

6 AIR SURVEILLANCE

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6.1 RADIOLOGICAL AIR MONITORING AT THE BNL SITE

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SUMMARY OF PROPOSED CHANGES

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.

DESCRIPTION AND TECHNICAL BASIS

Airborne emissions can be generated from various facilities at Brookhaven National Laboratory (BNL) during operations, research, and scientific activities. The Laboratory's environmental protection program implements engineering and administrative controls to detect, reduce, prevent, and/or eliminate air pollutants from emission to the environment. Pollution prevention and control technologies, such as high-efficiency particulate air (HEPA) filters or charcoal high-efficiency gas (HEGA) air filters, are applied when potentially toxic or radioactive pollutants are possible. BNL conducts both air surveillance and facility emissions monitoring to assess the adequacy of these controls to protect human health and determine any impact from air pollutants on the environment.

Environmental surveillance at BNL involves the analysis of particulate matter collected on filters, water vapors chemically trapped in a collection medium, real-time counting of effluent sample air flowing through a steady-state volume of flowing air, and real-time monitoring of ambient air around the Lab site. Specific diffuse sources, where particulates or gases could become airborne due to environmental restoration activities, are also monitored, as needed. Dose impacts that have the potential to exceed National Emission Standards for Hazardous Air Pollutants (NESHAPs) limits are calculated to show compliance with Department of Energy (DOE) requirements, federal and state laws and regulations, and industry standards.

DRIVERS FOR AIR MONITORING AT THE BNL SITE

- Compliance
- Support compliance
- Surveillance
- Restoration

- DOE Order 436.1A (2023), *Departmental Sustainability*, and DOE Order 458.1 (2020), *Radiation Protection of the Public and the Environment*, define standards for controlling exposures to the public from operational DOE facilities.
- Regulation 40 CFR 61, Subpart H, administered by the US Environmental Protection Agency (EPA), requires DOE facilities to monitor for radiological discharges and to estimate the radiological dose to the public.
- Guidance on emissions sampling is provided in the Environmental Radiological Effluent Monitoring and Environmental Surveillance (DOE-HDBK-1216-2015),

- “Standards of Performance for New Stationary Sources” (40 CFR 60), and the NESHAPs-cited American National Standards Institute standards (ANSI N13.1-2011).
- DOE Order 458.1 establishes a primary radiation protection standard for members of the public at 100 mrem/yr effective dose equivalent (EDE) for prolonged exposure from all sources, including air emissions. For air, derived concentration guides (DCGs) listed in DOE Standard 1196 specify the concentrations of radionuclides that can be inhaled without exceeding the DOE primary radiation protection standard for the public. The order also states that facilities should have the capability, consistent with the types of operations conducted, to monitor routine and unplanned releases and to assess dose impact to members of the public.
- BNL’s air monitoring is governed by the Clean Air Act (CAA). The fundamental objective of the CAA is to protect human health and the environment from air pollutants. The CAA enables EPA to define and establish standards and criteria for air pollutants that are of major concern. These pollutants and the National Primary and Secondary Ambient Air Quality Standards (NAAQS) are defined in 40 CFR 50. In 1990, Section 112 of the CAA, NESHAPs 40 CFR 61, was amended by Title III. Title III lists 189 hazardous air pollutants (HAPs), which include radionuclides, calls for the reduction of toxic substance emissions to the air, and imposes new standards on both new and existing sources. While standards have not yet been set for many hazardous air pollutants, a dose limit has been established for radionuclide emissions.

DATA QUALITY OBJECTIVE ANALYSIS

Step 1: State the Problem

BNL’s research operations and scientific activities could potentially impact human health and the environment. Therefore, an emissions surveillance program to quantify radiological emissions is a regulatory requirement. DOE–HDBK–1216-2015 states that all DOE or DOE contractors conducting radiological activities must develop and implement a documented Environmental Radiological Protection Program. This program must describe the methods used to achieve compliance with DOE 458.1 and should: (1) demonstrate compliance with applicable requirements, (2) confirm adherence to DOE environmental and radiation protection policies and directives, and (3) support environmental management decisions. It should also provide for properly and accurately measuring radionuclides in their effluents and in the ambient environmental media with provisions for the detection and quantification of unplanned releases of radionuclides to the environment.

This guidance document also specifies that the surveillance program shall characterize the radiological conditions at off-site environment locations, estimate public doses, confirm predictions of public dose based on effluent monitoring data and modeling, and provide compliance data for all applicable environmental regulations. The guidance document further states that surveillance may be necessary for legal reasons, public concerns, and/or state and local commitments.

The historical tritium air surveillance data collected at the Laboratory has shown that tritium concentrations have been well below the minimum detection level (MDL) at most sampling locations following the shutdown of the reactors. Therefore, by streamlining the sampling program while retaining the capability to detect unplanned releases, the Laboratory has eliminated the redundant locations for air sampling for tritium. While air surveillance is necessary and is required to show compliance with the different regulations, sampling for airborne tritium at the blockhouses is believed to be sufficient to monitor the few sources of tritium left on site and to document compliance with EPA and DOE requirements. A

reduction in sample collection must support budget constraints on the environmental protection program. In addition, because less-detailed analysis of samples, such as gross alpha/gross beta analysis rather than gamma composite analysis, might provide sufficient protection, gross alpha/gross beta sampling is implemented to achieve savings in monitoring costs as well.

