

EXPLORING EARTH'S MYSTERIES
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Alternating Gradient Synchrotron

Facility Environmental Monitoring Report

Calendar Year 2004



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Alternating Gradient Synchrotron

Facility Environmental Monitoring Report

Summary of Results

Tritium continues to be detected in groundwater downgradient of the g-2/VQ12 Magnet source area, but at much lower concentrations than those observed in 2002 and early 2003. During 2004, tritium concentrations showed a steady decline from a maximum of 380,000 pCi/L in April to 93,200 pCi/L in October.

Tritium concentrations downgradient of the former E-20 Catcher and former U-Line target and beam stop areas continue to be well below the 20,000 pCi/L drinking water standard, indicating that the impermeable caps installed over these areas are effective in preventing additional residual activation from entering the groundwater. Groundwater monitoring results for other soil activation areas such as Building 914, Building 912, and the J-10 stop indicate only low to nondetectable levels of tritium. Tritium was not detected in wells located downgradient of the Booster beam stop or the NSRL facility.

Thermoluminescent dosimeter 054-TLD1 posted near the new NSRL facility, and dosimeters 054-TLD2 and 054-TLD3 posted on the east and west side of the Bldg. 913B, showed that the ambient annual dose equivalent in the AGS vicinity was 62 ± 18 mrem, 130 ± 151 mrem and 74 ± 47 mrem, respectively. The dose for 054-TLD1 was similar to the site wide average of 66 ± 11 mrem. However, the quarterly dose from 54-TLD2 at the northeast corner of bldg. 913B was 45.3 mrem in the first quarter, and 52.6 mrem for the fourth quarter, which was much higher than quarterly site wide average. The 054-TLD3 located on the northwest corner of bldg. 913B also showed higher dose but only in the first quarter at 27.2 mrem. The probable cause of higher doses at these locations is being evaluated.

There were no SPDES permit excursions attributable to AGS activities in 2004.

Environmental Monitoring Program

As required by DOE Order 450.1, *Environmental Protection Program*, (DOE, 2003), BNL has established an environmental monitoring program at the Alternating Gradient Synchrotron (AGS) facility to evaluate potential impacts to environmental quality from its operation.

Operations at the AGS facility have the potential to affect soil, surface water and groundwater quality. The primary environmental concern is beam line interaction with the AGS beam stops and targets. Secondary particles created in these areas may interact with the surrounding soil shielding. These interactions can result in the production of tritium and sodium-22, both of which can be leached out of the soils by rainwater if left unprotected. A number of engineered controls (i.e., impermeable caps, stormwater

collection systems, and tunnel structures) are in place to prevent rainwater infiltration into the activated soils, and potential leaching and transport of tritium and sodium-22 to the groundwater.

In addition, various routine cooling water and floor drain discharges from the AGS complex have the potential to affect surface water quality via discharge to the BNL sewage treatment plant. Additional discharges from once through cooling water systems, cooling towers, and stormwater have the potential to affect groundwater quality at recharge basins.

The environmental monitoring program for the AGS area is described in the *BNL Environmental Monitoring Plan* (BNL, 2004). The monitoring programs results are summarized below.

Monitoring Results

Groundwater Program

Groundwater quality in the activated soil shielding areas is monitored by more than 50 wells. The locations of the AGS monitoring wells are shown on Figure 1.

Historical surface spills and discharges of solvents to cesspools and recharge basins near the AGS have contaminated soils and groundwater with volatile organic compounds (VOCs). VOC contamination is monitored under the Environmental Restoration program's OU III Central Areas (see Volume II of the *BNL Site Environmental Report* for details on VOC groundwater contamination in the AGS area).

g-2 Tritium Plume/VQ12 Source Area

Monitoring results for wells located approximately 150 feet downgradient of the VQ12 source area indicate that tritium continues to be released to the groundwater, but at much lower concentrations than those observed in 2002 and early 2003 (Figure 2). During 2004, tritium concentrations showed a steady decline from a maximum of 380,000 pCi/L in April to 93,200 pCi/L in October (Table 1). In the area immediately downgradient of Building 912, a distance of approximately 600 feet from the VQ12 source area, the maximum tritium concentration observed during 2004 was 451,000 pCi/L in well 065-122 (Figure 3). In May 2004, seven Geoprobe wells were installed in the AGS Parking Lot area to characterize the leading edge of the g-2 tritium plume. The maximum observed tritium concentration was 518,000 pCi/L, which was detected in Geoprobe well GP-34. Figure 4 shows the locations of the Geoprobe wells and the position of the g-2 tritium plume during 2004.

The distribution of tritium concentrations within the plume is indicative of four distinct periods of tritium release (also referred to as slug releases) from the source area (Figure 2). The leading segment of tritium contamination was released in 1999 prior to the installation of the cap over the VQ12 area, whereas the subsequent slugs were released

following the cap installation. As discussed below, the release of tritium following cap installation appears to be related to the flushing of residual tritium from the vadose zone (unsaturated soils above the water table) following significant periodic rises in the local water table.

