Air Quality

CHAPTER 5

To monitor facility operations and ensure compliance with the federal Clean Air Act, Brookhaven National Laboratory (BNL) performs continuous air emission sampling at several facilities. In addition to facility emission monitoring, environmental air sampling is conducted to verify local air quality. Total radiological and regulated, nonradiological air releases for 1998 are tabulated in this chapter. Ambient radiological air quality data collected at various onsite locations are also summarized.

The most significant contributors to radioactive air emissions from the BNL site were the Brookhaven Medical Research Reactor (BMRR), the High Flux Beam Reactor, and the Brookhaven Linac Isotope Producer. Over the course of 1998, a total of 2,455 Ci (91 TBq) of airborne radioactive material was released from these facilities. Releases of gaseous argon-41 from the BMRR accounted for 96 percent of this total. Total radionuclide emissions were consistent with those of recent years.

Conversion of three boilers at the Central Steam Facility to dual-fuel (oil/natural gas) firing capability allowed an increase in the use of natural gas with associated declines of 11 tons of particulate matter, 8.5 tons of nitrogen oxides (NO_x), and 66.2 tons of sulfur dioxide (SO_2) from 1997 levels.

5.1. AIRBORNE EMISSIONS - RADIOACTIVE

Federal air quality laws and Department of Energy (DOE) regulations governing the release of airborne radioactive material include 40 CFR 61 (Subpart H, the National Air Emission Standards for Hazardous Air Pollutants or NESHAPs), and DOE Orders 5400.1, General Environmental Protection Program, and 5400.5, Radiation Protection of the Public and the Environment. Under NESHAPs, a section of the federal Clean Air Act (CAA), facilities whose emissions have the potential to deliver a radiation dose of greater than 0.1 mrem/yr (1 μSv/yr) to a member of the public must be continuously monitored. Those facilities which fall below this value require only periodic, confirmatory monitoring. Annual emissions are discussed in the following sections and associated dose calculations are presented in Chapter 9. Figure 5-1 indicates the location of each of the monitored facilities within the BNL site.

5.1.1. BROOKHAVEN MEDICAL RESEARCH REACTOR (BMRR)

The BMRR is fueled with enriched uranium, moderated and cooled by light water, and is operated intermittently at power levels up to 3 MW (thermal). To cool the neutron reflector surrounding the core of the BMRR reactor vessel, air from the interior of the containment building is used. When air is drawn through the reflector, it is exposed to a neutron field which causes the argon component of the air to become radioactive. This radioactive form is known as argon-41. It is a chemically inert gas with a short half-life of 1.8 hours. After passage through the reflector, the air is routed through a roughing filter and a high efficiency particulate air (HEPA) filter to remove any particulate matter, and finally, a charcoal filter for the

