Green Buildings

FUTURE NSLS-II

RESEARCH SUPPORT BUILDING

CENTER FOR FUNCTIONAL NANOMATERIALS

2008 Site Environmental Report

BROOKHAVEN NATIONAL LABORATORY

SUMMARY

RESEARCH SUPPORT BUILDING

CENTER FOR FUNCTIONAL NANOMATERIALS

Two buildings at Brookhaven National Laboratory have been awarded a LEED silver rating by the U.S. Green Building Council. LEED stands for Leadership in Energy and Environmental Design. The two buildings, the 65,000 square-foot Research Support Building (RSB) and the 94,500 square-foot Center for Functional Nanomaterials (CFN), have become the standard for the newly designed state-of-the-art research centers at the Laboratory.

The LEED standard has been adopted nationwide by federal agencies, state and local governments, and interested private companies as the industry standard of measurement for "green" buildings. The LEED green building rating system provides credits for satisfying specified criteria. Projects are evaluated within five categories—sustainable sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental qualities.

The National Synchrotron Light Source II (NSLS-II) Facility, which is currently under construction, will also strive for LEED certification by incorporating a wide range of sustainable strategies and objectives throughout the design and construction process, while meeting the functional requirements of advanced technology and creating a workplace that is environmentally friendly, energy-efficient, and both healthy and pleasant to be in.

FUTURE NSLS-II

Designing buildings to achieve a LEED rating has many benefits, including lower operating costs, reduced waste going into landfills, conservation of energy and water, reduction of greenhouse gas emissions, and a healthier, safer workplace.

The Brookhaven National Laboratory 2008 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:

Brookhaven National Laboratory
Environmental Protection Division
Attention: SER Project Coordinator
Building 120
P.O. Box 5000
Upton, NY 11973-5000
(631) 344-3711

A MESSAGE FROM THE LABORATORY DIRECTOR

Samuel H. Aronson, Laboratory Director

Brookhaven's environmental performance remained at a high level in 2008 as we continued to work towards ever-cleaner and more efficient operations. In 2008, we received a DOE P2 STAR Honorable Mention Award, a Federal Environmental Executive Silver Award, and were the northeast winner of the Federal Environmental Executive's Annual Electronics Reuse & Recycling Campaign Award. These awards, the continued certification of our Environmental Management System, and our strong compliance assurance program are just a few examples of our commitment to environmentally responsible operations.

In 2008, two DOE Orders were issued which incorporated the goals of the 2007 Presidential Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*. These two new orders establish federal requirements for energy efficiency and conservation, renewable energy, fleet management, water conservation, sustainable buildings, reduction of toxic chemical use, purchasing of environmentally preferred products, electronic stewardship, and the implementation of an Environmental Management System. While most of these requirements are already incorporated into programs at BNL, these new orders will help direct the future of our Pollution Prevention Program.

Brookhaven also continues to advance its commitment to renewable energy research. This year, New York Governor David Paterson announced that a new solar power station would be sited at Brookhaven. The project, which will be the largest solar photovoltaic project in New York State, will provide a substantial source of lower-cost power, along with a significant research opportunity for Brookhaven. In addition to the main power array, there will be a smaller research array that will be used for a whole range of experiments. Our plan is to make the research array available to those at universities, in industry, and at other national laboratories.

This year's cover story discusses three Brookhaven buildings – our Center for Functional Nanomaterials and the Research Support Building—each have been awarded a LEED silver rating by the U.S. Green Building Council. Our newest facility, the National Synchrotron Light Source II (currently under construction), will also strive for LEED rating.

Finally, we continue to openly communicate with the community, regulators, employees, and other interested parties on our environmental issues and cleanup progress, incorporating their input into our decision processes. We know that the Laboratory's future as a world leader in science research depends in great part on the trust and support of our neighbors.

Signature on file

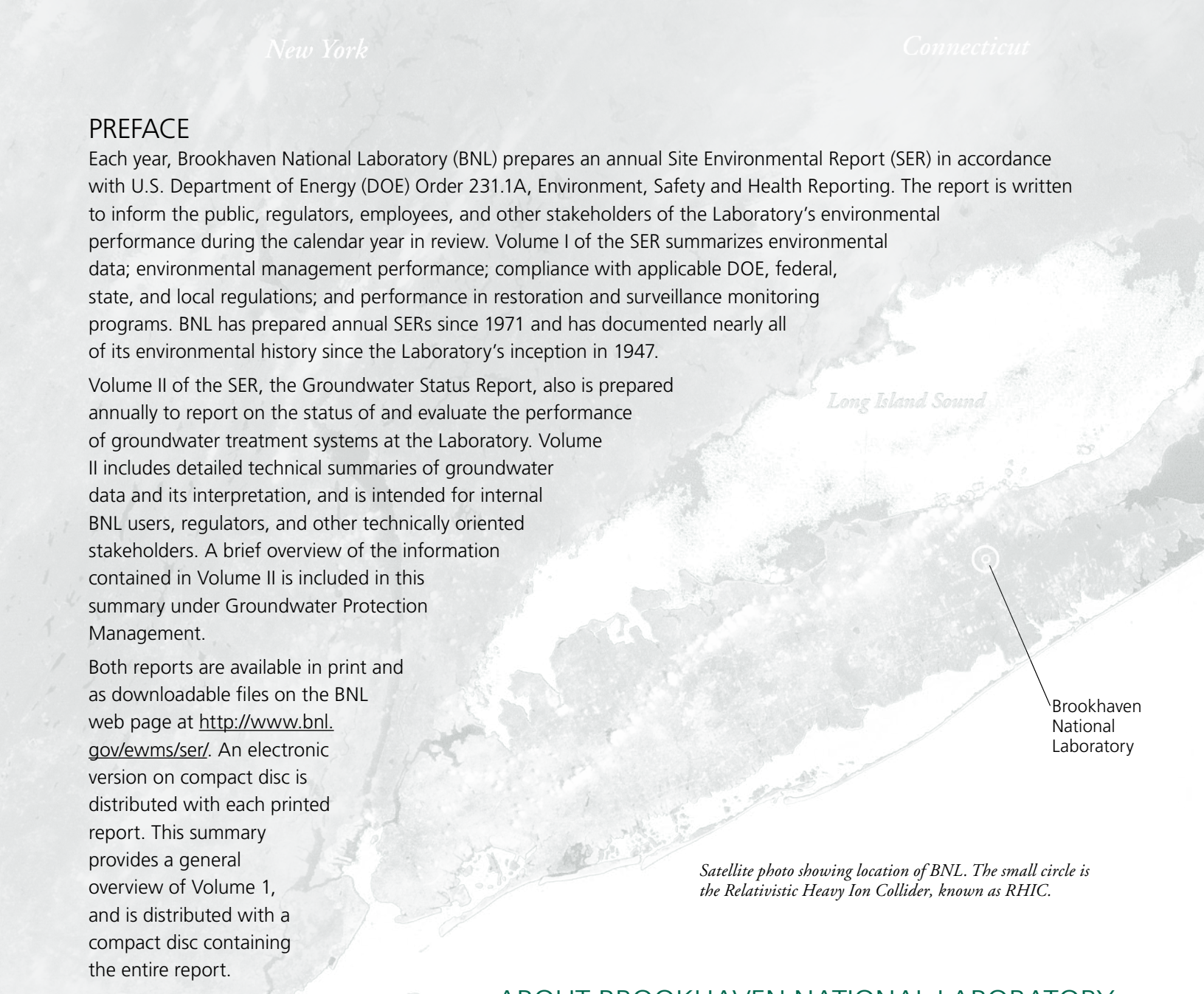
2008 SITE ENVIRONMENTAL REPORT **SUMMARY**

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. BNL has prepared annual SERs since 1971 and has documented nearly all of its environmental history since the Laboratory's inception in 1947.

Volume II of the SER, the Groundwater Status Report, also is prepared annually to report on the status of 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 Management.

Both reports are available in print and as downloadable files on the BNL web page 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 entire report.



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

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 carry out basic and applied research in long-term programs 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 in energy resources, environmental quality, and national security are:

- To conceive, design, construct, and operate complex, leading-edge, user-oriented research facilities.
- To develop advanced technologies that address national needs and initiate their transfer 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 on Long Island, 60 miles east of New York City. The Laboratory's 5,265-acre site is near Long Island's geographic center and is part of 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 2,800 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.

An independent Suffolk County Planning Commission report concluded that BNL's spending for operations, procurement, payroll, construction, medical benefits, and technology transfer spreads throughout Long Island's economy, making the Laboratory vital to the local economic health, as well as to New York State. In 2008, BNL purchased $5.8 million worth of supplies and services from Long Island businesses. The total annual budget in 2008 was approximately $530.9 million, of which approximately 60.7 percent was spent on employee salaries, wages, and fringe benefits.

BNL FACILITIES AND OPERATIONS

Most of the Laboratory's principal facilities are located near the center of the site. The developed area is approximately 1,650 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, research agricultural fields, housing facilities, and fire breaks
- 400 acres of roads, parking lots, and connecting areas

The balance of the site, approximately 3,600 acres, is mostly wooded and represents the native pine barrens ecosystem, of which 530 of these acres are part of the Upton Ecological Reserve.

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

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

Aerial photograph of the BNL site.

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 nations' 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.
- ***Relativistic Heavy Ion Collider (RHIC).*** The RHIC is a world-class scientific research facility. The RHIC accelerator drives two intersecting beams of gold ions, other heavy metal ions, and/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.
- ***Scanning Transmission Electron Microscope (STEM).*** The STEM facility includes two microscopes that are used for biological research. Both devices allow scientists to see the intricate details of living things, from bacteria to human tissue.
- ***Tandem Van de Graaff and Cyclotrons.*** The Tandem Van de Graff 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.