Although tritium continues to be released from the source area, routine inspections of the cap and review of its design have concluded that the cap over the VQ12 area has not failed and is properly positioned to prevent the infiltration of rainwater into the activated soil-shielding zone. The leading hypothesis at this time is that natural rises in the water table may be releasing residual tritium from the vadose zone soil into the groundwater. It is believed that this tritium was mobilized to the soils close to the water table before the cap was put in place in December 1999. Once the cap was in place, the lack of additional rainwater infiltration essentially kept the tritium in the vadose zone from migrating into the groundwater until the significant rise in water table mobilized it. There appears to be good correlation between high tritium concentrations detected in monitoring wells immediately downgradient of VQ12, and the groundwater table elevation about one year prior to the sampling (Figure 2). The groundwater travel time from beneath the source to the monitoring wells is about one year. Although the water table reached an elevation of nearly 50 feet AMSL in July 2003 (the highest level since the VQ12 source was created), the lower tritium concentrations observed during 2004 in wells immediately downgradient of the VQ12 source suggests that the amount of residual tritium in the vadose zone is less than in previous years.

Possible remedial actions for the g-2 tritium plume will be described in a Focused Feasibility Study (FFS) that is scheduled for completion in early 2006.

g-2 Beam Stop Area

The g-2 beam stop area is monitored using three downgradient wells (Table 3). In 2004, no tritium was detected in these wells. This indicates that the gunite cap installed over the beam stop area is effectively controlling rainwater infiltration into the potentially activated soil shielding surrounding the beam stop.

Former E-20 Catcher Area

In January 2000, tritium and sodium-22 levels were found to exceed the drinking water standards in monitoring wells located downgradient of the E-20 Catcher region, with concentrations of 40,400 pCi/L and 704 pCi/L, respectively. In April 2000, a temporary impermeable cap was installed over the E-20 Catcher area to prevent rainwater infiltration and the continued leaching of radionuclides out of the soils. A permanent cap was constructed by October 2000. Following cap construction, tritium and sodium-22 concentrations have remained below the applicable drinking water standards (Figure 5). During 2004, the maximum observed tritium concentration was 1,490 pCi/L in well 064-80 (Table 4).

Former U-Line Target

Low levels of tritium have been routinely detected in wells downgradient of the former U-Line target since monitoring began in July 2000 (Figure 6). The highest tritium concentration during 2004 was 2,400 pCi/L in well 054-129 located approximately 200 feet downgradient of the target area (Table 3).

Former U-Line Beam Stop

Following the detection of tritium at concentrations up to 71,600 pCi/L in temporary wells installed downgradient of the Former U-Line beam stop in March–April 2000, BNL installed a temporary impermeable cap over the U-Line beam stop soil activation area to prevent rainwater infiltration and the continued leaching of radionuclides out of the soils and into groundwater. By October 2000, a permanent cap was constructed over the U-Line stop area, and additional wells were installed to provide improved long-term monitoring. Since 2001, tritium concentrations in downgradient wells have been well below the drinking water standard (Figure 7). During 2004, the maximum observed tritium concentration in wells closest to the target area was 1,230 pCi/L in well 054-168 (Table 4).

Building 912 Area

Other than tritium contamination that is traceable to either the g-2/VQ12 magnet or former U-Line beam target/stop source areas, there are no indications that tritium is being released from the activated soils located beneath the experimental floor of Building 912.

The g-2 tritium plume has been tracked from the VQ12 magnet source, beneath a portion of Building 912, to an area located just to the south of the Waste Concentration Facility (Figure 4). Tritium from this plume was detected in a number of wells downgradient of Building 912 (Tables 1 and 2), with a maximum concentration of 451,000 pCi/L in the January sample from well 064-122 (Figure 3).

Low levels of tritium that are probably traceable to releases from the former U-Line target and stop area were detected in downgradient wells 055-31 and 055-32 (up to 680 pCi/L).

Booster Beam Stop Area

During 2004, facility operations limited access to the monitoring wells to only one sample round (February). Although low levels (up to 1,340 pCi/L) of tritium were detected downgradient of the Booster stop during 2001 and 2002, tritium was not detected during 2003 and 2004 (Figure 8, Table 4).

The tritium that was detected in 2001 and 2002 was probably related to a short-term uncovering of activated soil shielding near the former Booster beam stop location (northwestern section of the Booster) during construction of the tunnel leading from the Booster to the new NASA Space Radiation Laboratory (NSRL). This work, which began in September 1999 and was completed by October 1999, may have allowed rainwater to

infiltrate the low-level activated soil shielding surrounding the former beam stop location.¹

Building 914 Transfer Area

Low levels of tritium have been detected in groundwater downgradient of the Building 914 transfer tunnel since January 2000 (Figure 9). During 2004, the maximum tritium concentration was 980 pCi/L in a sample from downgradient well 054-53 (Table 4). The detection of low levels of tritium suggests that rainwater may be infiltrating some portions of the activated soils.