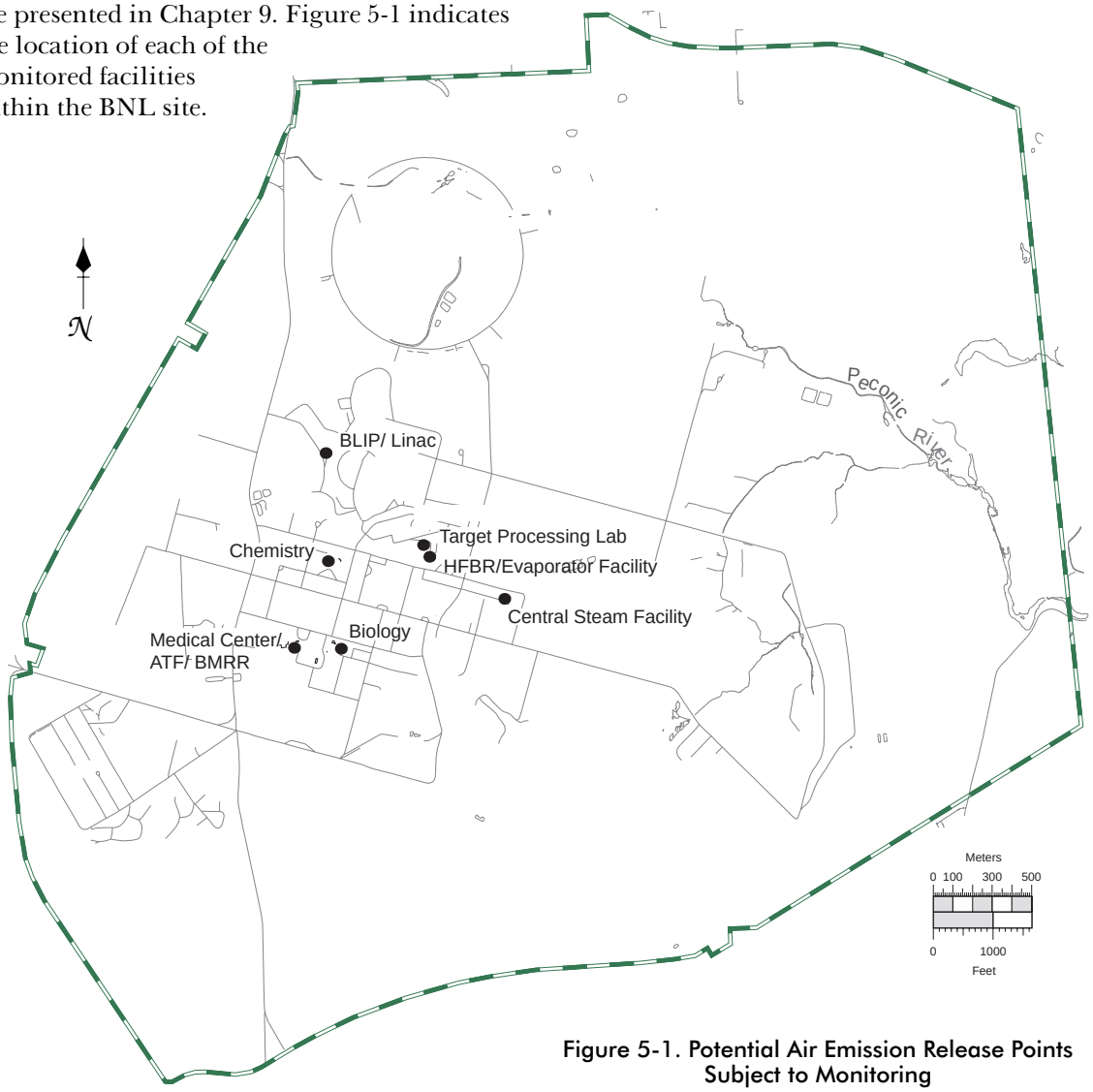

Figure 5-1. Potential Air Emission Release Points Subject to Monitoring

removal of radioiodines produced by the fissioning of fuel. Following the filter bank, the air is exhausted to a 46 meter (150 ft) stack adjacent to the reactor containment building.

A real time monitor is in place to track argon-41 air emissions, while passive filter media are used to collect and quantify radioiodines and particulates. Because non-argon radionuclide concentrations in the air emissions are of a much lower concentration and total activity, they contribute less than 10 percent of the total public dose resulting from the BMRR's air emissions. In accordance with NESHAPs, these nuclides are sampled only on a periodic basis to confirm that their concentrations remain consistent with expected levels. Therefore, annual release totals for these nuclides are not included in this report.

In 1998, the BMRR released 2,359 Ci (87 TBq) of argon-41 to the atmosphere. This value is consistent with this facility's emissions totals for previous years. Argon-41 consistently constitutes the greatest fraction of all radionuclide activity released from the BNL site.

5.1.2 HIGH FLUX BEAM REACTOR (HFBR)

The HFBR is capable of operating at power levels ranging from 30 to 60 MW (thermal).

Heavy water is used to cool the reactor fuel and moderate neutrons used in the fission process. (Heavy water, or D_2O, is water which is composed of a non-radioactive isotope of hydrogen known as *deuterium*.) Heavy water flowing in the reactor core is exposed to a dense neutron field which activates the deuterium atoms in the water to produce tritium (half-life = 12.3 years). The rate at which the tritium concentration builds in the primary cooling water is dependent upon the reactor power level and the amount of time elapsed since the last reactor shutdown or coolant change out. This, in turn, determines the amount of tritium which may eventually be released as an airborne emission. The primary mechanism by which tritium is transferred from the interior coolant system to the building atmosphere is depressurization of the reactor vessel and evaporative losses during maintenance and refueling operations. Diffusion at valve seals and other fittings also occurs. Tritiated water vapor (abbreviated "HTO") is thus released from reactor systems to building air where it is routed to the facility's 98 meter (320 ft) stack. Concentrations of HTO in air emissions are determined by the use of an integrating silica gel absorbent.