RESEARCH AND DISCOVERIES AT BNL

The Laboratory is one of the nation's—and the world's—leading research institutions. Six 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.

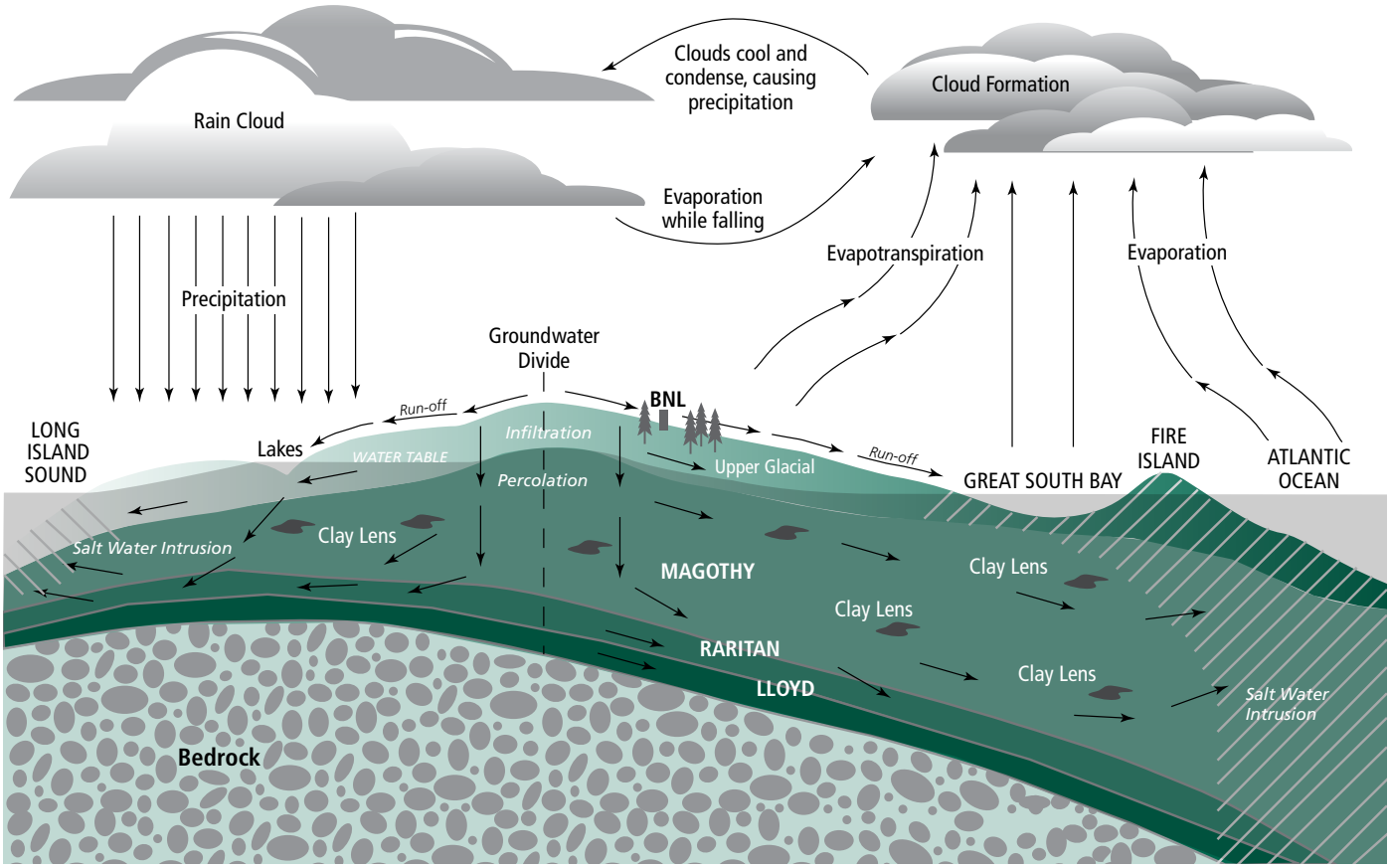
Scientific Discoveries

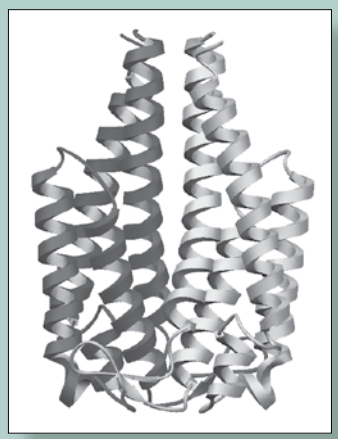
- *Courant-Snyder strong focusing principle, critical to the design of all modern particle accelerators.*
- *Theories and experiments to determine the mechanisms underlying high-temperature superconductors.*
- *Study of the effects of radiation on biological systems, important to cancer treatment and prevention, and to human space travel.*
- *Important studies of the brain, including those uncovering the roots of psychiatric disorders, brain metabolism, and drug addiction.*
- *Large-scale studies of the effect of increased carbon dioxide on ecosystems.*
- *The discovery of a perfect liquid, a type of matter thought by scientists to have existed microseconds after the Big Bang.*
- *The development of thallium-201, now used in hundreds of thousands of heart stress-tests each year.*
- *X-ray and neutron scattering facilities that have made possible countless studies of molecular structures important to disease.*
- *Use of L-dopa for the treatment of Parkinson's disease (the gold standard for treatment).*
- *X-ray angiography for non-invasive heart imaging.*
- *Environmentally 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.*

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 72 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

Precipitation Cycle in the Area of Brookhaven National Laboratory





A 3-D model of a Lyme disease protein, used in a new, effective vaccine.

The Brookhaven-developed fan-atomized oil burner offers improved fuel- and air-mixing for better performance.

BNL's Relativistic Heavy Ion Collider has two accelerators in one made of crisscrossing rings of superconducting magnets enclosed in a tunnel 2.4 miles in circumference. In the two rings, beams of heavy ions are accelerated to nearly the speed of light in opposite directions, held in their orbits by powerful magnetic fields.

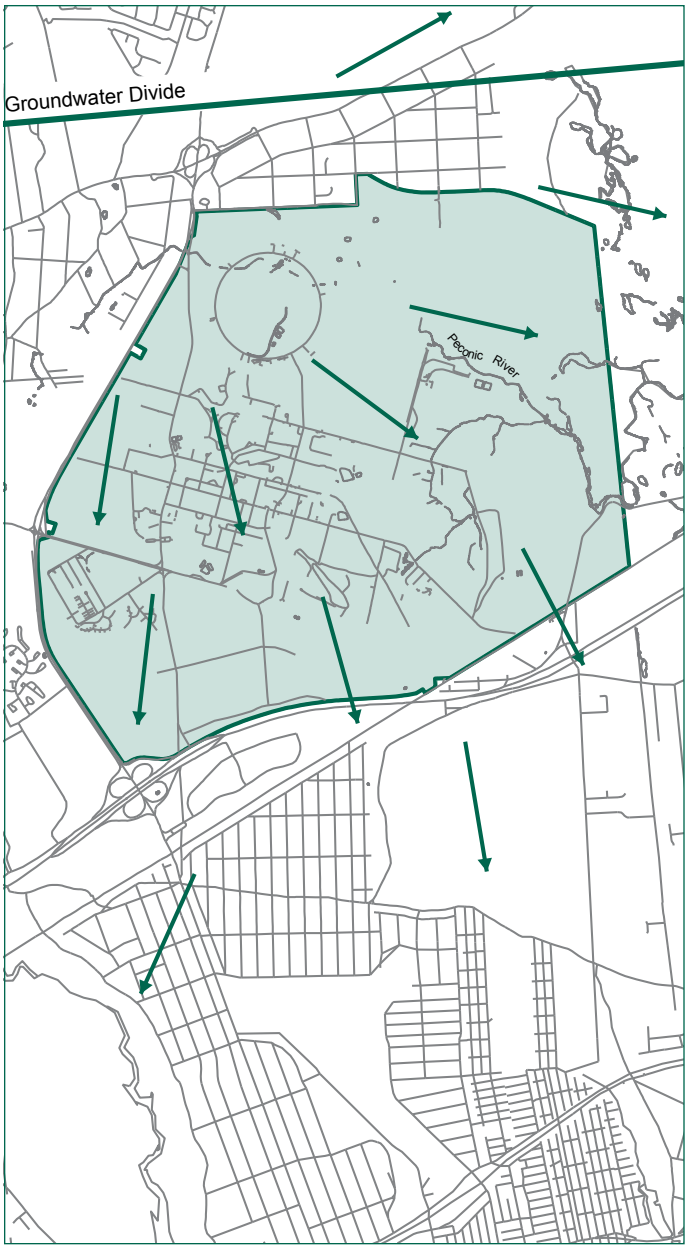
source of drinking water for both on- and off-site private and public supply wells.

The terrain of the site is gently rolling, with elevations varying between 44 and 120 feet above mean sea level. Depth to groundwater from the land surface ranges from 5 feet near the Peconic River to approximately 80 feet in the higher elevations of the central and western portions of the site. Studies of Long Island hydrology and geology in the vicinity of the Laboratory indicate that the uppermost Pleistocene deposits, composed of highly permeable glacial sands and gravel, are between 120 and 250 feet thick. Water penetrates these deposits readily, and there is little direct runoff into surface streams unless precipitation is intense. The sandy deposits store large quantities of water in the Upper Glacial aquifer. On average, about half of the annual precipitation is lost to the atmosphere through evapotranspiration and the other half percolates through the soil to recharge the groundwater.

