

EXECUTIVE SUMMARY

Brookhaven National Laboratory (BNL) is a multi-program national laboratory operated by Brookhaven Science Associates, LLC for the U.S. Department of Energy (DOE) and is located on a 5,265-acre site in Suffolk County, Long Island, New York. DOE Order 436.1A (2023), *Departmental Sustainability*, requires DOE sites to maintain an Environmental Management System (EMS). An EMS specifies requirements for conducting general surveillance monitoring to evaluate the effects, if any, of site operations. DOE Order 458.1 Admin Chg. 4 (2020), *Radiation Protection of the Public and Environment*, requires DOE sites to maintain surveillance monitoring for determining radiological impacts to the public and environment.

BNL has a comprehensive EMS in place, which meets the requirements of the International Organization for Standardization 14001 Standard. The Laboratory's extensive environmental monitoring program is one component of the EMS, and the BNL Environmental Monitoring Plan (EMP) describes this program in detail. The data derived from systematically monitoring the various environmental media enables the Laboratory to make informed decisions concerning the protection of human health and the environment and to be responsive to stakeholder concerns.

The Laboratory's Environmental Protection Program ensures that operations fully comply with applicable federal, state, and local environmental laws and regulations; executive orders; and DOE policies. The Laboratory monitors radiological and non-radiological aspects of ambient air quality, emissions from point sources, wastewater discharges, surface water quality, groundwater quality, precipitation, soil, flora, and fauna. Sampling is performed under one or more types of environmental monitoring: compliance, restoration, or surveillance monitoring. Compliance monitoring ensures adherence to regulatory and permit limits. Restoration monitoring measures the impact of past operations and assesses the effectiveness of remedial measures. Surveillance monitoring evaluates the impacts, if any, of current or historical operations on the various environmental media.

Air surveillance monitoring at the Laboratory involves the analysis of particulate matter collected on filters, as well as vapor chemically trapped in a collection medium. Monitoring is conducted for various airborne radionuclides (including particulates and tritiated water vapor) at both on- and off-site locations. Continuous radiological monitoring is conducted for operations that have the potential to result in a radiological dose at the closest offsite residence or occupied building in excess of 0.1 millirem per year. For facilities with emissions below that value, periodic confirmatory monitoring is conducted. Specific diffuse or nonpoint sources, arising as a result of environmental restoration activities, are monitored to protect worker and public health. BNL also measures environmental background radiation through a network of on- and off-site thermoluminescent dosimeter (TLD) badges.

Samples of wastewater effluent from Laboratory operations are collected at the point of discharge. Monitoring is conducted in accordance with permit requirements and includes water quality parameters—such as pH, dissolved oxygen, and temperature—as well as radiological, organic, and inorganic parameters.

The Peconic River is sampled at several on-site locations from the point where the Peconic River enters the BNL site to the point where the river leaves the BNL site. The Carmans River, located to the west of the BNL site, is used as a control location to determine background or ambient conditions. Collected samples are analyzed for radiological and non-radiological parameters.

The Laboratory site is included on the Comprehensive Environmental Response, Compensation & Liability Act (CERCLA) National Priorities List. The U.S. Environmental Protection Agency

(EPA) and the New York State Department of Environmental Conservation (NYSDEC) have integrated DOE's response obligations into a comprehensive Federal Facilities Agreement. In compliance with this agreement, BNL's comprehensive groundwater protection program evaluates groundwater contamination from historical operations and determines whether measures taken to protect or restore groundwater quality are effective. To comply with NYS operating permits and DOE Orders, groundwater quality is also monitored at research and support facilities where there is a potential for environmental impact to determine whether operational and engineered controls designed to protect groundwater are working effectively.

The Laboratory maintains four operable groundwater production wells to supply potable water. The supply wells and distribution system are monitored for chemical and radiological parameters to ensure that concentrations of regulated contaminants present in the domestic water system are less than the maximum contaminant levels specified by regulation.