The HFBR has been in a stand-by mode since January 1997 following the discovery of an underground plume of tritium emanating from the spent fuel storage pool. This pool was drained in December 1997 to prevent additional leakage as well as to facilitate repairs. Though the HFBR did not operate in 1998, the reactor vessel remained filled with D_2O containing significant amounts of tritium. This tritium is still a source of radioactivity which may be released to the atmosphere via the mechanisms described above. In 1998, 37 Ci (1.4 TBq) of airborne HTO were released from the HFBR (see trend plot shown in Figure 5-2).

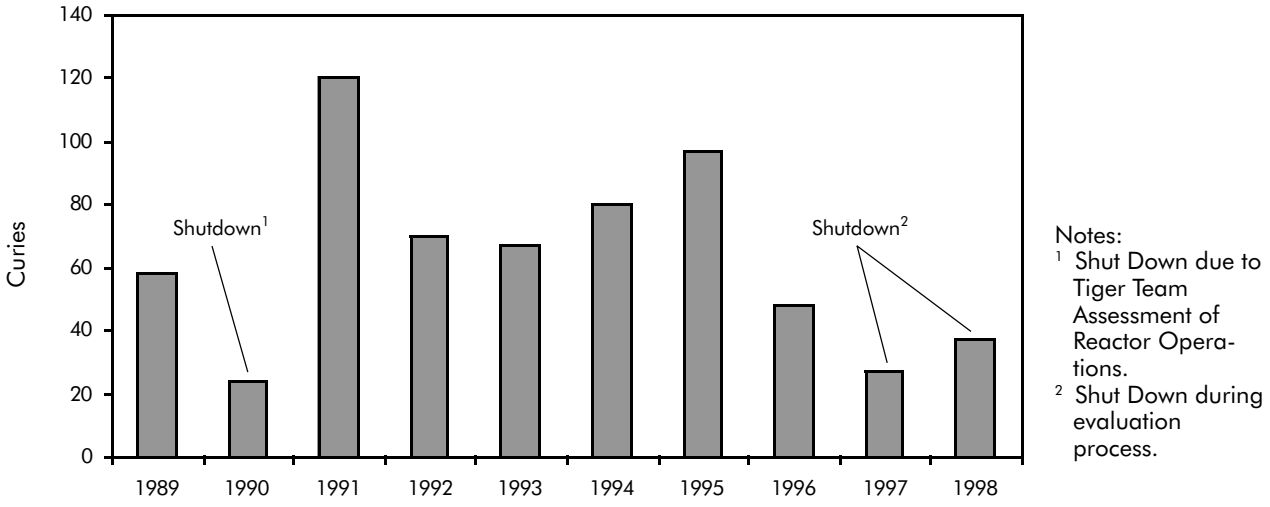

Figure 5-2. HFBR Airborne Tritium Emissions, 10 Year Trend

5.1.3. BROOKHAVEN LINAC ISOTOPE PRODUCER (BLIP)

Protons from the Linear Accelerator (Linac) are sent via an underground beam tunnel to the BLIP where they strike various target metals. These metals, which become activated by the proton beam, are then transferred to the Building 801 Target Processing Laboratory for later use in radiopharmaceutical production. The targets are cooled by a continuously recirculating water system. During irradiation, several radioisotopes are produced in the cooling water, the most significant of which is gaseous oxygen-15, a radionuclide with a very short half-life of 123 seconds. This isotope is released as an airborne emission. A total of 58 Ci (2.1 TBq) of oxygen-15 was released as an airborne emission in 1998. Other radionuclides such as tritium and germanium-69 were released in much smaller quantities. See Table 5-1 for a complete listing.

5.1.4. EVAPORATOR FACILITY

The Building 802 Evaporator Facility was constructed to reduce the total amount of HTO water released to the Peconic River from BNL operations. Since the proposal followed the promulgation of NESHAPs, the facility was evaluated for compliance with the Rule prior to construction. Following submission of an application to construct the facility, formal approval from the United States Environmental Protection Agency (USEPA) Region II was awarded. Wastewater processing began in 1995.

