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 offsite 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 2025

Highlights of proposed changes for the calendar year (CY) 2025 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 calendar year (CY) 2025 at the Brookhaven National Laboratory (BNL) Linear Accelerator (LINAC) Isotope Producer (BLIP) facility. An uninterruptible power supply will be placed in service for the continuous emissions monitoring system in CY2025 after being delayed in CY2024. Also, plans are being developed for the installation of a cascading delay tank gaseous emissions mitigation system for the BLIP. This system is intended to mitigate or eliminate the emission of C-11 and O-15 gases from the stack, which is the largest contributor to offsite dose to the maximally exposed off-site individual (MEOSI).

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

In calendar year (CY) 2024, new active air monitoring instruments in each of the four perimeter air monitoring stations were installed and became operational. Three more monitoring instrument sets are expected to be deployed in CY 2025. No additional changes in radiological air monitoring are expected.

DIRECT RADIATION: THERMOLUMINESCENT DOSIMETERS (CH. 7)

One off-site thermoluminescent dosimeter (TLD) was taken out of service in calendar year (CY) 2024 due to Retirement. One off-site location will be sought in early 2025 to maintain full, 16-sector TLD coverage off site around BNL.

LIQUID EFFLUENTS (CH. 9)

SEWAGE TREATMENT PLANT

Updated to clarify procedure used to minimize the impact of analytical errors associated with Sewage Treatment Plant State Pollutant Discharge Elimination System (SPDES) permit compliance sampling.

SURFACE WATER (CH.10)

Updated to clarify analysis and frequency of surface water monitoring surveillance sampling conducted at Peconic River outfall HV.

GROUNDWATER MONITORING (CH. 12):

• OU I SOUTH BOUNDARY (RA V REMOVAL ACTION)

The proposed changes for the Operable Unit (OU) I South Boundary (RA V Removal Action)

Treatment System groundwater monitoring program for CY 2024 are as follows:

- Maintain the VOC post-closure groundwater monitoring program of annual sample collection from post-closure wells: 107-40, 107-41, 115-13, 115-16, and 115-51. Maintain quarterly sampling of Current Landfill sentinel well 098-99.
- Install temporary wells as needed to fill monitoring data gaps and characterize extent of the Sr-90 plume. Install a temporary well to the west of OU I -Sr-90-GP-74 to verify the western extent of this higher concentration plume segment.

• 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 2025 is to remove monitoring well 106-56 from OU III Middle Road monitoring program. This well has not had VOC concentrations above maximum contamination levels (MCL)s in over ten years. Two additional monitoring wells for VOCs were added during 2024, wells 105-80 and 105-81.

• OU III SOUTH BOUNDARY PUMP AND TREAT SYSTEM

The proposed change for the OU III South Boundary Treatment System groundwater monitoring program for calendar year 2025 is to discontinue sampling monitoring wells 114-06, 121-18, 121-21, 122-09, 122-10 and 122-31 from OU III South Boundary monitoring program. These wells have not had VOC concentrations above MCLs in over ten years. Monitoring well 121-57 for VOCs was added during 2024.

Environmental Monitoring Plan

OU III INDUSTRIAL PARK

There are no changes for calendar year 2025 for the Industrial Park In-Well Air Stripping System groundwater monitoring program. Based upon the concentration trends in both the monitoring and extraction wells it is anticipated that this system will have achieved its cleanup goals by the end of 2024 and a Petition for Shutdown will be submitted in 2025.

• OU III NORTH STREET

Due to the system having met its cleanup goals, a Petition for Closure for the North Street Pump and Treat System and groundwater monitoring program was submitted and approved in CY 2019. Seven of the core monitoring wells will be sampled annually for volatile organic compounds (VOCs) until results for individual VOCs are consistently below MCLs. Sampling of the other monitoring wells will be discontinued but the wells will be retained until the completion of the per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane characterization as per regulatory guidance.

• OU III NORTH STREET EAST

Maintain quarterly sampling frequency for the 12ethylene 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. Prepare a petition for system shutdown if EDB concentrations remain below the DWS through the third quarter of 2024.

• OU III LONG ISLAND POWER AUTHORITY (LIPA)

The proposed change for the OU III Long Island Power Authority (LIPA) treatment system groundwater monitoring program for calendar year 2025 is to maintain the current monitoring schedule for the LIPA monitoring wells pending approval of the LIPA system is received from the regulators. Upon approval, begin the proposed post closure monitoring schedule of wells 000-130, 000-131, 000-425, 000-448, and 000-449 on an annual basis.

OU III SOUTH BOUNDARY RADIONUCLIDE

Due to the lack of radionuclide detections above the Drinking Water Standard (DWS) for the last 20 years, a recommendation to discontinue further sampling for the OU III South Boundary and Western South Boundary Pump and Treat Systems was submitted to regulators and approved. The 48 monitoring wells that formerly comprised this program are listed in Table 12.13.2 and shown on Figure 12.13.1.

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

The proposed change for the Brookhaven Graphite Research Reactor (BGRR) Waste Concentration Facility (WCF) Groundwater Treatment System groundwater monitoring program in CY 2025 are as follows:

Discontinue sampling of existing monitoring wells 075-809, 075-810, 075-811, 075-415, 075-417, 075-419, 085-171, 085-285, 085-286, 085-287, 085-01, 085-406, 085-407, and 085-290 for Sr-90 analysis. This data was utilized to evaluate the presence of Sr-90 in the vicinity of extraction well FF-RW-A and is no longer needed.

CURRENT LANDFILL POST-CLOSURE

The changes to the Current Landfill monitoring program for calendar year 2025 are to add PFAS EPA Method 1633 and 1,4-dioxane EPA Method 8270D SIM to the analytical list of parameters for all 12 monitoring wells on an annual basis with collection during the fourth quarter sampling round.

• 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 (semi-annual) groundwater monitoring program starting in calendar year (CY) 2023. These wells will continue to be sampled during CY 2025.

• 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 continue to be maintained for potential post-decommissioning/demolition surveillance.

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

For calendar year 2025, 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 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 1,1,1- trichloroethane (TCA) in areas upgradient of the Current Firehouse (e.g., Alternating Gradient Synchrotron) and the downgradient Paint Shop areas.