J-10 Beam Stop Area

Beam-scraping activities at J-10 began in December 1999. The J-10 section of the AGS ring is covered by layers of Styrofoam and soil-crete (a concrete soil mixture). The soil-crete layer is expected to act as a barrier to rainwater infiltration. To further reduce rainwater infiltration, a gunite (concrete) cap was constructed over a remaining exposed soil area that was overlying J-10. Since 2001, low-levels of tritium have been routinely detected in downgradient wells (Figure 10). During 2004, the maximum tritium concentration was 1,100 pCi/L (Table 4). The detection of low levels of tritium suggests that rainwater may be infiltrating some portions of the activated soils.

NSRL Beam Stop Area

Beam line operations at this facility began in 2003. The entire beam line and beam stop areas of the NSRL facility are capped by geomembrane fabric to prevent rainwater infiltration. Two downgradient wells are used to verify the effectiveness of the cap. Tritium was not detected in any of the 2002 and 2003 preoperational samples collected from these wells (Table 4). During 2004, beam line operations prevented access to one of the downgradient wells (054-08). Tritium was not detected in second well (054-191).

Environmental Dosimeters

Environmental thermoluminescent dosimeters (TLDs) are used in the vicinity of the beam stops, collider labyrinths and other potential fault areas to measure direct penetrating radiation in the field. The environmental TLDs measure an ambient external dose to living organisms. Five TLDs are placed in the vicinity of the AGS (074-TLD1, 074-TLD2, 054-TLD1, 054-TLD2, and 054-TLD3) to establish ambient dose rates. The environmental TLD locations for the BNL site are shown on Figure 11. The dosimeter 054-TLD1 located at Bldg. 914, near the new NSRL facility, showed normal background dose similar to site wide background. Because 054-TLD1 showed higher dose in previous years, and to better define the source of these high doses, two additional dosimeters (054-TLD2 and 054-TLD3) were posted last year in proximity to the AGS shield berm on the east and west side of the building 913B.

¹ Before construction of the NSRL tunnel commenced, soil samples were collected by drilling through the tunnel wall near the Booster Beam Stop to verify that the tritium and sodium-22 levels were within acceptable limits for worker safety and environmental protection.

In 2003, thermoluminescent dosimeters 054-TLD1, 054-TLD2, and 054-TLD3 showed that the ambient annual dose equivalent in the vicinity was 56 ± 16 mrem, 69 ± 19 mrem and 65 ± 27 mrem, respectively. In CY 2004, the ambient dose for 054-TLD1 was 62 ± 18 mrem, which is similar to BNL site wide average of 66 ± 11 mrem. However, the quarterly dose from 054-TLD2 that is posted on the northeast side of building 913B was 45.3 mrem for the first quarter, and 52.6 mrem in the fourth quarter, which was much higher than quarterly site wide average. The 054-TLD3 located on the northwest corner of bldg. 913B also showed higher dose but only in the first quarter at 27.2 mrem. The probable cause of higher doses at these locations is being evaluated.

SPDES Monitoring

The State Pollution Discharge Elimination System (SPDES) permit authorizes discharges from the Sewage Treatment Plant (STP) to the Peconic River, and discharges of cooling water and stormwater to recharge basins. Sanitary wastes from AGS facilities are discharged to the BNL sanitary sewer system. Cooling tower blowdown from Bldg. 902 is also discharged to the sanitary sewer, and is monitored quarterly for flow, pH, and polypropylene glycol monobutyl ether, a heat transfer fluid (UCONN LB-170-X). In addition, a daily log of oil consumption must be maintained. Monitoring of the site sanitary system is performed at the treated effluent discharge to the Peconic River.

In addition, various cooling water, floor drain, and stormwater discharges from the AGS complex are monitored at five recharge basin outfalls (Figure 13). Outfall 002 (Basin HN) receives cooling tower blowdown from Bldg. 912, and stormwater runoff. Outfall 003 (Basin HO) receives AGS non-contact cooling water discharged from the main magnet heat exchanger located in Bldg. 911. Outfall 006A (Basin HT-W) receives Linac noncontact cooling water, NSRL noncontact cooling water, cooling tower blowdown, and floor drain and stormwater runoff. Outfall 006B (Basin HT-E) receives Bldg. 919 cooling tower blowdown, noncontact cooling water, as well as floor drain and stormwater discharges. Finally, Outfall 012 (Recharge Basin HZ) receives stormwater discharges from buildings 197, 902, 905, and 941. Discharges to Outfall 012 started in October 2002.

During 2004, these outfalls were monitored for flow and pH on a weekly basis, and oil and grease on a monthly basis. The BNL SPDES permit does not require oil and grease analyses at Outfall 012. However, quarterly sampling for this parameter was added to the Environmental Surveillance Monitoring program in October 2004, when it was determined that vacuum pump blowdown from Bldg. 902 has the potential to impact the discharge to Outfall 012. The outfalls were also monitored for volatile organic compounds and cooling tower treatment reagent residuals, as required for each outfall.

There were no SPDES permit excursions attributable to AGS activities in 2004.