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 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 2008, the Laboratory used approximately 1.15 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 3.4 million gallons of groundwater were pumped each day from remediation wells. The water was treated to remove contaminants and then returned to the aquifer by way of recharge basins or injection wells.

Groundwater flow directions across the site are influenced by natural drainage systems: eastward along the Peconic River, southeast toward the Forge River, and south toward the Carmans River. Pumping from on-site supply wells affects the direction and speed of groundwater flow, especially in the central, developed areas of the site. The main groundwater divide on Long Island is aligned generally east–west and lies approximately one-half mile north of the Laboratory. Groundwater north of the divide flows northward and ultimately discharges to the Long Island Sound. Groundwater south of the divide flows east and south, discharging to the Peconic River, Peconic Bay, south shore streams, Great South Bay, and Atlantic Ocean. In most areas on site, the horizontal velocity of groundwater is approximately 0.75 to 1.2 feet per day. In general, this means that groundwater travels for approximately 20 to 22 years as it moves from the central, developed area of the site to the Laboratory's southern boundary.



BNL Groundwater Flow Map

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 ensures that the Laboratory integrates DOE's five Core Functions and seven Guiding Principals into all work processes. These integrated safety processes contributed to BNL's achievement of 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.

In 2001, an Environmental Management System (EMS) was established at BNL 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. BNL's EMS was designed to meet the rigorous requirements of the globally recognized ISO 14001 Environmental Management Standard and was the first Laboratory under the DOE Office of Science to become officially registered to this standard. Annual independent audits, which are required to maintain the registration, are conducted to validate that BNL's EMS is being maintained and to identify evidence of continual improvement. In 2008, an EMS surveillance audit determined that the Laboratory continues to conform to the standard.

NSF International Strategic Registrations

789 North Dixboro Road, Ann Arbor, Michigan 48105
(888) NSF-9000

Certificate of Registration

This certifies that the Environmental Management System of

Brookhaven National Laboratory
Building 860
E. 5th Street
Upton L.I., New York, 11973-5000 USA

has been assessed by NSF-ISR and found to be in conformance to the following standard(s):

ISO 14001:2004

Scope of Registration:

Facilities, experiments, and operations managed by Brookhaven Science Associates at Brookhaven National Laboratory in accordance with the Environmental Management System.

Industrial Classification:

IAF: 34
SIC: 8733
NACE:

ANAB ACCREDITED

Certificate Number: 69525-E4
Certificate Issue Date: 10-Dec-2007
Company Initial Date: 10-Jul-2001
Registration Date: 18-Jun-2007
Expiration Date*: 17-Jun-2010

Christian B. Lupo, General Manager
NSF-ISR, Ltd.

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ENVIRONMENTAL AWARDS

One measure of an effective EMS is recognition of good environmental performance. In 2008, BNL was recognized with two national and one regional award:

- DOE awarded BNL a P2 STAR Honorable Mention Award for pollution prevention practices in the Study of DNA Repair Using Fluorescently Labeled Oligonucleotides
- BNL received its second Silver Level Award for Electronics Recycling from the Office of the Federal Environmental Executive
- BNL was named the Northeast Region winner in the Office of the Federal Environmental Executive's annual Electronics Reuse & Recycling Campaign. The Laboratory reused or recycled 143,600 pounds of electronics in 2008

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. An overview of BNL's environmental programs and a summary of performance for 2008 follows:

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.

During 2008, two DOE Orders were issued which incorporated the goals of Presidential Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management, released in 2007. DOE Order 430.2B, Departmental Energy, Utilities, and Transportation Management, was issued in February 2008 and establishes federal requirements for energy efficiency and conservation, renewable energy, fleet management, water conservation, and sustainable buildings. DOE Order 450.1A, Environmental Protection Program, was issued in June 2008 and establishes federal requirements for pollution prevention, reduction of toxic chemical use, purchasing of environmentally preferred products, electronic stewardship, and implementation of an Environmental Management System (EMS). These requirements will direct the future of BNL's P2 program and most have already been incorporated within its program.

An important function of the P2 Program is to seek funding to implement pollution prevention projects. Five P2 proposals were funded in 2008, for a combined investment of approximately $16,000. The anticipated annual savings from these projects is estimated at $13,867, for an average payback period of approximately 1.3 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. These positive trends are also driven by the EMS emphasis on preventing pollution and establishing objectives and targets to reduce environmental impacts.

The implementation of pollution prevention opportunities, recycling programs, and conservation initiatives has significantly reduced both waste volumes and management costs. In 2008, these efforts resulted in more than $1.8 million in cost avoidance or savings and approximately 9.7 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 2008, BNL collected more than 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, drill press machine coolant, and antifreeze were also recycled. Also in 2008, 16 tons of computer equipment were reused internally.

EPA'S PERFORMANCE TRACK PROGRAM

BNL's Performance Track (PTrack) Program recognizes top environmental performance among participating U.S. facilities of all types and is considered the "gold standard" for facility-based environmental performance. The program requires that facilities commit to several improvement goals for a 3-year period and report on the progress of these goals annually. The Laboratory was accepted into the program in 2004 and completed its first set of goals. In 2007, the Laboratory renewed its membership and established four new goals. The performance for these goals in 2008 is summarized below:

- *Reduce BNL's Non-Transportation Energy Consumption:* BNL reduced the overall metric tons of greenhouse gas emissions by 17,000 metric tons of CO_2. Efforts to achieve these reductions included reduced electricity consumption and the use of biobased fuel oils in satellite boilers. Specific energy reduction initiatives included replacing older refrigeration compressors at BNL's Relativistic Heavy Ion Collider facility to gain efficiency, and modifications to the cryogenic piping systems to improve overall system reliability and efficiency and to reduce power demands.
- *Initiate a Biobased Fuel Program for Heavy Equipment:* The goal of this measure is to replace conventional diesel fuels with biobased blends for use in heavy equipment. This goal saw little progress in the first year due to concerns for equipment warranties. These issues are being negotiated with the equipment suppliers.
- *Achieve 95 Percent E-PEAT Registered Products for All Computer Acquisitions:* BNL's commitment is to ensure that 95 percent of all purchased computers and accessories are registered silver under the Electronic Procurement Environmental Assessment Tool (E-PEAT). In 2008, only 40 percent of all computer purchases were E-PEAT registered. BNL will continue to work with computer suppliers and requisitioners to improve this statistic in future years.
- *Reduce BNL's Toxic Releases through Effective Biosolids Management:* BNL made significant achievements in this goal in 2008, including receiving New York State Department of Environmental Conservation approval for the disposal of ac-

cumulated biosolids and sand filter media at a conventional Subtitle D landfill, and the recharacterization of routinely generated biosolids as nonradioactive. By recharacterizing this waste stream, routine local disposal of the accumulated sludge can occur, resulting in lower operating costs.

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 DOE Order 430.2B and the Secretary's Transformational Energy Action Management (TEAM) initiative.

The Laboratory has more than 4 million square feet of building space. In 2008, BNL used approximately 233 million kilowatt hours (kWh) of electricity, 708 thousand gallons of fuel oil, 36 thousand gallons of propane, and 517 million cubic feet of natural gas. Due to market conditions, fuel oil and natural gas were used whenever each respective fuel was least expensive.

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. No curtailment days were requested in 2008, in part due to mild weather. However, mere participation in this program produced a rebate of $45,000. The Laboratory continues to keep electric loads at a minimum during the summer, by scheduling operations at BNL's Relativistic Heavy Ion Collidar during cooler weather to avoid peak demand periods. This scheduling allowed the Laboratory to save $4.2 million in electric costs in 2008 and greatly helps maintain the reliability of the Long Island Power Authority (LIPA) electric system to meet all of its users' needs.

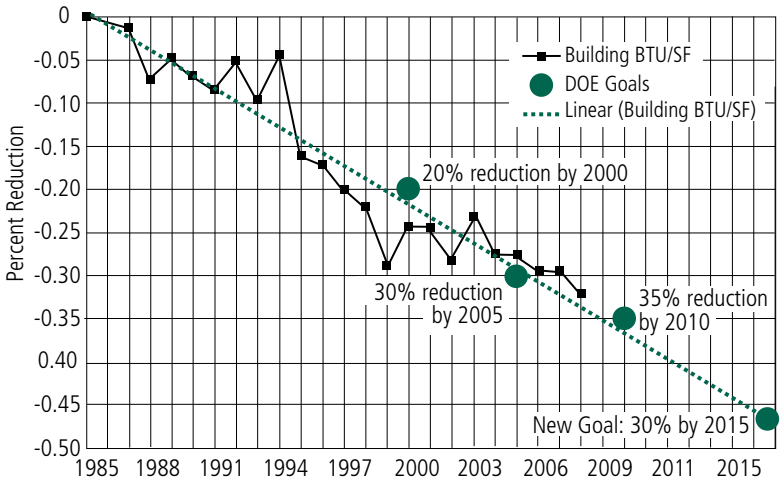
In 2008, LIPA issued a Request for Proposals for 50 MW of solar photovoltaic (PV) generating projects. The construction of a 37 MW solar array at the Laboratory site by BP Polar was one of four projects selected by LIPA for development and is expected to provide a substantial source of lower-cost power at BNL.

BNL also maintains a contract with the New York Power Authority (NYPA) that resulted in an overall cost avoidance of $19 million in 2008. The Laboratory will continue to seek alternative energy sources to meet its future energy needs, support federally required "green" initiatives, and reduce energy costs.

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 FY06–FY15. In 2007, an Executive Order increased the target reduction to 3 percent per year, which is a 30 percent reduction by the end of FY2015. Further, DOE Order 430.2B and the Secretary's TEAM initiative have set even more stringent requirements, including renewable energy and transportation fuels that go significantly beyond the previous goal of a 30 percent reduction by 2005, compared to 1985. BNL's energy use per square foot in 2008 was over 30 percent less than in 1985 and 11.6 percent less than in 2003.