Finally, blind duplicate quality assurance sampling is conducted to test the precision of sampling and analyses. At present, the duplicate station is permanently stationed at P7, which does not allow testing the sampling precision at other environmental sampling stations, although P7 is located downwind of the most significant emission points and in the predominant wind direction. The rotation of the duplicate sampling station would enhance the capability to compare and test the precision and accuracy of all the sampling locations rather than only the P7 location, as is currently done.

Step 2. Identify the Decisions

The desired decisions for the air surveillance and monitoring program are:

- Will the number of air samples collected and their frequency of collection be adequate to detect any potential impact from research operations?
- Will the regulatory compliance requirements for ambient air quality be met if air monitoring is reduced?
- Will the capability to confirm the effectiveness of current emission control systems continue to be adequate using reduced monitoring?
- Will the risk and dose to the members of the public exceed any threshold values, and will the data collected continue to be defensible?

Step 3: Identify Inputs to the Decisions

Environmental air surveillance samples shall be collected in accordance with Environmental Monitoring Standard Operating Procedures (EM-SOPs):

- BNL EM-SOP-500, Air Sampling at Permanent Monitoring Stations
- BNL EM-SOP-501, Tritium Air Sampling at Portable Stations
- Data from active monitors at P-stations and various other site locations

The particulate matter sampling media consists of a 5-cm (diameter) glass fiber air filter with a backing to hold the filter in place. While air sampling pumps generally run continuously, samples are collected weekly and counted for gross alpha and gross beta radiation using an anti-coincidence proportional counter. Environmental air sample criteria are based on the premise that representative samples of the ambient air are taken continuously. The preferred sampling height is 1.5 meters above the ground and away from traffic, large buildings, or similar obstructions. Analyses for gamma-emitting nuclides on monthly composites are not performed, since review of historical data has shown no detection of such radionuclides attributed to BNL operations.

At the P-stations, the ambient air is sampled for tritiated water vapor by continuously drawing streams of air through silica gel cartridges. After collection, any entrapped liquid is extracted from the desiccant and analyzed for tritium using liquid scintillation techniques. In all cases, flow rates, media volumes, and exposure periods are such that the media are not likely to be saturated during the sampling period; high collection efficiencies are achieved in accordance with the manufacturer's recommendations.

Specific inputs include:

- The highest concentrations of the pertinent radionuclide expected above the MDL near operations and their dispersion due to meteorological conditions;
- Representative radionuclide concentrations in areas where public health is a concern; occupancy factors and doses to the public via the air pathway from operations must remain as low as reasonably achievable relative to standards;
- The existence of areas known to have potential for contamination; an increase in contamination by resuspension of particulates in those areas would require air monitoring;
- Frequency of review of actual emissions from facilities and in areas with surface and soil contamination;
- Pre-operational baseline data and any environmental surveillance data for areas near waste units that are scheduled for treatment or restoration, to assess the integrated effects of individual site influence over time;
- Measurements at the site perimeter and in nearby communities;
- Continuous operation of the remaining on-site air monitors, including new real-time air monitors;
- Use of thermo-luminescent dosimeters (TLDs) to assess the environmental doses from unusual releases, if any;
- Review of analytical results by project managers in accordance with Environmental Protection Division (EPD) data review procedures to ensure data are of acceptable quality;
- Trends of background concentration levels with historically collected data in each wind sector to assess the impact of site operations, if any.

Step 4: Define the Study Boundaries

Since 1972, the perimeter blockhouse ambient air monitoring stations have collected weapons test fallout data and natural background data. These stations are located in all the predominant wind directions and, where warranted, by site-specific meteorological conditions. Four of the six air particulate sample collection stations are situated within dedicated blockhouses. These sample collection stations (P2, P4, P7, and P9) are located at the boundary perimeter. The population surrounding the Laboratory is beyond the sampling stations, which allows for the opportunity to detect and mitigate any unplanned releases.

Step 5: Develop the Decision Rules

If the tritium concentrations are greater than twice the 12-month trailing average, **then** request re-analysis of the sample, investigate the source of elevated tritium at that location, and implement corrective actions. The project manager will review all detections above the limits for comparison with historical values and significance. **If** the gross alpha concentration in the filters is greater than twice the minimum detection limit (MDC), **then** request re-analysis of the sample and collect more samples in the vicinity. The project manager will review all detections above the limits for comparison with historical values and significance. **If** the gross beta concentration in the filters is greater than twice the 12-month trailing average, **then** request a re-analysis of the sample and collect more samples in the vicinity. If one or more active monitoring stations senses a count rate of 200 counts per minute above the established background, then the display of the count rate will register an alert signal on the display. The project manager will review all detections above the limits for comparison with historical values and significance. All values greater than the above-stated gross alpha/beta concentration and/or gamma background shall trigger an investigation of potential sources in that wind sector.

Step 6: Specify Acceptable Limits on Decision Areas

Air surveillance data are analyzed with the intent of satisfying the following goals:

- Estimate concentrations at each sampling point.
- Compare current concentrations to previous concentrations to identify changes or inconsistencies.
- Compare concentrations to established DCGs or permit limits.
- Compare concentrations at a single location, or a group of locations, to control or background locations and evaluate the reliability of the comparisons.

Step 7: Optimize the Design

The duplicate mobile station at P7 shall be moved from one blockhouse to another and kept at each blockhouse for a period of two months to test the precision of all the environmental sampling and analyses. Facility process data is reviewed and the effectiveness of emission controls in the relevant facilities and other remediation projects for potential source of emissions, if any, is assessed.

The air monitoring program shall be optimized based on the surveillance data, audits, and air surveillance assessments during the calendar year.

See Appendix B for the monitoring program for this Data Quality Objective.

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