Environmental Surveillance Monitoring

Besides SPDES monitoring, all discharges are monitored quarterly for radionuclides, metals, volatile organic compounds, and water chemistry parameters as part of BNL's Environmental Surveillance Program.

Outfall 002 (HN)

In addition to SPDES monitoring, all discharges to Outfall 002 (HN) are monitored quarterly for radionuclides, metals, volatile organic compounds, and water chemistry parameters as part of BNL's Environmental Surveillance Program. Outfall 002B, which receives cooling water discharges from Buildings 1002 and 1004, does not warrant surveillance monitoring at this time.

During 2004, no radionuclides related to Laboratory operations were detected in the discharges to basin HN. Gross alpha and beta readings were recorded for most samples collected in 2004. The maximum alpha concentration was 2.6 ± 1.3 pCi/L, whereas the maximum gross beta concentration was 7.9 ± 1.6 pCi/L for a sample collected on February 6, 2005. Because there were no gamma emitting nuclides detected, the gross alpha and beta results are being attributed to natural radioactive materials. Tritium was detected just above the MDL of 170 pCi/L in one of the four samples collected in 2004. The maximum tritium concentration recorded for 2004 was 200 ± 120 pCi/L.

In 2004 as in the past, aluminum and iron were detected above the NYSDEC groundwater effluent limit. Because unfiltered sample concentrations were much higher than filtered concentrations, they are attributable to native sediments carried by stormwater runoff and/or corrosion products associated with piping for the cooling system. Low levels of trihalomethanes were sporadically detected in the discharges to Outfall 002. However, these compounds are common byproducts of potable water disinfection, and are not attributable to RHIC operations. Acetone and methylene chloride were also detected in the discharge from Outfall 002. Although these compounds are sporadically detected in many basin discharge samples, they are usually associated with cross-contamination of samples in the analytical laboratory.

Outfall 003 (HO)

During 2004, no radionuclides related to Laboratory operations were detected in the discharges to basin HO. All gross alpha and beta analyses were less than the associated MDL, except for a gross beta result of 3.6 ± 1.1 on May 17, 2004. Tritium was detected in one of the four samples collected in 2004, at a concentration of 290 ± 180 pCi/L, just above the MDL of 230 pCi/L.

In February 2004, chloride levels reached a maximum of 766 mg/L, which exceeded the NYS groundwater effluent standard of 250 mg/L. The elevated chloride concentration is attributed to winter roadway applications of salt. Analyses for metals did not find any parameters above the NYS effluent standards with most being non-detectable. Low levels of trihalomethanes were sporadically detected in the discharges to Outfall 003. However, these compounds are common potable water disinfection by-products, and not

attributable to AGS operations. Acetone and methylene chloride are sporadically detected in many basin discharges, however, these are usually associated with cross-contamination of samples in the analytical lab.

Outfall 006A (HT-W)

During 2004, no radionuclides related to Laboratory operations were detected in the discharges to basin HT-W. All gross alpha and beta analyses were less than the associated MDL, except for two gross beta samples. The maximum gross beta concentration was 7.8 ± 1.6 pCi/L on November 18, 2004. The other gross beta detection of 6.0 ± 1.6 pCi/L occurred on May 14, 2005. Gamma analyses on these samples did not detect any BNL generated radionuclides. Tritium was not detected above the MDL for any of the samples collected in 2004.

Analyses for metals did not find any parameters above the NYS effluent standards with most being non-detectable. Low levels of trihalomethanes were sporadically detected in the discharges to Outfall 006A. However, these compounds are common potable water disinfection by-products, and not attributable to AGS operations. Acetone and methylene chloride are sporadically detected in many basin discharges, however, these are usually associated with cross-contamination of samples in the analytical lab.

Outfall 006B (HT-E)

During 2004, no radionuclides related to BNL operations were detected in the discharges to basin HT-E. All gross alpha analyses were below the MDL except for the May 21, 2004 sample, which had a concentration of 1.3 ± 0.9 pCi/L. Three of the four gross beta sample concentrations were above the MDL, with a maximum value of 6.5 ± 1.5 pCi/L for the same May 14th sample. Gamma analyses on all samples did not identify any radionuclides associated with BNL operations. Tritium was detected in the November 18, 2004 sample at a concentration of 190 ± 120 pCi/L, just above the MDL of 180 pCi/L.

One sample (February 6th) had aluminum and iron concentrations above the NYSDEC effluent limit. Although low levels of metals are commonly present in recharge basin discharges, they are in particulate form and ultimately settle in the basin and do not pose risk to groundwater quality. Their presence is due to native sediment entrained by stormwater runoff or to corrosion products associated with the cooling system piping.