To reduce energy use at non-research facilities, several activities were undertaken in 2008:

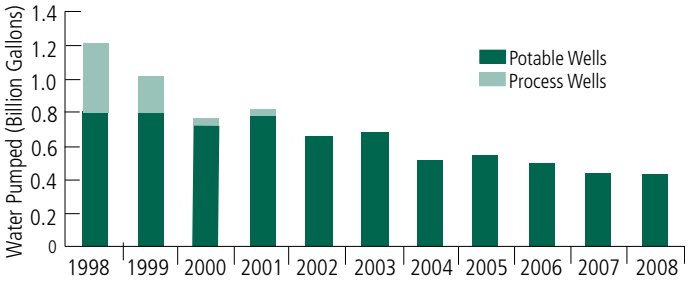
- An Initial Proposal for a sitewide Energy Savings Performance Contract audit was completed for the Laboratory by Constellation Energy and included projects that will reduce the Laboratory's overall energy intensity (Btu/ft^2) by 11 percent and save over $2 million/year in energy costs.
- 25 MW of demand was rescheduled to avoid coinciding with the utility summer peak, saving several million dollars in electricity charges.
- A demonstration project for a solar hot water combination system at BNL's Brookhaven Center was begun.
- Work continued in the replacement of aging, inefficient T-40 fluorescent lighting fixtures with new, efficient T-8 and T-5 units; two to three hundred fixtures are typically replaced annually, saving tens of thousands of kWhs and reducing costs by several thousand dollars.
- Continued conservation efforts in BNL's overall facilities energy usage in 2008 was approximately 11.6 percent less than in 2003, saving over $2.2 million.
- Efficient fuel purchasing strategies (buying and storing oil and burning the least expensive fuel) saved $1.3 million, compared to purchasing only oil as it is consumed.
- The Center for Functional Nanomaterials was completed and received LEED (Leadership in Energy and Environmental Design) silver certification.
- Over 25,000 gge (gasoline gallon equivalents) of natural gas were used in place of gasoline for the Laboratory's vehicle fleet.



Building Energy Performance, 1985 – 2015

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. During the past 7 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 at BNL 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 2008, BNL generated the following types and quantities of waste from routine operations:

- Hazardous waste: 5.5 tons
- Mixed waste: 12 cubic feet
- Radioactive waste: 1,738 cubic feet

In 2008, there was a small increase in hazardous waste generation from 2007 due to the disposal of approximately 2,000 pounds of material from BNL's Instrumentation Division. The decrease in routine mixed waste and routine radioactive waste was due to decreased activities at BNL's Collider-Accelerator Department. The Laboratory continues to clean up facilities and areas containing radioactive and chemical contamination resulting from long-past operations.

COMPLIANCE MONITORING PROGRAM

BNL has an extensive Compliance Monitoring 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 13 groundwater remediation systems, and several other binding agreements. In 2008, BNL complied with the majority of these requirements, and instances of noncompliance were reported to regulatory agencies and corrected expeditiously.

Eleven external environmental audits were conducted in 2008 by federal, state, and local agencies that oversee BNL activities:

- The New York State Department of Environmental Conservation (NYSDEC) performed its annual inspection of BNL's Hazardous Waste Program, and three instances of waste labeling were identified that did not fully comply with hazardous waste storage requirements. NYSDEC issued a Notice of Violation; however, no fine or penalties were issued because all items were corrected immediately.
- NYSDEC conducted an inspection of BNL's Chemical Bulk Storage (CBS) facilities and one issue was identified that required corrective action: modifying the generic BNL tank identification label to include both the design and working capacities of each tank registered under the CBS program. The issue was corrected in accordance with the NYSDEC directive.
- NYSDEC conducted its annual inspection of BNL's Major Oil Storage Facility and found three conditions that required corrective action: repair of a malfunctioning alarm system associated with a fuel oil pipeline secondary containment leak detection system, inspection and repair of a product pipe stanchion that had settled and was not providing the necessary structural support, and evaluation of the Cathodic Protection System servicing three tanks to ensure that it is adequately protecting the tanks. Three other conditions were identified regarding underground storage tank management: reapplication of the proper color coding for an underground storage tank containing gasoline, addressing deficiencies associated with a satellite fuel tank, and modifying the generic BNL tank identification label to include both the design and working capacities of each tank. Most conditions were corrected in accordance with NYSDEC directives, and the remaining conditions will be addressed in 2009.
- NYSDEC inspected the Laboratory's Sewage Treatment Plant and other State Pollutant Discharge Elimination System (SPDES) regulated outfalls; no issues were identified.
- The Suffolk County Department of Health Services (SCDHS) conducted its annual inspection of BNL's potable water system; no issues were identified.
- SCDHS conducted quarterly inspections of the Laboratory's Sewage Treatment Plant to evaluate operations and sample effluent; no performance or operational issues were identified.
- SCDHS also performed an inspection BNL recharge basins

permitted under the SPDES program; no issues were identified.

- NYSDEC was present during an annual Relative Accuracy Test Audit on site. Monitoring equipment at BNL's Central Steam Facility was evaluated by a contracted testing firm to ensure that all equipment is operating as required and to document compliance with permit-related monitoring requirements. All conditions and equipment were found satisfactory.

In addition to routine regulatory inspections, EPA conducted an unannounced government-initiated oil spill response exercise and field inspection to test notification procedures, equipment deployment, and other actions associated with a response to an oil spill scenario identified within BNL's Facility Response Plan (FRP). The Laboratory's FRP outlines emergency response procedures to be implemented in the event of a worst-case discharge of oil. All objectives were met.

BNL underwent several reviews by DOE in 2008. An assessment of the Laboratory's implementation of its Emergency Management Program was performed by DOE's Office of Emergency Management. Although significant improvement was noted compared to an audit in 2004, several areas for improvement were identified. A corrective action plan has been prepared to continue improvement in this program. The DOE Chicago Support Center and the DOE Brookhaven Site Office conducted a mercury assessment of the site, focusing on efforts to minimize mercury in effluents and emissions and to reduce the on-site inventory of mercury-bearing devices and chemicals. The assessment found mercury management to be satisfactory, with two recommendations for improvement; both recommendations were addressed immediately. The Site Office also conducted an assessment of the management of the radiological inventory at BNL's Waste Management Facility. Two findings and three noteworthy practices were identified. Corrective actions have been implemented to address accuracy in waste inventory and modification to personnel protective equipment. All corrective actions are complete. In addition, the Site Office also coordinated with the Chicago Operations Support Center to perform a review of long-term monitoring and surveillance activities established for the Peconic River. Long-term stewardship was found to be effective and two improvements were recommended: interpret data presented in BNL's annual report and evaluate the need to maintain or remove the sediment trap installed at the site boundary. Both recommendations are being addressed through routine discussions with regulators and through modifications to routine reports.

The Laboratory also performs self-assessments of its programs to ensure continued compliance. In 2008, BNL conducted a programmatic self-assessment on several aspects of it's Environmental Management System, including: requirements related to properly maintaining institutional and engineered controls for known or potentially contaminated areas of the site, accurately collecting and analyzing groundwater surveillance samples, and maintaining and retrieving environmental surveillance data. No conformance or noncompliance issues were identified and seven noteworthy practices, six observations, and 15 opportunities for improvement were identified. Corrective actions for the observations are being tracked to closure.

Compliance monitoring in 2008 showed that emissions of nitrogen oxides, carbon monoxide, and sulfur dioxide from BNL's Central Steam Facility were all within permit limits. In addition, no opacity excursions were noted for the entire year.

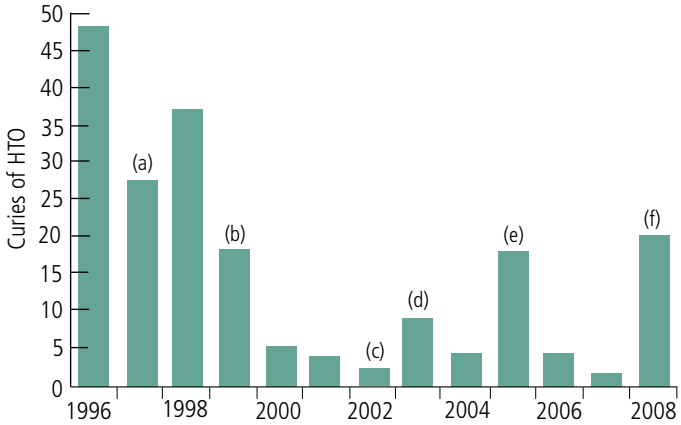
Approximately 1,230 pounds of ozone-depleting refrigerants were recovered from refrigeration equipment for reuse by other DOE facilities or federal agencies. These reductions included the disposition of 10 cylinders of Halon 1301 from fixed fire suppression systems removed from operation. Additionally, approximately 4,500 pounds of ozone depleting substances were transferred to the Department of Defense Ozone Depleting Substances Reserve.

Monitoring of the potable water supply showed that all drinking water quality requirements were met. Most of the liquid effluents discharged to surface water and groundwater met applicable SPDES permit requirements; however, three minor excursions were reported for the year and reported to NYSDEC and SCDHS. Groundwater monitoring at the Major Petroleum Facility continued to demonstrate that current oil storage and transfer operations are not affecting groundwater quality.

The Laboratory continues to reduce the number and severity of spills on site. In 2008, there were nine reportable spills of petroleum products, antifreeze, or chemicals. All releases were cleaned up to the satisfaction of NYSDEC.