Liquid waste generated onsite which contains residual radioactive material is processed at the Building 811 Waste Concentration Facility (WCF). At the WCF, suspended solids and a high percentage of radionuclides are removed from the liquid using a reverse osmosis process. However, because of its chemical properties, tritium is not removed during this process. The HTO water which remains following waste concentration is delivered to the Evaporator Facility where it is converted to steam and released as an airborne emission. This method is preferable to release via surface water because (1) there is virtually no potential to influence the groundwater aquifer, and (2) the potential for this tritium to contribute to an offsite dose is minimized by atmospheric dispersion. The emission is directed to the same stack used by the HFBR for building air exhaust. In 1998, 2.2 Ci (81 GBq) of HTO were released as an airborne emission from the Evaporator Facility.

Since the waste concentration process does not remove all other radionuclides with complete efficiency, radionuclides other than tritium are released at much lower activity levels (see Table 5-1 for a listing). The activity values listed in the table are estimated since facility emissions are tracked by an inventory system. Liquid shipments to the Evaporator Facility are sampled and analyzed prior to delivery to determine actual radionuclide concentrations. The total emissions for a water tanker delivery are calculated by computing

Table 5-1. Airborne Radionuclide Releases from Monitored Facilities

Facility	Nuclide[1]	Half-life[2]	Ci-Released[3]
BMRR	Ar-41	1.8 h	2.36E+03
Bldg. 801	As-74	18 d	9.38E-06
	Br-77	57 h	7.81E-05
	Cs-137	30 y	7.33E-07
	F-18	110 m	1.74E-01
	Ga-68	68 m	1.33E-01
	Ge-69	36 h	1.37E-04
	Rb-86	18.6 d	2.36E-05
	Se-75	120 d	6.74E-07
HFBR	Be-7	53 d	1.21E-07
	Cs-137	30 y	1.25E-07
	V-48	16 d	3.48E-08
	H-3	12.3 y	3.73E+01
BLIP	O-15	2 m	5.77E+01
	H-3	12.3 y	7.46E-03
	Be-7	53 d	9.97E-06
	Ge-69	36 h	1.33E-04
	Rb-86	18.6 d	1.55E-05
Evaporator Facility	Co-56	79 d	1.94E-05
	Co-57	271 d	6.71E-05
	Co-58	71 d	4.07E-05
	Co-60	5.2 y	1.44E-06
	Cs-137	30 y	2.68E-06
	Ga-66	9.4 h	7.31E-05
	H-3	12.3 y	2.18E+00
	Mn-54	312 d	2.48E-06
	Rb-83	86 d	7.46E-05
	Zn-65	244 d	8.02E-05

Notes:
1. While other nuclides are released from the BMRR, none contribute more than 10% of the total public dose due to BMRR air emissions. See text for discussion.
2. Half-life abbreviations:
   m = minutes
   h = hours
   d = days
   y = years
3. 1 Ci = 3.7×10^{10} Bq.

the product of the concentration and the total volume evaporated. This method is very conservative since some fraction of the chemically reactive radionuclides bind to the interior surfaces of the boiler system; hence, airborne releases and projected doses from this facility are most likely overestimated.

5.1.5. BUILDING 801 TARGET PROCESSING LABORATORY

Target metals which have been irradiated at the BLIP facility are transported to the Building 801 Target Processing Laboratory, where the useful isotopes are chemically extracted. Airborne radionuclides released during the extraction process are drawn through multistage HEPA and charcoal filters and then vented to the HFBR stack (see Table 5-1 for isotopes and quantities). Radionuclide quantities released from this facility annually are small, typically in the microcurie to millicurie (or megabecquerel) range. Isotopes released to the atmosphere from Building 801 operations are not significant contributors to the site perimeter dose via the airborne pathway (less than one percent).

5.1.6. ADDITIONAL MINOR SOURCES

There are several research departments within BNL conducting work which involves very small quantities of radioactive materials (in the microcurie to millicurie [or megabecquerel] range). This material is typically used in fume hoods designated for use with radioactive materials. Operations such as transferring material between containers, pipetting, and chemical compound labeling are typical of the work conducted with these sources. Due to the use of filters, the nature of the work conducted, and the small quantities involved, these operations have a very low potential for atmospheric release of any environmentally significant quantity of radioactive material. Compliance with NESHAPs is demonstrated through the use of an inventory system which allows an upper estimate of potential releases to be calculated. Facilities which demonstrate compliance in this way include buildings 463, 555, 318, 490, 490A, 703W and 830. Hosted in these buildings are a wide range of research operations including the fields of biology, chemistry, medicine, applied science and advanced technology.

