BNL's Cultural Resource Management Program (CRMP) is to ensure the proper stewardship of BNL and DOE historic resources. Additional goals include maintaining compliance with various historic preservation and archeological laws and regulations, and ensuring the availability of resources to Laboratory personnel and the public for research and interpretation.

Cultural resource management activities performed in 2010 included identification and relocation of historic artifacts.

WORLD WAR I TRENCHES

From 1917 through 1920, the site of what is now the Laboratory was the U.S. Army's Camp Upton. Named for Civil War General Emory Upton, Camp Upton was one of 16 U.S. Army training camps. Here, recruits mostly from the New York metropolitan area were trained for the famed 77th Infantry Division, also known as the Liberty Division, which began leaving Camp Upton for fighting in France in March 1918.

Training included marching, weapons-use and, among other techniques, trench warfare. Trench warfare was a form of combat in which armies dug zig-zagging lines of interconnected ditches. Within these trenches, troops lived in muddy water, among rats and lice while defending their territory and combating their opponents.

The trenches shown here may be some of the only surviving examples of WWI earthworks in the U.S., and they have been determined to be eligible for listing on the National Register of Historic Places.

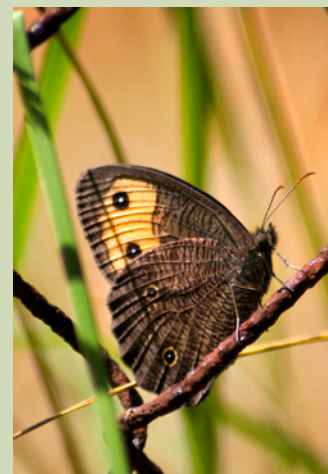


UPTON ECOLOGICAL AND RESEARCH RESERVE

The Upton Reserve, on the eastern boundary of the Laboratory, is home to a wide variety of flora and fauna. It contains wetlands and is largely within the core preservation area of the Long Island Central Pine Barrens. The reserve is managed by BNL and the Foundation for Ecological Research in the Northeast (FERN). Based on information from a 1994–1995 biological survey of the Laboratory, experts believe the reserve is home to more than 200 plant species and at least 162 species of mammals, birds, fish, reptiles, and amphibians.

Research conducted in 2010 included:

- Continued investigation into the microbial world of soils located within the pine barrens and experimental areas at BNL.
- A research team from the Southern University at New Orleans completed genetic analysis of microbes.
- An aquatic invertebrate survey of the Carmans River.



COMMUNICATION AND COMMUNITY INVOLVEMENT

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

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

business, civic, education, employee, community, environmental, and health organizations. The CAC sets its own agenda in cooperation with the Laboratory and meets monthly in sessions that are open to the public. Weekly phone calls with regulators keep them up-to-date on project status, obtain feedback and input, and provide an opportunity to discuss emerging environmental findings and obtain feedback and input on them. The Community Relations Office website is used to host links to important cleanup documents and to announce public meetings.

The Community Relations Office manages several outreach programs that provide opportunities for stakeholders to become familiar with the Laboratory's facilities and

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

BNL's Media and Communications Office issues press releases and publishes *The Bulletin*, a weekly employee newsletter. A Director's Office web-based publication is issued

bi-weekly, focusing on topics important to the Laboratory. BNL maintains an informative website at <http://www.bnl.gov>, where these publications, as well as extensive information about science and operations, past and present, are posted. Employees and the community can also subscribe to the Laboratory's e-mail update service at <http://lists.bnl.gov/mailman/listinfo/bnl-announce-1>.

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

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

Summer Sundays
at BNL



Annual "Your Environment" Art Contest



One of the many events BNL hosts each year in honor of Earth Day is the “Your Environment” art contest. Students from local schools in grades 3-5 are asked to create a poster focusing on an environmental theme. The winning students receive a \$100 gift check and all students who enter receive a Certificate of Participation at our annual awards celebration.



a)



b)



c)



d)

The winning posters for this year's contest were created by:

- a) **Gracee Kaiser**
Charles E. Walters Elementary School
- b) **Ana Melissa Marquez**
Coram Elementary School
- c) **Nicole Cordes**
Laddie A. Decker Sound Beach School
- d) **Gabriela Reyes**
Ridge Elementary School
- e) **Guri Umanzor**
Verne W. Critz Elementary School

