

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 436.1 (2011), *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 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 five 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 six 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 EMP CALENDAR YEAR 2021

Highlights of proposed changes for the calendar year (CY) 2021 monitoring program are described below. Full descriptions of the changes are detailed in each DQO.

AIR EMISSIONS SOURCE

CENTRAL STEAM FACILITY EMISSIONS

The effective date of BNL's Title V Facility permit was updated and the latest period emission test dates of Boilers 1A and 5 were added to demonstrate compliance with applicable nitrogen oxides (NO_x) emission standards.

TARGET PROCESSING LABORATORY (TPL)

For calendar CY 2021, the continuous active emissions monitoring system will be upgraded to monitor radioactive alpha, gamma, and tritium emissions from the main exhaust.

EMISSION/EFFLUENT SOURCES AND PATHWAYS

TARGET PROCESSING LABORATORY (TPL)

Gamma analysis of monthly composite samples was discontinued in 2013 but is likely to resume when Ac225 processing begins in late CY 2021. This decision was based on historical analytical results of TPL particulate filters that showed gross alpha/beta levels to be very low and consistent with background concentrations. Gross alpha and beta analyses of TPL emissions will continue in CY 2021, and periodic alpha spectroscopy will begin with the start of Ac225 processing.

FLORA, FAUNA, PRECIPITATION, SOILS, AND PECONIC RIVER

Changes for CY 2021 include addition of a statement indicating that data are reviewed upon being received to determine usability.

GROUNDWATER MONITORING

GROUNDWATER ELEVATION MONITORING

BNL continues to collect water level data from wells screened in the deep Upper Glacial aquifer and upper Magothy aquifer to evaluate flow directions and gradients.

GROUNDWATER MONITORING AT THE WASTE MANAGEMENT FACILITY

With anticipated changes in groundwater flow directions in the Waste Management Facility (WMF) area due to increased use of nearby water supply Well 11 in 2020, and the planned routine use of supply Well 12 in late 2021, two monitoring wells (056-23 and 066-84) will be re-incorporated into the groundwater monitoring program.

OU IV AREA OF CONCERN 6 - BUILDING 650 SUMP OUTFALL AREA

Changes include removing wells 076-09, 076-263, and 076-417 from the Building 650 Sr-90 Monitoring Program due to the plume shifting away from these wells, adding wells 076-04, 076-06, and 076-20 to the Building 650 Sr-90 Monitoring Program, and sampling on an annual basis due to plume migration.

OU III BUILDING 452 FREON-11 SOURCE AREA AND GROUNDWATER PLUME

The Building 452 Freon-11 groundwater remediation system met the defined cleanup goal, and a Petition for Closure was submitted to the regulatory agencies in June 2019. Following regulatory agency approval of the Petition for Closure in August 2019, BNL ended the monitoring program for the Building 452 source area and downgradient areas. Several monitoring wells (085-386 and 095-313) were transferred to the Building 96 program.

OU III BUILDING 96 AREA

Changes for CY 2021 for the OU III Building 96 Area Groundwater Remediation System and monitoring program include the addition of monitoring well B96-GP02-2019 screened from 15 to 25 feet mean sea level (ft. msl) to supplement the existing system, and an increase in the monitoring frequency of well 095-159 to monthly to evaluate the influence of increased pumping rate of RTW-1 and the westward expansion of the capture zone.

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 VOCs until results for individual VOCs are consistently below Maximum Contaminant Levels (MCL). Other monitoring wells will be discontinued but retained until the completion of the per- and polyfluoroalkyl substances (PFAS) and

1,4-dioxane characterization.

OU I SOUTH BOUNDARY (RA V REMEDIAL ACTION)

Sampling for monitoring wells 115-41 and 115-42 for Sr-90 will be discontinued. These wells have been monitored since 1997 and no detections or Sr-90 have been observed. The annual tritium sampling of monitoring wells 087-21, 088-13, 088-14, 088-20, 088-26, 098-21, 098-30, 099-04, 107-24, 107-40, 108-08, 108-12, 108-13, 108-14, 108-17, 115-03, 115-13, 115-14, 115-15, 115-16, 115-28, 115-29, 115-30, 115-31, 115-41, 115-42, 116-05, and 116-06 will also be discontinued. There have been no tritium detections in any of these wells since 2014 or longer.

OU III SOUTH BOUNDARY PUMP AND TREAT SYSTEM

Changes for the OU III South Boundary Treatment System and groundwater monitoring program for the CY 2021 include reducing sample frequency of wells 114-06, 114-07, 121-20, 121-23, 122-09, and 122-22 for volatile organic compounds (VOCs) from semi-annually to annually. Total VOC (TVOC) concentrations in these wells have been non-detect to barely detectable for the past six years.

OU III SOUTH BOUNDARY RADIONUCLIDE

Due to the lack of radionuclide detections above the Drinking Water Standard (DWS) for the last 20 years, it is recommended that further sampling be eliminated for the O III South Boundary and Western South Boundary Pump and Treat Systems.

POTABLE WATER MONITORING

1,4 dioxane is required to be sampled quarterly and hexavalent chromium is required to be sampled annually in CY 2021. Lead and copper sampling will be repeated, possibly at a six-month interval. The Granulated Activated Carbon (GAC) system was updated on Well 11 to remove PFAS and requires bacteria and PFAS sampling on a quarterly basis. Well 10 is in the process of updating the GAC system and will be sampled quarterly when approved for use.

THERMOLUMINESCENT DOSIMETERS (TLDS)

Three new TLDS will be placed onsite in CY 2021, rather than 2020, as a result of the pandemic response measures. These TLDS will not be relocations of existing TLDS but will be additional to the existing number. No other changes are planned.

QUALITY ASSURANCE

The Quality Assurance chapter was amended to include updates to the Data Management and Verification, Validation, and Usability of Analytical Results sections.