5.1.7. PREVIOUSLY UNCHARACTERIZED EMISSION SOURCES EVALUATED IN 1998

As part of an initiative to review processes at BNL which could produce radioactive air emissions, a number of key facilities were inspected in 1998. The review identified the Linac and Alternating Gradient Syncrotron (AGS) cooling tower #2 as requiring air compliance assessments. The conclusions of the assessments are discussed below

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5.1.7.1. LINEAR ACCELERATOR (LINAC)

The Linac produces beams of polarized protons of energies up to 200 MeV for use at both the AGS and BLIP facilities. Due to the composition of the beam and the energies involved, production of airborne radionuclides through air activation and/or spallation interactions is possible. The most significant production point of airborne radionuclides inside the tunnel occurs where the beam crosses an air gap as it enters the BLIP vacuum system. These radioactive products are available for atmospheric release via the tunnel ventilation exhaust stack, located adjacent to the BLIP building. Radionuclides detected during sampling in 1998 include carbon-11 (half life, T½ = 20 min), nitrogen-13 (T½ = 10 min), sulfer-38 (T½= 3 hrs), chlorine-38 (T½ = 37 min), and chlorine-39 (T½ = 55 min). The total annual release of each isotope is no more than a few microcuries (megabecquerels).

The CAP88-PC (CAA Assessment Package-1988) computer dose modeling code was used to estimate the maximum public dose which could be caused by the radioactive air emissions from the Linac facility in a typical year. (See Chapter 9 for a description of the CAP88-PC model.) The model projects that the annual effective dose equivalent to the maximally exposed individual is approximately 0.000003 mrem (3E-4 mSv). This value is very small, compared to the annual limit under NESHAPs, which is 10 mrem (0.1 mSv) for all air emission sources. As stated in Chapter 4, the typical person's dose from exposure to natural radiation sources is about 300 mrem/yr (3 mSv/yr).

5.1.7.2. ALTERNATING GRADIENT SYNCROTRON (AGS) COOLING TOWER #2

Magnets used to steer the AGS particle beam experience significant heating and are cooled

via a recirculating, non-contact water loop. Under certain conditions such as High Energy Proton operations, low concentrations of radioactive elements may be produced in the cooling water when it circulates in the vicinity of the beam line. Radioisotopes which exist as gases may be liberated from the water when exposed to air during circulation in the outdoor cooling tower. These gaseous isotopes can constitute an airborne emission. The radionuclides which are likely to be released via this mechanism include oxygen-14 (T½ = 1.2 min), oxygen-15 (T½ = 2.1 min), nitrogen-13 (T½ = 10 min), and carbon-11 (T½ = 20 min). Tritium is also present and may be emitted from the tower as water vapor in microcurie (megabecquerel) quantities per year. Modeling using CAP88-PC indicates that the typical annual dose to the maximally exposed individual from this source is approximately 0.00002 mrem (2E-3 mSv). Again, a very small value as compared to the NESHAP annual limit.

5.2. AIRBORNE EMISSIONS - NON-RADIOACTIVE

Several state and federal regulations covering nonradioactive releases require facilities to conduct periodic or continuous emissions monitoring in order to demonstrate compliance with emission limits. BNL has several emission sources subject to state and/or federal regulatory requirements that do not require emissions monitoring (see Chapter 3 for more details). The Central Steam Facility (CSF) is the only BNL site that must perform nonradioactive emissions monitoring.

The CSF supplies steam for heating and cooling to all major facilities through the underground steam distribution and condensate grid. The location of the CSF is shown in Figure 5-1. The combustion units at the CSF are designated as Boiler Nos. 1A, 5, 6 and 7. Boiler 1A which was installed in 1962 has a heat input of 16.4 MW (56.7 MMBtu/hr). Boiler 5 was installed in 1965, and has a heat input of 65.3 MW (225 MMBtu/hr). The newest units, Boilers No. 6 and 7 were installed respectively in 1984 and 1996. Both of these boilers have heat inputs of 42.6 MW (147 MMBtu/hr).

Because of their design, heat inputs, and dates of installation, Boiler Nos. 6 and 7 are subject to Chapter 6 of the New York Code of Rules and Regulations (NYCRR) Part 227-2, and the New Source Performance Standard, 40 CFR Subpart Db. As such, these boilers are equipped with continuous emissions monitors (CEM) for nitrogen oxides (NO_x). Boiler No. 7 emissions are also continuously monitored for opacity in accordance with Subpart Db requirements. All four boilers are monitored for oxygen and carbon dioxide. Emissions from these boilers are reported on a quarterly basis to the USEPA and the NYSDEC.