Trace levels of the solvent 1,1,1-trichloroethane were detected in the February, May and August 2004 samples. All concentrations were below the method detection limit, with a maximum concentration estimated to be 1.6 µg/L. In the past, this chemical was detected in the discharge to Outfall 006B. Upon investigation, a leaking roof on a chemical storage shed was identified as allowing trace levels of this chemical to be washed into the stormwater discharge. Therefore, the facility's Environmental Compliance Representative has been asked to assess all chemical storage areas within the stormwater capture zone. Low levels of trihalomethanes were sporadically detected in the discharges to Outfall 006B. However, these compounds are common potable water disinfection by-products, and are not attributable to AGS operations. Acetone and methylene chloride

were also detected in the discharge samples from Outfall 006B. However, these compounds are sporadically detected in many basin discharges, and are usually associated with cross-contamination of samples in the analytical laboratory.

Outfall 012 (HZ)

Discharge to this outfall began in late 2002. The basin was constructed in an effort to divert some of the water load from Basin HN and prevent flooding of areas within the AGS area. This discharge consists primarily of stormwater runoff from the 902 area and some nominal once through cooling water.

During 2004, no radionuclides related to BNL operations were detected in the discharges to basin HZ. All gross alpha analyses were below the associated MDL. Two of the four gross beta sample concentrations were above the MDL with a maximum value of 9.9 ± 1.3 pCi/L for the November 17, 2005 sample. Gamma analyses on all samples did not identify any radionuclides associated with BNL operations. Tritium was not detected in any of the samples.

In February 2004, chloride levels reached a maximum of 601 mg/L, which exceeded the NYS groundwater effluent standard of 250 mg/L. The elevated chloride concentration is attributed to winter roadway applications of salt. Aluminum and iron concentrations in the February 6, 2005 sample exceeded the NYSDEC effluent limit.

Acetone and methylene chloride were the only detected VOCs in the discharge to Outfall 012. These compounds are sporadically detected in many basin discharges, and are usually associated with cross-contamination of samples in the analytical laboratory. As noted for other basins, their presence is likely due to native sediment entrained by stormwater runoff.

Future Actions

The following monitoring actions will occur during 2005:

- Complete the Focused Feasibility Study for the g-2 tritium plume.
- Continue quarterly monitoring of wells used to track the g-2 tritium plume, and install temporary wells to re-characterize the leading edge of the plume (i.e., Slug #1).
- Continue semiannual monitoring of wells used to monitor the former E-20 Catcher, former U-line Target and Stop areas, Building 912, J-10 Stop, 914 Transfer area, Booster Stop, and NSRL. For 2006, evaluate possible reduction of sampling frequency in low risk areas.
- Continue to perform quarterly monitoring of all recharge basins as part of the SPDES compliance and Environmental Surveillance Program.
- The Environmental Compliance Representative should assess condition of all chemical storage areas within the stormwater capture zone for basin 006B (HT-E).

- Investigate the source of higher environmental TLD doses in the vicinity of building 913B

References

BNL. 2004. *Brookhaven National Laboratory Environmental Monitoring Plan, Annual Update*. BNL-52676. Brookhaven National Laboratory, Upton, NY. January 2004.

DOE Order 5400.5. 1990. *Radiation Protection of the Public and the Environment*. U.S. Department of Energy, Washington, D.C. Change 2: 1-7-93.

