# 6 AIR SURVEILLANCE

## CHAPTER CONTENTS

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# RADIOLOGICAL AIR MONITORING AT THE BNL SITE

**DQO START DATE** January 1, 2003

**REVISION NUMBER/DATE** Rev. 1, November 26, 2012

**IMPLEMENTATION DATE** January 1, 2014

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## SUMMARY OF PROPOSED CHANGES

There are no proposed changes for calendar year (CY) 2014.

## DESCRIPTION AND TECHNICAL BASIS

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

Environmental surveillance involves analyzing particulate matter collected on filters, as well as water vapors chemically trapped in a collection medium. Specific diffuse sources, where particulates/gases could become airborne due to environmental restoration activities, are also monitored, as needed. Dose impacts that have the potential to exceed National Emission Standard for Hazardous Air Pollutants (NESHAPs) limits are calculated to show compliance with DOE requirements, federal and state laws and regulations, and industry standards.

## DRIVERS FOR AIR MONITORING AT THE BNL SITE

_X_ Compliance
_X_ Support compliance
_X_ Surveillance
___ Restoration

- DOE Order 436.1 (2011), *Departmental Sustainability*, and DOE Order 458.1 (2011), *Radiation Protection of the Public and the Environment*, define standards for controlling exposures to the public from operational DOE facilities.

- Environmental Protection Agency (EPA) regulation 40 CFR 61, Subpart H 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 Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (DOE/EH-0173T 1991), "Standards of Performance for New Stationary Sources" (40 CFR 60), and the NESHAP-cited American National Standards Institute standards (ANSI N13.1 1999).

- 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), of which radionuclides are counted as one, and calls for emission reductions of air toxics 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 radionuclides.

## 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, the emissions surveillance program is a regulatory requirement to qualitatively quantify the radiological emissions. DOE/EH-0173T states that all DOE operations shall properly and accurately measure 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 the 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 at the Laboratory have shown that tritium concentrations have been well below the minimum detection level (MDL) at most sampling locations after the shutdown of the reactors. Therefore, by streamlining the sampling program and still retaining the capability to detect unplanned releases, the Laboratory has eliminated the redundant tritium sampling locations. Sampling for airborne tritium at the blockhouses and three other wind sector locations is sufficient to monitor the few sources left on site. While air surveillance is necessary and is required to show compliance with the different regulations, monitoring of sources and collection of samples at four permanent monitoring stations is sufficient to document compliance with EPA and DOE requirements. The reduction in sample collection also supports budget constraints on the environmental protection program. In addition, because particulate filters are analyzed for gross alpha/beta, the reduction in gamma analyses for monthly composites also supports savings in monitoring costs.

The P7-2 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 precision at other environmental sampling stations. 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 support any potential impact from research operations?
- Will the regulatory compliance requirements for ambient air quality be met if air monitoring is reduced?
- Will the reduction in sampling in any way impact the capability to confirm effectiveness of emission control systems?
- Will the risk and dose to the members of the public exceed any threshold values, and will the data collected 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

The particulate matter sampling media consists of a 5-cm (diameter) glass fiber air filter with a backing to hold the filter in place. Samples are collected weekly and counted for gross alpha and gross beta radiation using an anticoincidence 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 that were performed on monthly composites shall be eliminated, since review of historical data shows no detection of radionuclides attributed to BNL operations..

Tritiated water vapor in the air is sampled biweekly by drawing a stream of air through silica gel cartridges. After collection, the 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.

- Determine the highest concentrations expected above the MDL of the pertinent radionuclide in the vicinity of operations and their dispersion due to meteorological conditions.

- Determine representative radionuclide concentrations in areas where public health is a concern, determine occupancy factors, and verify that doses to the public through the air pathway from operations remain as low as reasonable achievable, relative to standards.

- Evaluate potential areas with known contamination; an increase in contamination via resuspension of particulates in those areas would require air monitoring.

- Increase the review frequency of actual emissions from facilities and in areas with surface and soil contamination.

- Obtain 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.

- Obtain measurements at the site perimeter and in nearby communities to provide public assurance that the degree of contamination (if any) from DOE operations is known.

- Operate the remaining on-site air monitors continuously; use thermoluminescent 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 is of acceptable quality.

- Trend background concentration with historically collected data in each wind sector to assess the impact.

**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. Six of the air particulate sample collection stations are situated within dedicated blockhouses. Of these sample collection stations, P2, P4, P7, and P9 are located at the boundary perimeter. At each station, glass fiber filter paper is used to capture airborne particulate matter and silica gel tubes collect water vapor for tritium analysis. The population surrounding the Laboratory is beyond the sampling stations, which allows for the opportunity to mitigate any unplanned releases. The duplicate station at P7 shall be moved from one blockhouse to another and kept at each blockhouse for a period of 2 months to test the precision of all the environmental sampling and analyses.

**Step 5: Develop the Decision Rules**

**If** the tritium concentrations are greater than 8 pCi/m3, **then** investigate the source of elevated tritium at that location, implement corrective actions, and project manager will review all detections above the limits for comparison with historical values and significance.

**If** the gross alpha activity in the filters is greater than 3 fCi/m3, **then** collect more samples in the vicinity, and project manager will review all detections above the limits for comparison with historical values and significance.

**If** the gross beta activity in the filters is greater than 25 fCi/m3, **then** collect more samples in the vicinity, and 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 shall trigger an investigation of potential sources in that wind sector. 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.

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

### TOTAL COST OF THE PROGRAM

| ESTIMATED COSTS FOR MONITORING PROGRAM | | | | | | |
|---|---|---|---|---|---|---|
| Analysis | Minimum Sample Size ($m^3$) | Detection Limit ($\mu$Ci /mL) | Number of Samples per Year | Turnaround Time (calendar days) | Cost per analysis | Total Cost |
| Gross alpha/beta (filter) | 500–700 | 1.04E-15 | 4 x 52 | 14 days | $ 68.00 | $14,144 |
| Charcoal | 500–700 | | eliminated | 14 days | | |
| Gamma on Composite | Composite | | eliminated | 45 days | | |
| Tritium | Min-7 ml of tritiated water | 4.73E-7 | 4 x 26 | 30 days | $ 51.00 | $5,304 |

CY 2011 Cost $65,535
CY 2012 Cost $55,692
CY 2013 Cost $19,448
CY 2014 Cost $19,448

See Appendix B for the monitoring program for this DQO.

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