Data from the sampling and analysis of vegetation and fauna are used to estimate bioaccumulation and potential dose via the ingestion pathway. Precipitation, soil, and sediment are analyzed for contaminants released to the atmosphere and surface water.

All environmental monitoring data must meet appropriate quality assurance requirements. BNL maintains contracts with five contract analytical laboratories, all of which are certified by New York State for specific parameters and are subject to audits by the New York State Department of Health (NYSDOH), BNL, and/or DOE through their Laboratory Approval Program.

BNL uses the Data Quality Objective (DQO) process developed by EPA to describe the environmental monitoring matrices, sampling methods, locations, frequencies, and measured parameters, as well as the methods and procedures for data collection, analysis, maintenance, reporting, and archiving.

The EMP summarizes the drivers (i.e., compliance, support compliance, surveillance, and restoration), DQOs, potential sources and contaminants, extent and frequency of monitoring, analytical procedures, and quality assurance processes. The plan is reviewed and revised annually to reflect any changes made to the monitoring program from the previous year.

SUMMARY of PROPOSED CHANGES EMP CALENDAR YEAR 2024

Highlights of proposed changes for the calendar year (CY) 2024 monitoring program are described below. Full descriptions of the changes are detailed in each DQO.

AIR EMISSIONS SOURCE (CH. 5):

▪ AIR MONITORING AT THE BROOKHAVEN LINAC ISOTOPE PRODUCER

The Data Quality Objective was updated to capture two changes that will be made in CY 2024 at the Brookhaven LINAC Isotope Producer (BLIP) facility. First, since the change from glass fiber-type particulate filter to a membrane-type filter was delayed in 2023, that change will be made in 2024. Second, mass flowmeters will be installed in the two sensing legs of the emissions monitoring system. Finally, an uninterruptible power supply will be placed in service for the continuous emissions monitoring system.

▪ CENTRAL STEAM FACILITY EMISSIONS

Proposed changes for Central Steam Facility Emissions for calendar year 2024 include:

- Description and Technical Basis (paragraphs 7 and 8, respectively) were realigned to be in chronological order.
- Description and Technical Basis (paragraph 8) was revised to accurately reflect 6

NYCRR 227-2 NOx emission standards and to accurately reflect where compliance was and was not demonstrated by 2018 stack tests.

- Text in “Drivers for Monitoring Being Conducted Under This Program” was amended to reflect revisions to the 6 NYCRR 227-1 total suspended particulates emission limit.
- Paragraph 4 was added in “Drivers for Monitoring Being Conducted Under This Program” subsection to describe Title V permit modifications affecting intermittent particulate emissions testing requirements for Boilers 1A, 5, and 6.

RADIOLOGICAL AIR MONITORING AT THE BNL SITE (CH. 6)

In CY 2023, procurement problems delayed installation of the new active air monitoring instruments in each of the four perimeter air monitoring stations (P-stations). These instruments are expected to be deployed in CY 2024. No additional changes in radiological air monitoring are expected.

DIRECT RADIATION: THERMOLUMINESCENT DOSIMETERS (CH. 7)

Two off-site TLDs were taken out of service in calendar year CY 2023 due to retirements. Two off-site locations will be sought in CY 2024 to maintain full, 16-sector TLD coverage off site around BNL.

FLORA, FAUNA, PRECIPITATION, SOILS, AND PECONIC RIVER (CH. 8):

▪ PRECIPITATION MONITORING

The technical basis was updated to document the removal of reactor stacks which permanently removes potential for discharge.

LIQUID EFFLUENTS (CH. 9)

▪ SEWAGE TREATMENT PLANT

Minor updates were made regarding the Tolytriazole discussion in Step 7.