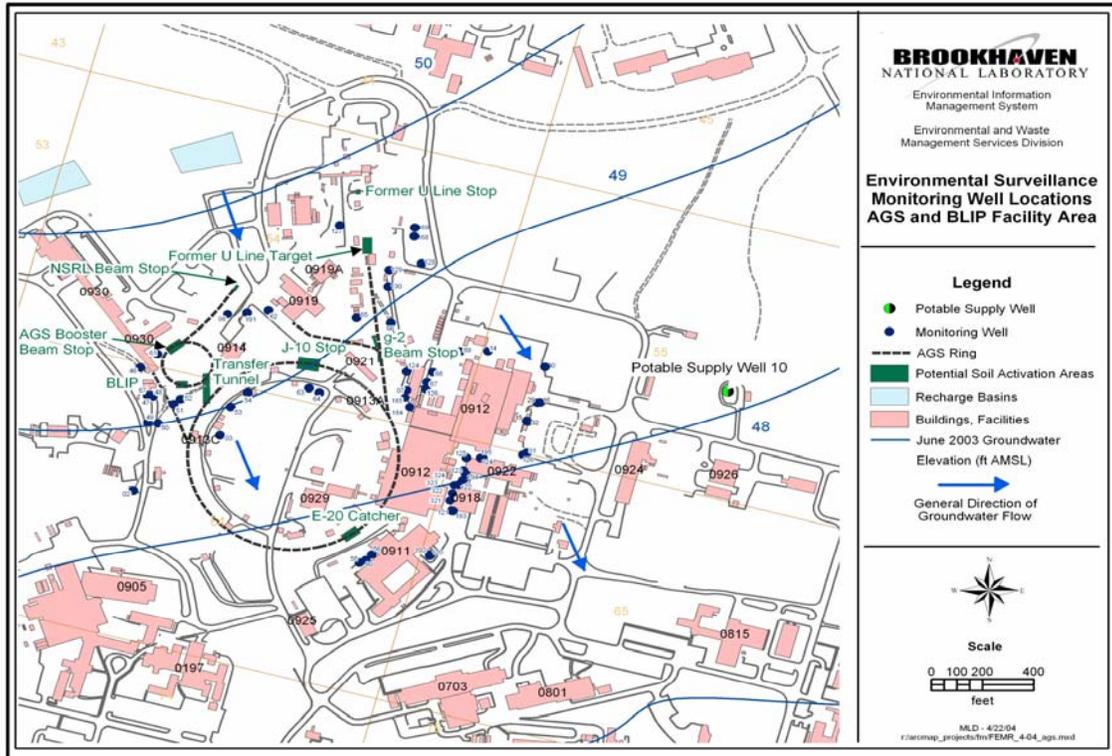


Figure 1. Locations of Groundwater Monitoring Wells in the AGS Area.

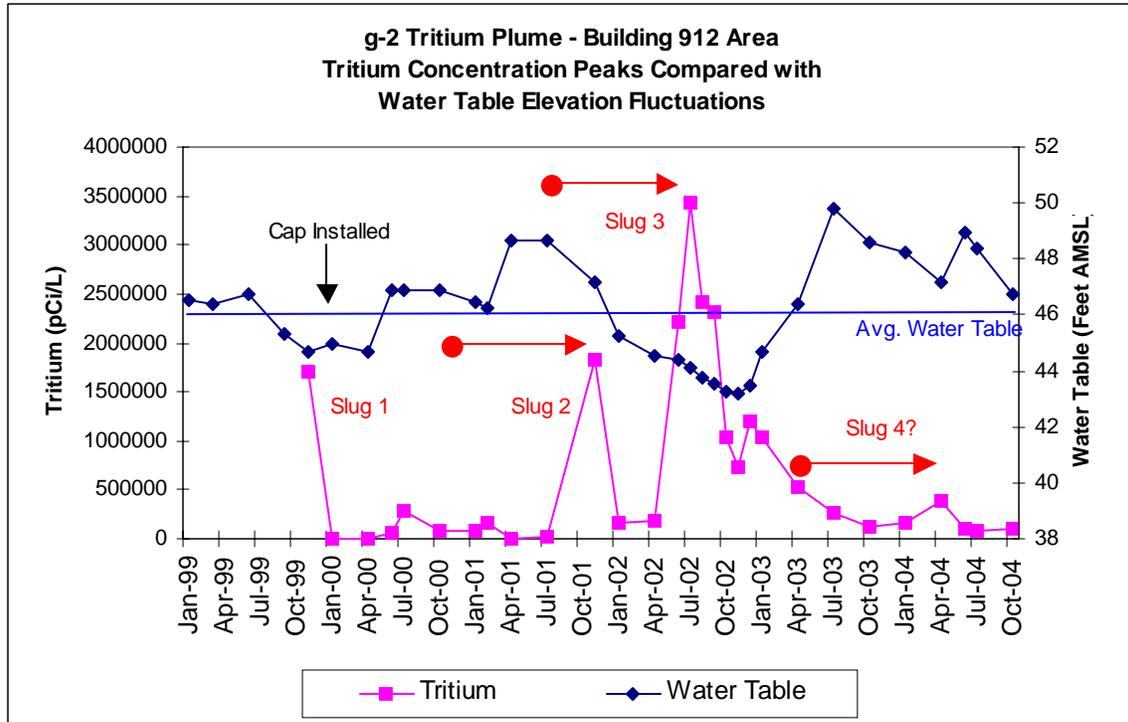


Figure 2. g-2 Tritium Plume. Maximum tritium concentrations observed in temporary and permanent monitoring wells located approximately 150 feet downgradient of the VQ12 source area.

Note 1: Slug one was released prior to capping the VQ12 source area.

Note 2: Red arrows indicate approximate one year of travel time from the VQ12 source area to first set of monitoring wells located near Building 912A (e.g., well 054-07).