In the spring of 1997, the Long Island Lighting Company completed work to extend a natural gas main into the CSF. To accommodate the combustion of natural gas, new gas rings were added to the burners of Boiler 5 and natural gas trains were installed to connect the gas main to Boiler Nos. 5 and 7. Plans to upgrade Boiler No. 6, which included the replacement of the existing steam atomized oil burners with two Peabody-Hamworthy dual-fuel low NO_x burners, and the addition of a natural gas train connection to the gas main were completed in early 1998. After shakedown testing of the new dual-fuel burners was completed in August, the CSF started burning natural gas in Boiler 6 for steam production.

From May 1 to September 15 (the peak ozone period), compliance with the 130 ng/J (0.30 lbs/MMBTU) NO_x emissions standard is demonstrated by calculating the 24 hour average emission rate from CEM readings and comparing the value to the emission standard. The remainder of the year, the calculated 30-day rolling average CEM emissions rate is used to establish compliance. In 1998, there were no measured exceedances of the NO_x emission standard for either boiler. Owing to the increased use of natural gas, annual particulate, NO_x, and sulfur oxide (SO_2) emissions at the CSF in 1998 declined by 11.0 tons, 8.5 tons, and 66.2 tons respectively from totals recorded in 1997. On an equivalent-heat input basis, particulate emissions at the CSF dropped by 10.6 tons, NO_x emissions dropped by 6.2 tons, and SO_2 emissions fell by 64.2 tons.

5.3. AIR MONITORING

As part of the environmental monitoring program, an array of stations is in place around the BNL site to collect air samples which are used to determine radiological air quality (see Figure 5-3). As shown in the photo, the blockhouses are fenced for security purposes to control access and protect costly

sampling equipment from inadvertent intruders. Six stations are located in dedicated blockhouses (see Figure 5-4 for locations). At each blockhouse, glass fiber filter paper is used to capture airborne particulate matter, charcoal cartridges are used to collect potential radioiodines (none were detected in 1998), and silica gel tubes are used to collect water vapor for tritium analysis (with the exception of Station S5 which does not contain a tritium sampler). Filter paper is collected weekly and analyzed for gross alpha and beta activity using a gas-flow proportional counter. Silica gel samples are also collected weekly and processed for liquid scintillation analysis. Charcoal cartridges are collected monthly and analyzed by gamma spectroscopy. In addition to the blockhouses, 18 pole-mounted, battery-powered silica gel samplers are distributed throughout the site, primarily along the site boundary.

In addition to these samples, the New York State Department of Health (NYSDOH) receives duplicate filter samples which are collected at Station P7, located at the southeast boundary. These samples are also collected on a weekly basis and are analyzed by an independent NYSDOH Laboratory. Analytical results are comparable to those collected by BNL and are reported annually in a document called "Environmental Radiation In New York State".

Figure 5-3. Environmental Air Sampling Blockhouse

Figure 5-4. Air Monitoring Stations

5.3.1. GROSS ACTIVITY

Particulate filter analytical results are reported in Table 5-2. Annual average gross alpha and beta airborne activity levels were equal to 0.0005 pCi/m^3 (0.02 mBq/m^3) and 0.015 pCi/m^3 (0.6 mBq/m^3), respectively. Annual gross beta activity trends recorded at Station P7 are plotted in Figure 5-5; the results at this location are typical for the site. The trend shows a seasonal variation of concentrations within a range which is representative of natural background. Note, however, that gross alpha activity is not plotted because the vast majority of results were below the Minimum Detection Limit (MDL). Measurable activity is primarily due to radionuclide decay products associated with natural uranium and thorium.

As part of a state-wide monitoring program, the NYSDOH also collects air samples in Albany, New York, a control location with no potential to be influenced by nuclear facility emissions (NYSDOH, 1993). The NYSDOH reports that typical airborne gross beta activity at that location varies between 0.005 and 0.025 pCi/m^3 (0.2 to 0.9 mBq/m^3). Sample results measured at BNL fall well within this range, demonstrating that onsite radiological air quality is consistent with that observed in locations in New York State not located near radiological facilities.