AIR QUALITY PROGRAM

BNL monitors radioactive emissions at three facilities on site to ensure compliance with the requirements of the Clean Air Act. During 2008, Laboratory facilities released a total



Notes:
(a) Shutdown during evaluation process.
(b) Permanent shutdown of the HFBR announced in November 1999.
(c) Frequency of sampling reduced to one week per month in 2002.
(d) Temporary increase due to decommissioning activities.
(e) Increase thought to be due to evaporation of residual heavy water from a drain-tank vent line.
(f) Increase due to venting of reactor vessel in preparation for control rod blade removal.

High Flux Beam Reactor (HFBR) Tritium Emissions, (1996 – 2008)

of 2,650 curies of short-lived radioactive gases. EPA 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 sampling. Although the dose to the public is less than 0.1 mrem and monitoring is not required by EPA, the Brookhaven Linear Isotope Producer (BLIP) is continuously monitored. 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 2008. The combined emissions were approximately 4 percent higher than 2007 levels, primarily due to increased hours of operation.

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 2008 continued to be very small (0.025 µCi). A rise in tritium releases from the HFBR in 2008 was due to periodic venting of the reactor vessel when domestic water was added to the reactor vessel in preparation for the removal of the HFBR control rod blades.

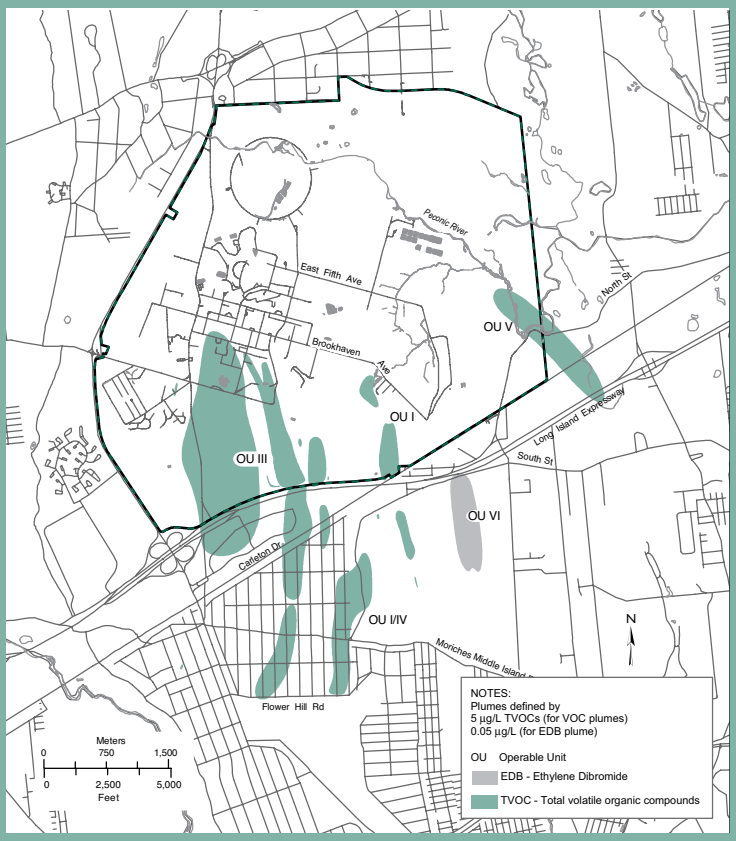
The Laboratory conducts ambient radiological air monitoring to verify local air quality and assess possible environmental and health impacts from BNL operations. Air monitoring stations around the perimeter of the site measure tritium and gross alpha and beta airborne activity. Results for 2008 continued to demonstrate that on-site radiological air quality was 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, boilers 6 and 7, are equipped with continuous emission monitors to measure opacity and nitrogen oxide (NOx) emissions. Opacity levels cannot exceed 20 percent, except for one 6-minute period per hour of not more than 27 percent opacity. In 2008, there were no exceedances of the NOx or opacity emission standards for either boiler.

Because natural gas prices were lower than residual fuel oil prices from January through October 2008, BNL used natural gas for most heating and cooling needs during these months. As a result, annual facility emissions of particulate matter, nitrogen oxides, and sulfur dioxide were considerably lower than in years when residual fuel oil was predominantly used.

GROUNDWATER PROTECTION MANAGEMENT

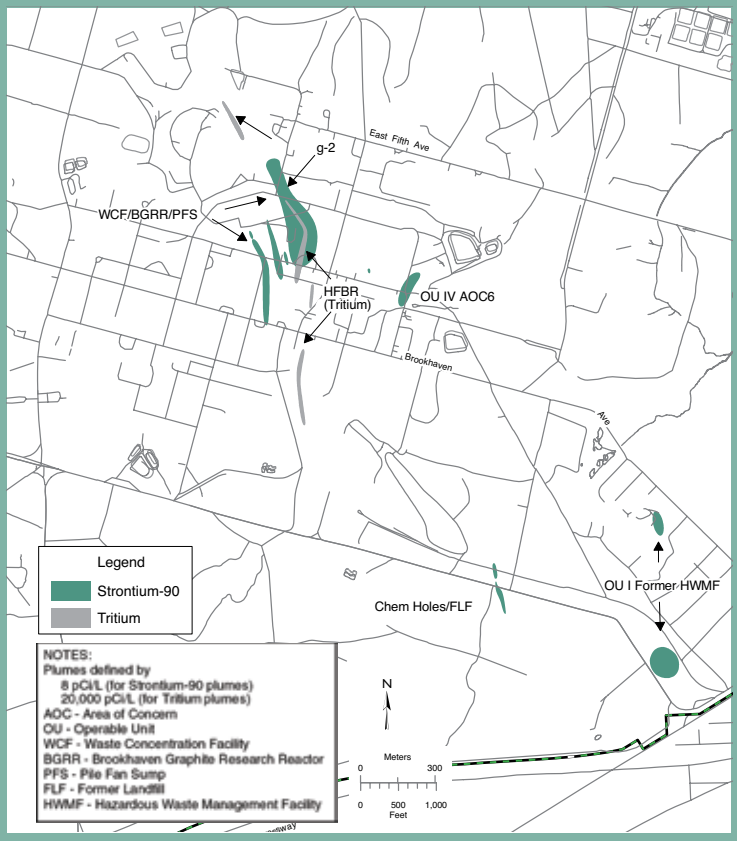
BNL's extensive groundwater monitoring well network is used to evaluate progress in restoring groundwater quality, to comply with regulatory permit requirements, to monitor active research and support facilities, and to assess the quality of groundwater that enters and exits the site. The Laboratory monitors research and support facilities where there is a potential for environmental impact to groundwater, as well as areas where past waste handling practices or accidental spills have already degraded groundwater quality. In 2008, BNL collected groundwater samples from 860 on- and off-site monitoring wells during 2,055 individual sampling events.



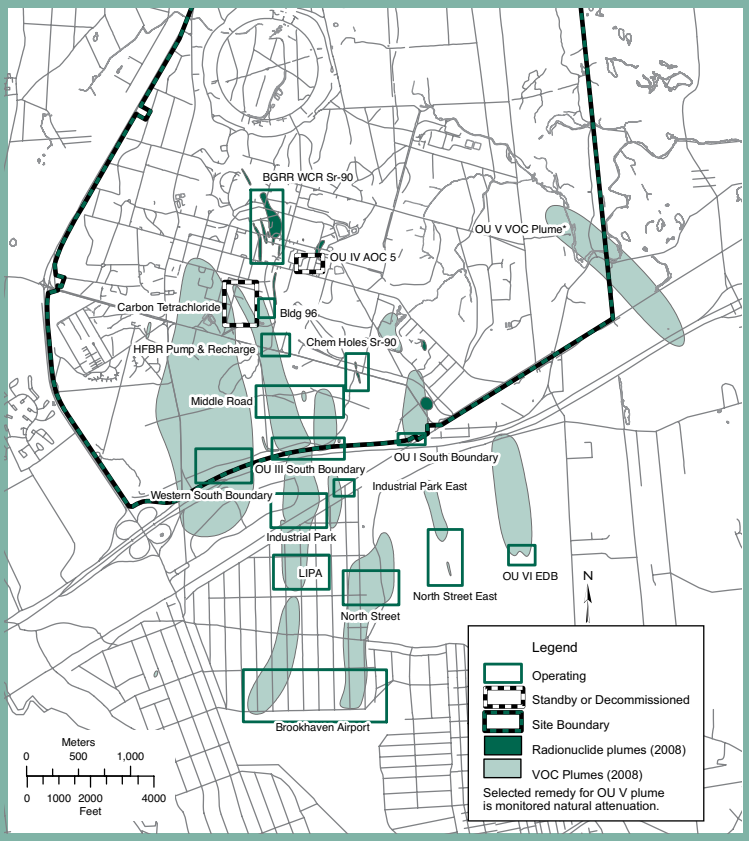
Extent of Volatile Organic Compound Plumes.

Under BNL's environmental surveillance program, 10 active research and support facilities were monitored during 2008. 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 facility, and the Upton service station facility. Tritium continues to be detected at concentrations above the 20,000 pCi/L Drinking Water Standard (DWS) in wells monitoring the g-2 source area. Monitoring data suggest that the continued release of tritium from the source area is due to residual tritium being flushed out of the unsaturated zone close to the water table by natural water table fluctuations. The amount of tritium entering the groundwater is expected to decrease over time, due to this flushing mechanism and by natural radioactive decay. At the Upton service station, volatile organic compounds (VOCs) associated with historical petroleum and solvent spills continue to be detected in the groundwater at concentrations above the applicable DWS. The levels of VOCs 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



Extent of Radionuclide Plumes On Site.