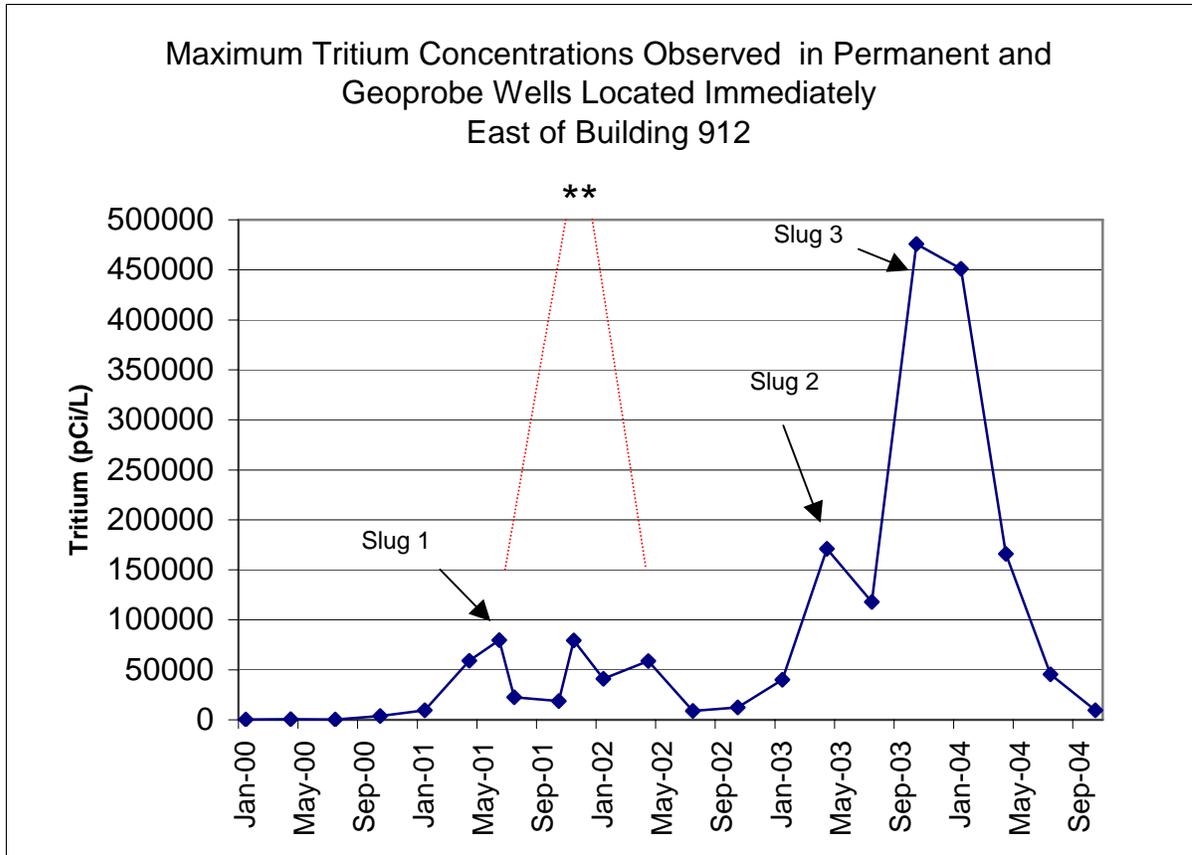


Figure 3. g-2 Tritium Plume. Maximum tritium concentrations observed in temporary and permanent monitoring wells located downgradient of Building 912 - approximately 600 feet downgradient of the VQ12 source area.

Note(**): Tritium concentrations up to 518,000 pCi/L were detected in Geoprobe wells installed in AGS parking lot in May 2004. This suggests that a small narrow zone of high tritium concentrations representing Slug 1 was missed during the mid to late 2001 monitoring period. In 2002, four additional wells were installed east of Building 912 to provide improved monitoring.

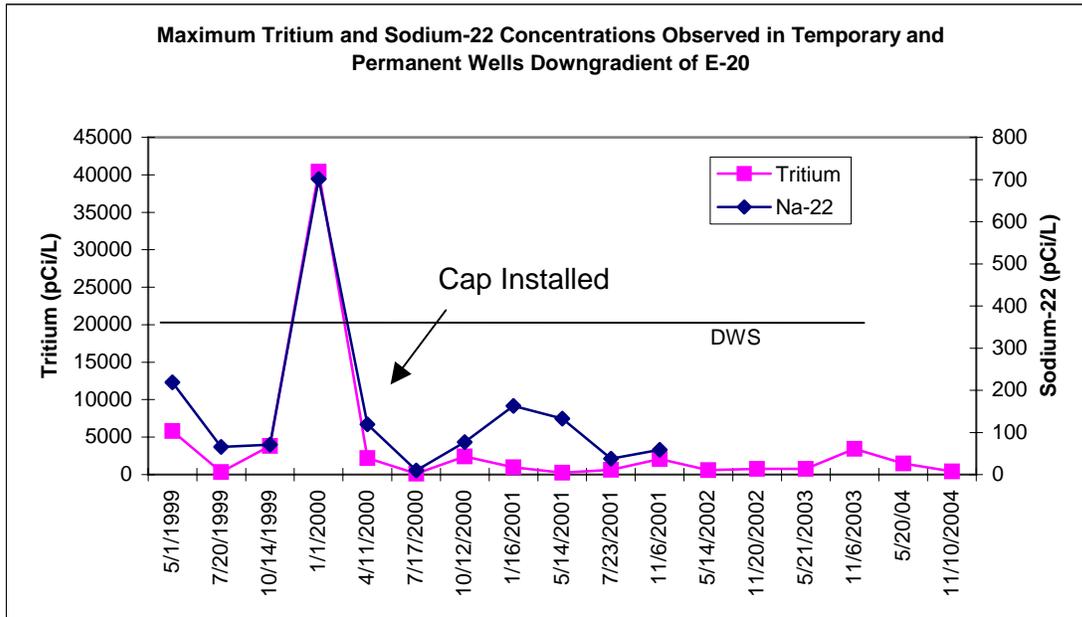


Figure 5. Maximum tritium and sodium-22 concentrations observed in temporary and permanent monitoring wells located approximately 100 feet downgradient of the former E-20 Catcher.