GROUNDWATER MONITORING (CH. 12):

▪ OU I SOUTH BOUNDARY (RA V REMEDIAL ACTION)

The proposed changes for the OU I South Boundary (RA V Remedial Action) Treatment System groundwater monitoring program for CY 2024 are as follows:

- Discontinue sampling for gamma spectroscopy for wells 087-21, 088-13, 088-14, 088-20, 107-40, 107-24, 115-03, 115-13, 115-14, 115-15, 115-16, 115-28, 115-29, 115-30, 115-31, 115-41, 116-05, 116-06, 088-26, 098-21, 098-30, 099-04, 108-08, 108-12, 108-13, 108-14, and 108-17. There have been no significant gamma detections during the 30-year monitoring period for these wells. Discontinue sampling for tritium for wells 107-23 and 115-36.
- Install temporary wells as needed to fill monitoring data gaps and characterize extent of the Sr-90 plume.
- Based on the lack of significant rebound in volatile organic compound (VOC) concentrations since system shutdown in 2013, and very low remaining VOC concentrations in area monitoring wells, a petition for closure of the OU I South Boundary Treatment System was submitted and approved in 2019.
- The VOC groundwater monitoring program of annual sample collection will continue for plume core wells 107-70, 107-41, 115-13, 115-16, and 115-51. Quarterly sampling of well 098-99 will be maintained.

▪ **OPERABLE UNIT (OU) III MIDDLE ROAD PUMP AND TREAT SYSTEM**

The proposed change to the OU III Middle Road Pump and Treat System groundwater monitoring program for CY 2024 is to install permanent monitoring wells at locations of vertical profile locations installed during 2021 (MR-VP-01-2021 and MR-VP-02-2021).

▪ **OU III BUILDING 96 AREA**

The proposed changes to the OU III Building 96 Area Groundwater Remediation System monitoring program are as follows:

- Reduce the monitoring frequency to annually for wells 095-165, 095-166, 095-168, 095-169, and 095-170 due to low VOC concentrations observed in these wells.
- Reduce the sampling frequency for wells 085-349, 085-350, 085-351, 085-352, and 085-354 from quarterly to semi-annually due to Total VOCs being below the capture goal.

▪ **OU III SOUTH BOUNDARY PUMP AND TREAT SYSTEM**

The proposed change for the OU III South Boundary Treatment System groundwater monitoring program for CY 2024 is to install a permanent monitoring well at the location of a vertical profile installed in 2021 (SB-VP-01-2021).

▪ **OU III NORTH STREET EAST**

The proposed changes to the OU III North Street East groundwater remediation system groundwater monitoring program for CY 2024 are as follows:

- Maintain quarterly sampling frequency for the 12 ethylene dibromide (EDB) monitoring wells using Method 504, except for upgradient perimeter well 115-42 which is sampled semi-annually.
- Maintain annual VOC sampling using Method 8260 Low Level for all wells except for 115-42 and 000-138.

▪ **WILLIAM FLOYD SENTINEL MONITORING**

The proposed change to the William Floyd Sentinel Monitoring Program for CY 2024 is to reduce the sampling frequency from quarterly to annually for gamma spectroscopy, strontium-90 (Sr-90), and tritium due to historic low radionuclide concentrations.

▪ **OU III LONG ISLAND POWER AUTHORITY (LIPA)**

The proposed change for the OU III Long Island Power Authority treatment system groundwater monitoring program for CY 2024 is to decrease the sampling frequency for the 17 wells from quarterly to semi-annually.

▪ **OU III BROOKHAVEN GRAPHITE RESEARCH REACTOR WASTE CONCENTRATION FACILITY STRONTIUM-90**

The proposed changes for the Brookhaven Graphite Research Reactor (BGRR) Waste Concentration Facility (WCF) Groundwater Treatment System groundwater monitoring program in CY 2024 are as follows:

- Increase sampling frequency in well 065-169 to semi-annually to evaluate the October 2022 Sr-90 concentration increase in the vicinity of Building 801.
- Install a temporary vertical profile well to a depth of 140 feet below ground surface adjacent to 085-402 to monitor for the high concentration segment of the per- and polyfluoroalkyl substances (PFAS) plume migrating beneath Building 725.