Locations of BNL Groundwater Remediation Systems.

groundwater program is to operate and maintain groundwater treatment systems and prevent additional groundwater contamination from migrating off site. During 2008, BNL continued to make significant progress in restoring groundwater quality with the removal of approximately 220 pounds of VOCs and approximately 3.4 mCi of strontium-90 with the treatment of more than 1.5 billion gallons of groundwater. To date, 6,117 pounds of VOCs 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 monitoring areas. Also to date, two of the treatment systems have removed approximately 20 mCi of strontium-90.

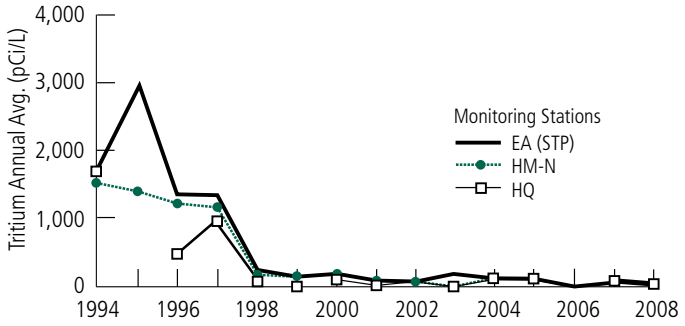
Groundwater reports that summarize and evaluate groundwater data are prepared quarterly and annually. BNL also has a Groundwater Contingency Plan that provides a formal process to promptly communicate off-normal or unusual monitoring results to Laboratory Management, DOE, regulatory agencies, and other stakeholders, including employees and the public.

WATER QUALITY SURVEILLANCE PROGRAM

BNL discharges treated wastewater into the headwaters of the Peconic River via BNL'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.

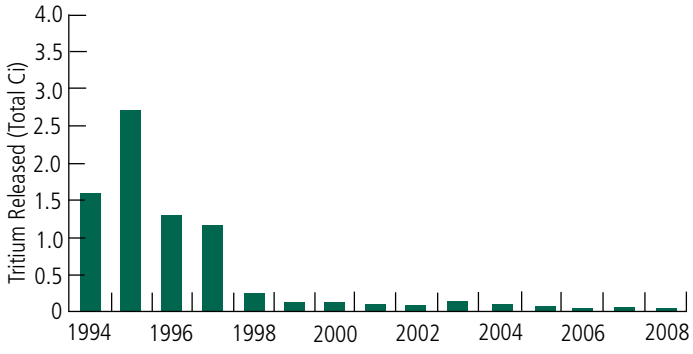
To assess the potential impact of discharges on the water quality of the Peconic River, surface water monitoring is conducted at several locations upstream and downstream of the STP discharge. The Carmans River, located to the west of BNL, is monitored as a geographical control location for comparative purposes, as it is not affected by Laboratory operations. In 2008, the average gross alpha and beta activity levels in the STP discharge were well below drinking water standards. Tritium detected at the STP originates from either sanitary system releases from BNL's High Flux Beam Reactor or from small, infrequent batch releases that meet Laboratory discharge criteria from other facilities. Although BNL's High Flux Beam Reactor 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 High Flux Beam Reactor facility.

In 2008, with the exception of a single low-level reported value, tritium was not detected in the STP effluent. Due to the low level of detection and the high uncertainty, the concentration was indistinguishable from the minimum detection limit (MDL). Tritium was also detected in a



Notes:
NYS Drinking Water Standard is 20,000 pCi/L.
There were no samples collected at monitoring Station HQ in 1995 and 2002 due to low water table conditions.

Sewage Treatment Plant/Peconic River
Annual Average Tritium Concentrations, (1994–2008)



Tritum Released to the Peconic River,
15-Year Trend, (1994–2008)

single sample of STP influent at a similar low-concentration (280±170 pCi/L). This concentration is also indistinguishable from the MDL due to the low level of detection and the uncertainty. Both positive detections were reported as estimates by the contract analytical laboratory. Total tritium released for 2008 was 40 percent less than that recorded for 2007, and the annual average concentration trend has been declining since 1995.There were no gamma-emitting nuclides or strontium-90 (Sr-90) detected in the STP wastewater throughout 2008. The STP effluent continued to show no detection of cesium-137 (Cs-137), Sr-90, or other gamma-emitting nuclides attributable to BNL operations. There were also no radionuclides detected along the Peconic River attributable to BNL operations. The STP was also monitored for nonradiological contaminants and all discharges were within permitted levels.

In 2008, Peconic River samples collected upstream, downstream, and at control locations demonstrated that elevated amounts of aluminum, iron, and vanadium detected in the river are associated with natural sources. Metals including copper, lead, silver, and zinc are present downstream of the STP at concentrations that are greater than the ambient water quality standard, but less than permitted levels for the STP discharge.

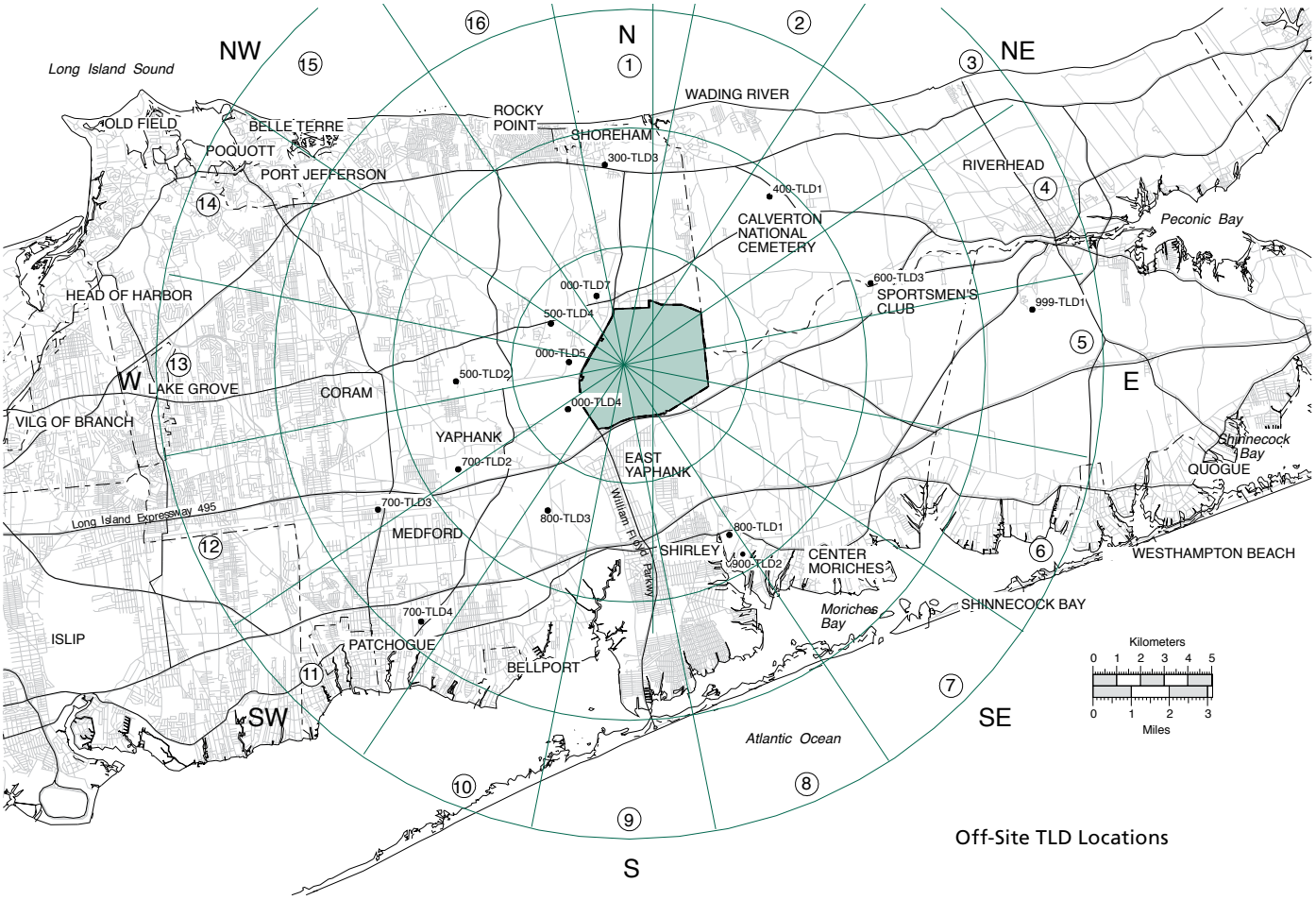
Discharges to recharge basins are sampled throughout the year for analyses of gross alpha and beta activity, gamma-emitting radionuclides, and tritium. Each recharge basin is a permitted point-source discharge under the Laboratory's permit. In 2008, there were no reported gamma-emitting nuclides or tritium attributable to BNL operations in any discharges to recharge basins. Low concentrations of disinfection byproducts were periodically detected in several of the basins throughout the year. Sodium hypochlorite and bromine, used to control bacteria in drinking water and algae in cooling towers, lead to the formation of volatile organic compounds, including bromoform, chloroform, dibromochloromethane, and dichlorobromomethane. All concentrations were less than 10 µg/L. Acetone was also detected above the MDL in discharges for most recharge basins. In most instances, acetone was also found as a contaminant in the contract analytical laboratory, as evidenced by detections in blank samples.

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." The potential radiological dose is calculated as the largest possible dose to a hypothetical Maximally Exposed Individual (MEI) living 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 operations is well below the EPA and DOE regulatory dose limits for the public and the environment. The dose impact from all BNL activities in 2008 was indistinguishable from natural background radiation levels.