Table 5-2. Gross Activity Detected in Air Particulate Filters

Sample Station		Gross Alpha (pCi/m^3)	GrossBeta (pCi/m^3)
P2	N	52	52
	Max.	< 0.002	0.052±0.0036
	Avg.	0.0006±0.0002	0.016±0.002
	NBD	52	2
P4	N	52	52
	Max.	< 0.002	0.040±0.003
	Avg.	0.0005±0.0001	0.016±0.002
	NBD	52	3
P7	N	52	52
	Max.	< 0.013	0.026±0.003
	Avg.	0.0004±0.0002	0.014±0.002
	NBD	52	6
P9	N	52	52
	Max.	< 0.003	0.035±0.004
	Avg.	0.0006±0.0002	0.014±0.002
	NBD	52	2
S5	N	52	52
	Max.	< 0.014	0.052±0.004
	Avg.	0.0005±0.0004	0.016±0.003
	NBD	52	3
S6	N	52	52
	Max.	< 0.008	0.045±0.009
	Avg.	0.0006±0.0002	0.015±0.002
	NBD	52	2

Notes:
1. All values shown with 95% confidence interval.
2. N = Number of samples collected.
3. NBD = Number of samples with results below the Minimum Detection Limit.

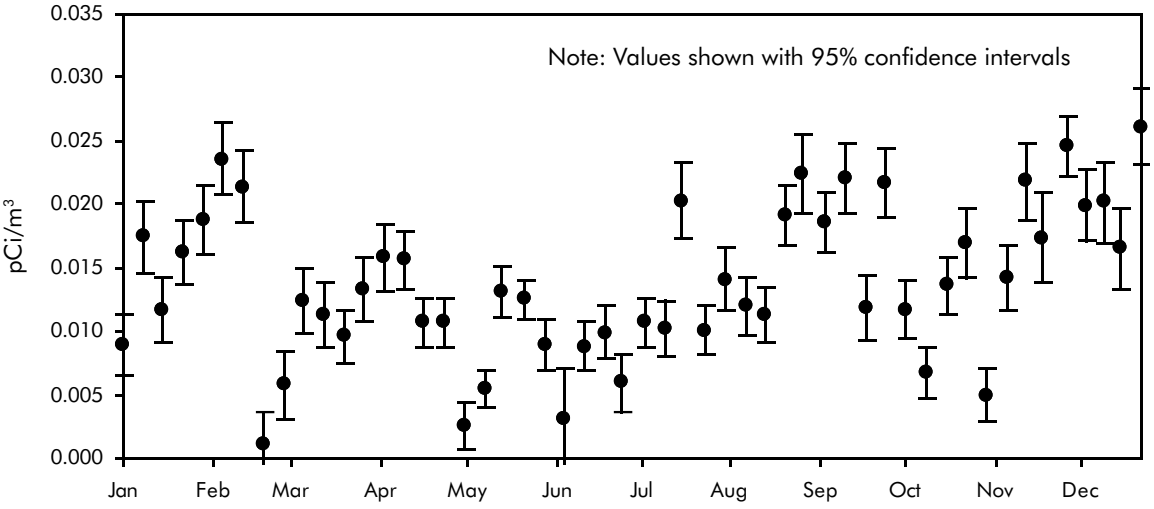

Figure 5-5. Airborne Gross Beta Concentration Trend recorded at Station P7

Table 5-3. Ambient Airborne Tritium Measurements

Station	Wind Sector	Validated Samples	Maximum (pCi/m³)	Average (pCi/m³)
006-300 (P9)	NE	48	< 3.3	0.3±0.4
011-300	NNE	35	2.5±1.5	0.1±0.3
012-300	NNE	35	7.1±3.0	0.6±0.6
017-300 (P2)	NNW	46	4.2±1.6	0.2±0.3
030-300	ENE	28	4.9±2.3	0.2±0.5
034-300	NNW	42	9.6±3.6	0.5±0.5
049-300	E	31	< 5.5	0.3±0.5
053-300	NW	45	5.2±1.6	0.3±0.4
063-300	W	43	16.2±8.8	0.5±0.8
075-300	SW	39	26.4±2.6	1.6±1.6
080-300	ESE	35	4.5±1.6	0.3±0.4
082-300	W	41	5.7±2.4	0.0±0.4
088-300 (S6)	SE	50	75.2±4.4	28.9±4.8
090-300 (P7)	ESE	51	5.8±2.5	0.4±0.4
105-300	S	41	4.5±2.2	0.0±0.5
108-300	SE	30	< 3.6	-0.1±0.6
109-300 (P4)	WSW	49	22.2±3.5	0.5±1.0
111-300	SW	45	< 5.0	0.0±0.4
122-300	SSE	40	21.7±2.6	0.2±1.2
126-300	SSW	46	3.5±2.2	0.1±0.3
Grand Average				2.0±0.5
DOE Order 5400.5 air DCG				**100,000**

Notes:
1. All values reported with 95% confidence interval.
2. Typical detection limit: 1 - 4 pCi/m³.