▪ **CHEMICAL/ANIMAL HOLES STRONTIUM-90**

The proposed changes for the Chemical/Animal Holes Strontium-90 (Sr-90) Treatment System groundwater monitoring program for CY 2024 are as follows:

- Discontinue monitoring of wells 106-14, 106-46, and 106-96 due to no Sr-90 detections above the Drinking Water Standards (DWS).
- Discontinue monitoring of wells 106-120, 106-121, and 106-122 due to no Sr-90 detections. Well 106-119 will now be used as the new bypass monitoring well.
- Discontinue monitoring of wells 106-102, 106-47, 106-13, 106-135, 106-48, and 106-50 due to low Sr-90 concentrations.

▪ **OU VI ETHYLENE DIBROMIDE**

The proposed changes for OU VI Ethylene Dibromide (EDB) Treatment System groundwater monitoring programs for CY 2024 are as follows:

- A system design modification was submitted to the regulators in mid-2023 for the addition of two deeper extraction wells immediately adjacent to the existing wells EW-1E and EW-2E. These wells were planned to be installed in 2023 and will replace the existing extraction wells, which will no longer be operated. This modification will establish capture of both the deep and slightly shallower portions of the EDB plume in this area and enhance remediation of the high concentration segment of the plume.
- Additional deep bypass monitoring wells will be installed to monitor the effectiveness of the new extraction wells.

▪ **GROUNDWATER MONITORING AT THE WASTE MANAGEMENT FACILITY**

With observed changes in groundwater flow directions in the Waste Management Facility (WMF) area due to increased use of nearby water supply Wells 11 and 12 starting in 2020 and 2022, respectively, four monitoring wells (056-21, 056-22, 056-23, and 066-84) were re-incorporated into the routine (semiannual) groundwater monitoring program starting in CY 2023. These wells will continue to be sampled during CY 2024.

▪ **GROUNDWATER MONITORING AT THE BROOKHAVEN MEDICAL RESEARCH REACTOR**

The Brookhaven Medical Research Reactor (BMRR) groundwater monitoring wells were sampled every two years, with the last sampling of the wells occurring in 2022. Because tritium was not detected during the past three sample periods (2018, 2020, and 2022), the monitoring program is being discontinued starting in 2024. The monitoring wells will be maintained for potential post-decommissioning/demolition surveillance.

▪ **GROUNDWATER MONITORING AT THE NATIONAL SYNCHROTRON LIGHT SOURCE II (NSLS-II)**

For CY 2024, continue annual sampling of the wells that monitor the National Synchrotron Light Source II (NSLS-II) beam loss areas. However, discontinue sampling upgradient wells 076-18 and 076-19 located at the Major Petroleum Facility because sufficient data have been collected from these wells to verify that tritium is not present in the shallow groundwater upgradient of the NSLS-II facility.

▪ **OU X FORMER FIREHOUSE GROUNDWATER TREATMENT SYSTEM**

Routine groundwater sampling activities related to the Former Firehouse PFAS treatment system began in January 2023. The monitoring program uses 42 wells to evaluate the effectiveness of the Environmental Monitoring Plan

groundwater treatment system to remediate PFAS that were released to soil during firefighter training activities from 1966 through 1985. In addition to testing for PFAS, samples from select wells are also analyzed for 1,4-dioxane, which originated from the releases of the solvent 1,1,1-trichloroethane (TCA) in areas upgradient of the Former Firehouse (e.g., the Alternating Gradient Synchrotron) and downgradient (e.g., the former Building 208 vapor degreaser facility).

- **OU X CURRENT FIREHOUSE GROUNDWATER TREATMENT SYSTEM**

Routine sampling activities related to the Current Firehouse PFAS treatment system began in October 2022. The treatment system is designed to remediate PFAS plumes originating from firefighter training areas located at the Current Firehouse and west of Building 170. The monitoring program uses 77 wells to evaluate the effectiveness of the treatment system. In addition to testing for PFAS, samples from select wells are also analyzed for 1,4-dioxane, which originated from the releases of TCA in areas upgradient of the Current Firehouse (e.g., Alternating Gradient Synchrotron) and the downgradient Paint Shop areas.