Thermoluminescent dosimeters (TLDs) are used to measure ionizing radiation exposure by measuring the amount of visible light emitted from a crystal in the detector when the crystal is heated. The amount of light emitted is dependent upon the radiation exposure. To measure direct radiation at the Laboratory, 58 TLDs were placed on site in 2008 and 15 TLDs were placed in surrounding communities. An additional 30 TLDs were placed in a lead-shielded container for use as reference and control. The average doses from all TLDs showed there was no additional direct dose contribution to on- and off-site locations from BNL operations.

The annual on-site external dose from all potential sources, including cosmic and terrestrial radiation, was 69 ± 13 mrem (690 ± 130 µSv), and the annual off-site external dose was 63 ± 11 mrem (630 ± 110 µSv). The effective dose to the MEI from air emissions was 6.12E-2 mrem (0.61 µSv). The ingestion pathway dose was estimated as 12.48 mrem (125 µSv) from consumption of deer meat and 0.09 mrem (0.9 µSv) from consumption of fish caught in the vicinity of the Laboratory. The total annual dose to the MEI from all pathways was estimated as 12.63 mrem (126 µSv). 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 µSv), and the total dose was less than 13 percent of DOE's annual dose limit of 100 mrem (1,000 µSv) 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 the Laboratory, any source that has the potential to emit radioactive materials is evaluated for regulatory compliance. In 2008, a preliminary NESHAP evaluation was performed for the removal of the graphite pile and bioshield at BNL's Brookhaven Graphite Research Reactor. The evaluation determined that although this project would not result in a potential dose exceeding 0.1 mrem, the facility will be continuously monitored for radionuclides during the removal of these materials.

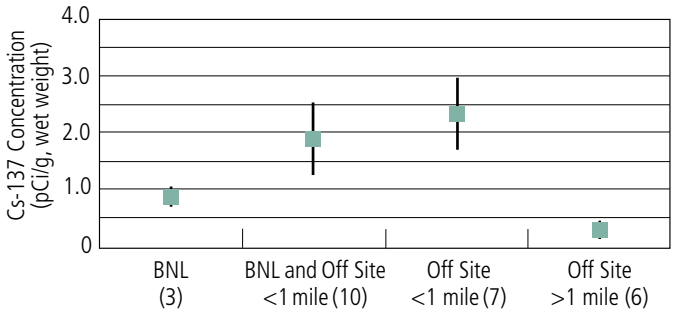
In 2008, BNL's Brookhaven Linear Isotope Producer facility operated over a period of 23 weeks. Due to an anticipated increase in operations in 2009, BNL applied to EPA for NESHAPs authorization to increase operations which could result in a dose from facility emissions approaching 0.2 mrem. The request was approved noting that the Laboratory continue its efforts to maintain the dose "as low as reasonably achievable."

During 2008, tritium monitoring at BNL's High Flux Beam Reactor was increased from monthly to weekly when the reactor vessel, primary cooling water system, and fuel canal were filled with domestic water to prepare for removal of the control rod blades. Because the reactor vessel was periodically opened, tritium levels in the building were much higher than observed in recent years; consequently, tritium emissions in 2008 were slightly higher.

NATURAL AND CULTURAL RESOURCE MANAGEMENT PROGRAM

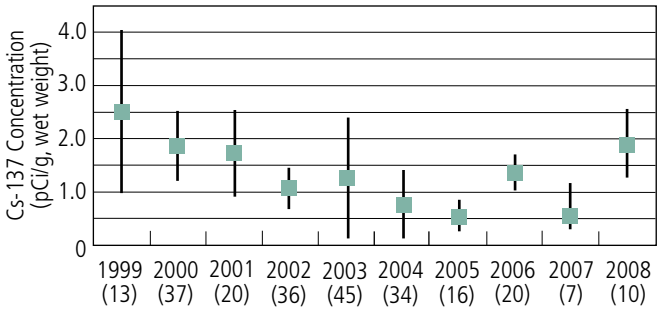
The BNL Natural Resource Management Program was designed to promote stewardship of the natural resources found on site and to integrate natural resource management and protection with the Laboratory's scientific mission. The goals of the program include protecting and monitoring the ecosystem, conducting 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.

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 on-site deer consume small amounts of contaminated soil and graze on vegetation growing in soil where elevated Cs-137 levels are known to exist. Cs-137 in soil can be transferred to aboveground plant matter via root uptake, where it then becomes available to browsing animals. The maximum on-site concentration in 2008 was seven times higher than the highest level reported in 2007, but continues to be much lower than the highest level ever reported in 1996. The New York State Department of Health (NYSDOH) has formally reviewed the potential public health risk associated with elevated levels of



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

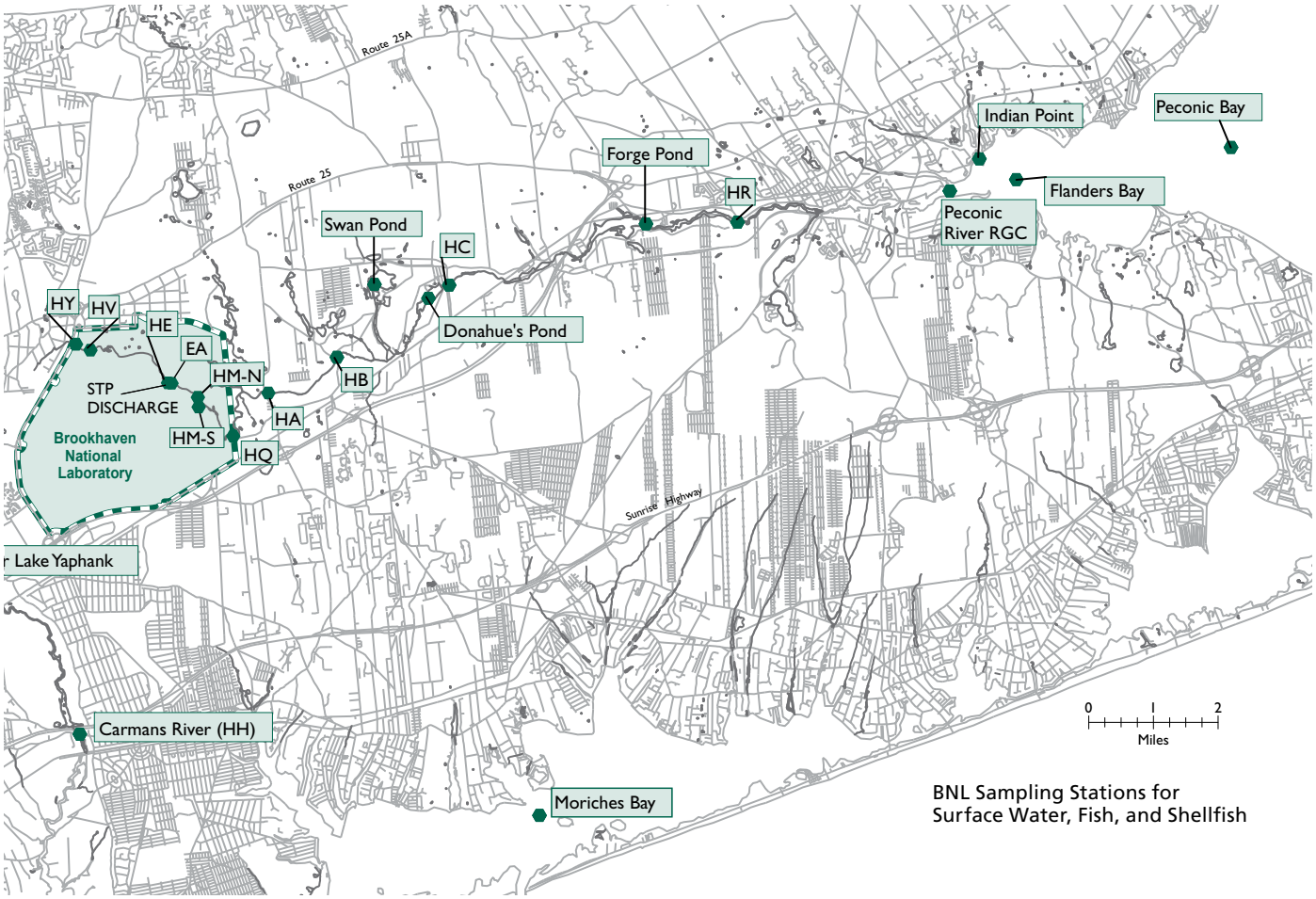
Comparison of Cesium-137 Average Concentrations in Deer, 2008



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 shown with a 95% confidence interval.

Ten-Year Trend of Cesium-137 Concentrations in Deer Meat at BNL and within 1 Mile of BNL

Cs-137 in on-site deer and determined that neither hunting restrictions or formal health advisories are warranted. Hunting is not permitted on site. BNL continues to test for Strontium-90 (Sr-90) in deer bone to develop baseline information. Testing of deer bones for Sr-90 in 2008 indicated background levels. Sr-90 is present in the environment at background levels as a result of worldwide fallout from nuclear weapons testing. When possible, liver samples are taken concurrently with meat samples. Liver generally accumulates Cs-137 at a lower rate then muscle tissue. The typically lower values in liver allow the results to be used as a validity check for meat values (i.e., if liver values are higher than meat values, results can be considered questionable and should be confirmed). In 2008, liver samples for Cs-137 ranged from 0.07 to 0.35 picocuries per gram (pCi/g) wet weight, with an average of 0.19 pCi/g wet weight. The off-site Cs-137 concentration in liver samples ranged from non-detectable to 2.03 pCi/g wet weight, with an average for all off-site liver samples of 0.33 pCi/g wet weight.



BNL Sampling Stations for Surface Water, Fish, and Shellfish

In an effort to restore fish populations, the Laboratory suspended most on-site fish sampling in 2001. By 2007, fish populations had recovered and annual on site sampling resumed. In 2008, Cs-137 was detected at low levels in all fish 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 in 2004 and 2005 removed approximately 88 percent of Cs-137 in the sediment that was co-located with mercury. Natural decay is expected to result in further deceases.