5.3.2. AIRBORNE TRITIUM

Airborne tritium in the form of HTO is monitored throughout the BNL site. Twenty monitors (not including those which monitor the Removal Action V ([RA V]) recharge basin) are located at or near the property boundary (see Figure 5-4 for locations). HTO is collected by using a pump that draws air through a column of silica gel, a water-absorbent medium which retains moisture. The absorbed water is recovered in the Analytical Services Laboratory (ASL) and analyzed using liquid scintillation counting techniques.

Table 5-3 lists the number of validated samples collected at each location, the maximum value observed and the annual average concentration. (Validated samples are those which were not rejected due to equipment malfunction or other factors, e.g., a battery failure in the sampler, or frozen or super-saturated gel.) While each location showed a maximum value at some point in the year which was above the typical detection limit of about 4 pCi/m³ (0.15 Bq/m³), the vast majority of sample results were below the MDL. These data demonstrate that there is no significant difference in ambient tritium concentrations onsite or at the site boundary. With the exception of Station S6, which is located adjacent to the former Hazardous Waste Management Facility (HWMF), all annual average concentrations were observed to be below the MDL. The maximum concentration recorded at Station S6 was 75 pCi/m³ (2.8 Bq/m³). The higher values observed at this station may be due to its proximity to the HWMF. By comparison, the DOE Order 5400.5 Derived Concentration Guide (DCG) for tritium in air is 100,000 pCi/m³ (3.7 kBq/m³). The airborne DCG is the concentration of a radionuclide in air which, if inhaled at that level for one year, would result in an effective dose equivalent of 100 mrem (1 mSv) to the exposed individual.

5.3.2.1. REMOVAL ACTION V (RA V) RECHARGE BASIN

In 1997, an interim pump-and-recharge system was constructed to control the leading edge of the plume of tritium associated with the leakage of the spent-fuel storage pool at the HFBR. Three extraction wells are used to pump groundwater containing both tritium and volatile organic compounds (VOCs) from approximately 150 feet below ground surface to carbon filtration units and ultimately to the RA V recharge basin, located 3,000 feet to the north of the plume edge. (The VOCs being treated by this system are from sources unrelated to the HFBR.) Using assumptions which later proved to be very conservative, the recharge basin was evaluated as a potential air emission source for NESHAPs compliance prior to the start of pumping operations (see the Section 5.1.6.1 of the BNL Site Environmental Report for Calendar Year 1997 for a discussion of that evaluation).

Airborne HTO monitoring in the vicinity of the RA V recharge basin continued in 1998. Two monitors are installed immediately adjacent to the basin at the northeast and southeast corners, the downwind directions of the predominant winds on site (see BNL wind rose in Figure 1-10). An additional station was placed near the National Weather Service building, approximately 0.3 km (0.2 mi) to the

east of the basin. As can be seen in Table 5-4, no tendency toward measurable airborne tritium was observed. Only eight of 116 total samples showed results greater than the MDL, and those eight were at values consistent with what was observed throughout the site. This is as expected since direct analysis of the basin water showed tritium values which were rarely above the MDL of about 350 pCi/L (13 Bq/L).

Table 5-4. Ambient Tritium Monitoring Results at RA V Recharge Basin

Location	Validated Samples	Detections	Maximum (pCi/m^3)	Average (pCi/m^3)
Northeast corner of basin	41	3	5.9+/-1.7	0.8+/-0.5
Southeast corner of basin	27	1	< 3.2	0.4+/-0.6
National Weather Service Building	48	4	3.9+/-1.4	0.3+/-0.4

Notes:
Typical MDL between 1 and 4 pCi/m^3.

REFERENCES:

New York State Department of Health. 1993.
Environmental Radiation in New York State 1993.
Albany, New York.