Non-radiological analysis of fish continued in 2008. All values for metals are considered not to 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. Polychlorinaded biphenyl (PCB) analysis in fish was also discontinued off site, but continued to be conducted for fish on site. A single sample taken from Area A, which is the closest to BNL's STP, tested positive for PCBs. The cleanup of the Peconic River, completed in 2005, has removed most PCBs within the sediments on site.

Annual sampling of sediment, vegetation, and freshwater in the Peconic River and a control location on the Carmans River was also conducted in 2008. On- and off-site aquatic vegetation and sediments contained low levels of Cs-137 and metals in amounts that were consistent with levels detected in previous years. Pesticides and PCB analyses of aquatic samples were also discontinued in 2008.

Under the Peconic River remediation project, sediment from the Peconic River was remediated to remove mercury and associated contaminants from the river. This project was completed in the summer of 2005. Sampling results for 2008 indicated that 97 percent of the samples were below the cleanup goal of 2.0 milligrams per kilograms (mg/kg).

Water column sampling for mercury and methylmercury was performed at 20 Peconic River sampling locations, the STP, and one reference location on the Connetquot River in 2008. The general trend of total mercury in water samples decreased with increasing distance downstream from the STP. Methylmercury concentrations increased slightly from the STP to the BNL site border; 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.

BNL has completed two years of wetland monitoring and invasive species control. A formal approval from EPA will be requested in 2009 that all Peconic River federal wetland restoration requirements have been met due to the completion of the Peconic River cleanup.

On-site sampling of garden vegetables was completed in 2008 and the 5-year periodic confirmatory sampling of local farm vegetables was also conducted. Data shows that vegetables grown in the BNL garden plot and by local farmers continue to support historic analyses that there were no Laboratory-generated radionuclides in the produce sampled.

WILDLIFE PROGRAMS

Under BNL's Natural Resource Management Program, the Laboratory focuses on protecting New York State threatened and endangered species on site, and continuing it's leadership role within the greater Long Island Central Pine Barrens ecosystem.

A wide variety of vegetation, birds, reptiles, amphibians, and mammals inhabit the site. Endangered, threatened, and species of special concern have been identified as having been resident at BNL during the past 30 years. The only New York State endangered species confirmed as now inhabiting the site is the eastern tiger salamander. The New York State endangered Persius duskywing butterfly and the crested fringed orchid have also been identified on the site in the past. Five New York State threatened species have been positively identified and two other species are considered likely to be present. The banded sunfish, swamp darter fish, and the stiff goldenrod plant have been previously reported. The northern harrier was seen hunting over open fields in November 2003. In 2005, the Pine Barrens bluet damselfly was confirmed at one of the many coastal plain ponds located on site. The frosted elfin butterfly has been identified as possibly being at BNL, based on historic documentation and the presence of its preferred habitat and host plant (wild lupine). In addition, stargrass was reconfirmed to exist at BNL. Several other species that inhabit the site, visit during migration, or have historically been identified, are listed as rare, species of special concern, or exploitably vulnerable by New York State.

Eastern Hognose Snake (Heteroden platyrhinos).

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

Eastern Tiger Salamander (Ambystoma t. tigrinum).

To eliminate or minimize any negative effects that Laboratory operations might cause to these species, precautions are in place to protect their on-site habitats and natural resources. Activities to eliminate or minimize negative effects on sensitive or critical species are either incorporated into Laboratory procedures or into specific program or project plans. Environmental restoration projects remove pollutant sources that could contaminate habitats. Human access to critical habitats is limited. In some cases, habitats are enhanced to improve survival or increase populations. Even routine activities such as road maintenance are not performed until they have been evaluated and determined to be unlikely to affect habitat.

BNL 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 2008, the Environmental Protection Division hosted 19 interns and one faculty member who worked on a variety of projects: surveying dragonflies and damselflies, radio tracking and genetics of red and grey fox, analyzing water chemistry from the Carmans and Peconic Rivers, investigating turtle and amphibian diseases, investigating the loss of the southern leopard frog on Long Island, assessing the population health of the banded sunfish, analyzing soil microbial communities, performing statistical analysis of migratory bird data, studying the distribution of aquatic invertebrates within the Carmans River, habitat analysis on tiger beetle habitats, and developing mapping techniques for small wetlands.

UPTON ECOLOGICAL AND RESEARCH RESERVE

In November 2000, DOE established the Upton Ecological and Research Reserve at BNL. The 530-acre Upton Reserve (10 percent of the Laboratory's property) is on the eastern portion of the site, in the Core Preservation Area of the Central Pine Barrens. The Upton Reserve creates a unique ecosystem of forests and wetlands that provides habitats for plants, mammals, birds, reptiles, and amphibians. From 2000 to 2004, funding provided by DOE under an Inter-Agency Agreement between DOE and the U.S. Fish & Wildlife Services was used to conduct resource management programs for the conservation, enhancement, and restoration of wildlife and habitat in the reserve.

Under management of the Foundation for Ecological Research in the Northeast (FERN) since 2005, research supported in 2008 included continued investigation into the microbial world of soils located within a number of the Forest Health Plots and microbial research that identified several new species of fungus and bacteria previously unknown. Additional work included an aquatic invertebrate survey of the Carmans River, and the development of a DVD documenting the various sampling protocols used within the Open Space Stewardship Program sponsored by the Office of Education at BNL. Further information on FERN research can be found at www.fern-li.org.

CULTURAL RESOURCES AT BNL

The BNL Cultural Resource Management (CRM) Program ensures that the Laboratory fully complies with numerous cultural resource regulations. The Cultural Resource Management Plan for BNL guides the management of all Laboratory historical resources. Along with achieving compliance with applicable regulations, one of the major goals of the CRM program is to fully assess both known and potential cultural resources. The range of BNL's cultural resources includes buildings and structures, WWI earthwork features, the Camp Upton Historical Collection, scientific equipment, photo/audio/video archives, and institutional records. As various cultural resources are identified, plans for their long-term stewardship are developed and implemented. Achieving these goals will ensure that the contributions BNL and the site have made to our history and culture are documented and available for interpretation.

The Laboratory has three structures or sites that have been determined to be eligible for listing on the National Register of Historic Places: the Brookhaven Graphite Research Reactor complex, the High Flux Beam Reactor complex, and the WWI training trenches associated with Camp Upton. The BNL trenches are examples of the few surviving WWI earthworks in the United States.

Outreach activities in 2008 included providing presentations on Laboratory cultural resources and tours of the WWI trenches on site. In addition, BNL participated in the planning and execution of the 77th Division Casing of the Colors Ceremony by hosting soldiers from the U.S. Army at a ceremony marking the retiring of the 77th U.S. Army Regional Readiness Command. The infantry division began its distinguished 91-year history on the BNL site when it was Camp Upton, a U.S. Army induction and training center during WWI and WWII, and formally retired its colors in October. Further information regarding BNL's history and cultural resources can be found at http://www.bnl.gov/ewms/cresources/.

CASING OF THE COLORS CEREMONY

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.

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.

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

To facilitate effective dialogue between BNL 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 rou-tinely 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 on issues related to the Laboratory that are important to the community. The CAC is composed of approximately 30 member organizations representing business, civic, education, employee, community, environmental, and health organiza-tions. The CAC meets monthly in sessions that are open to the public, and sets its own agenda in cooperation with the Laboratory.
- BNL's 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 provides speakers for educational and other organizations interested in the Laboratory.
- BNL's Summer Sunday tours enable the Laboratory to educate the public by featuring different facilities and program areas.
- The Laboratory participates in various annual events, such as a week-long celebration in honor of Earth Day, and local State Park festivals and fairs.
- Lunchtime tours are held once per month and offer employees the opportunity to learn about activities outside the scope of their jobs.
- The Laboratory's research, history, and natural environment, as well as cleanup projects, have all been topics covered under BNL's lunchtime talks. Periodically, bag lunch meetings are held with employees on specific topics of interest or concern, such as health benefits or wildlife management.
- BNL issues press releases; publishes the Laboratory Link, a bi-monthly update on BNL science and events; and the Bulletin, a weekly employee newsletter.
- The Laboratory maintains an informative website at http://www.bnl.gov, where these publications, as well as extensive information about BNL's science and operations, past and present, are posted. In addition, employees and the community can subscribe to the Laboratory's e-mail update service at http://lists.bnl.gov/mailman/listinfo/bnl-announce-1.

BNL routinely involves the community in cleanup projects through briefings and presentations. In 2008, BNL stakeholders were provided information regarding environmental impacts and controls associated with work involving nanomaterials, an overview of the 2007 Site Environmental Report, annual Peconic River monitoring results, climate change concerns, and global and regional environmental threats to Long Island's Central Pine Barrens. In addition, BNL stakeholders participated in the decision-making process for the High Flux Beam Reactor decommissioning project and the competition of BNL's Prime Contract.

Summer Sundays at BNL (right)
Annual "Your Environment" Art Contest (below)

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One of many events BNL hosts each year for Earth Day includes the "Your Environment" art contest. Students from local schools in grades 3-5 are asked to create a poster focusing on a specific environmental theme. The winning students receive a $100 gift check and all students who enter receive a Certificate of Participation.

The winning posters for this year's contest shown above were created by a) Amanda Gallagher, Charles E. Walter Elementary School; b) Caylie Silveira, Coram Elementary School; c) Shane Powers, Ladie A. Decker Sound Beach School; d) Janie Olgesby, Ridge Elementary School; and e) Sierra Lattuca, West Middle Island Elementary School.

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