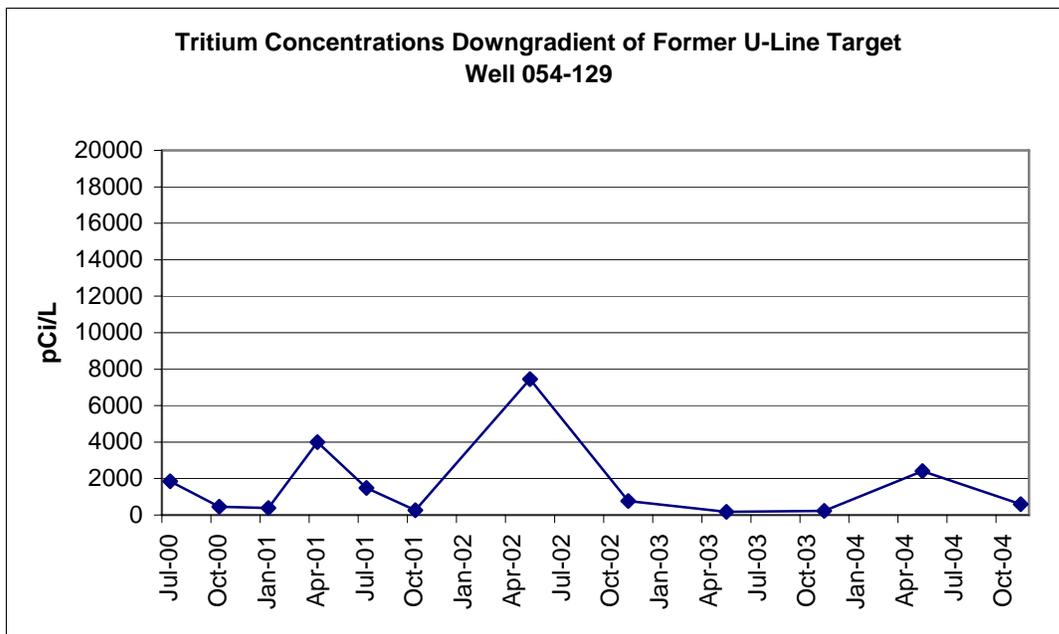


Figure 6: Maximum tritium concentrations observed in monitoring well 054-129 located downgradient of the former U-Line Target.

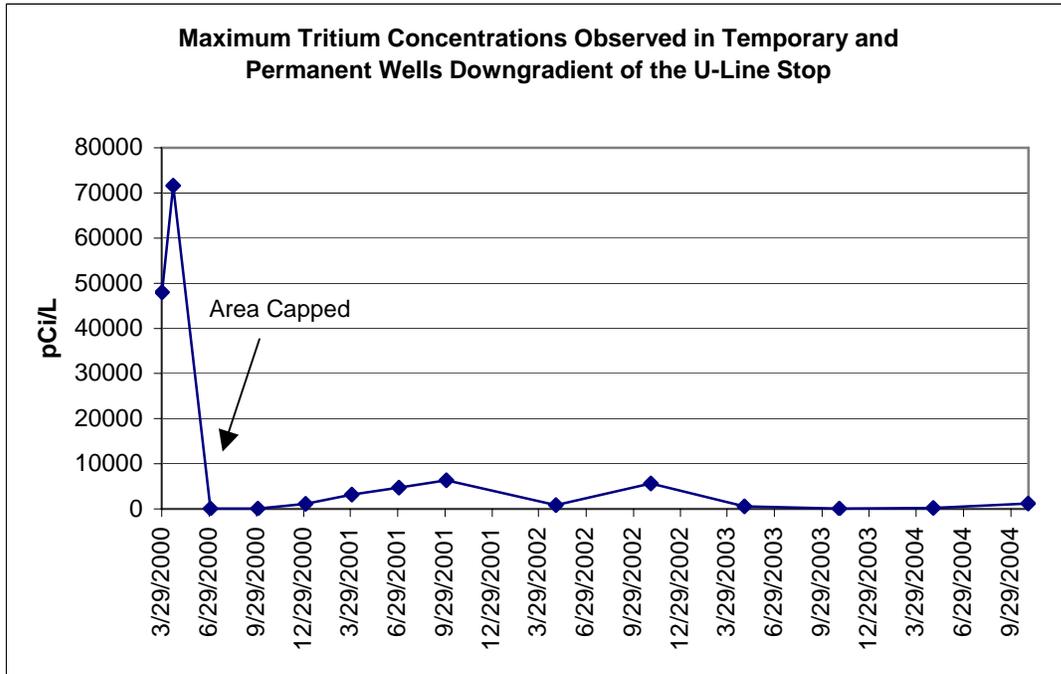


Figure 7. Maximum tritium concentrations observed in temporary and permanent monitoring wells located downgradient of the former U-Line Stop.

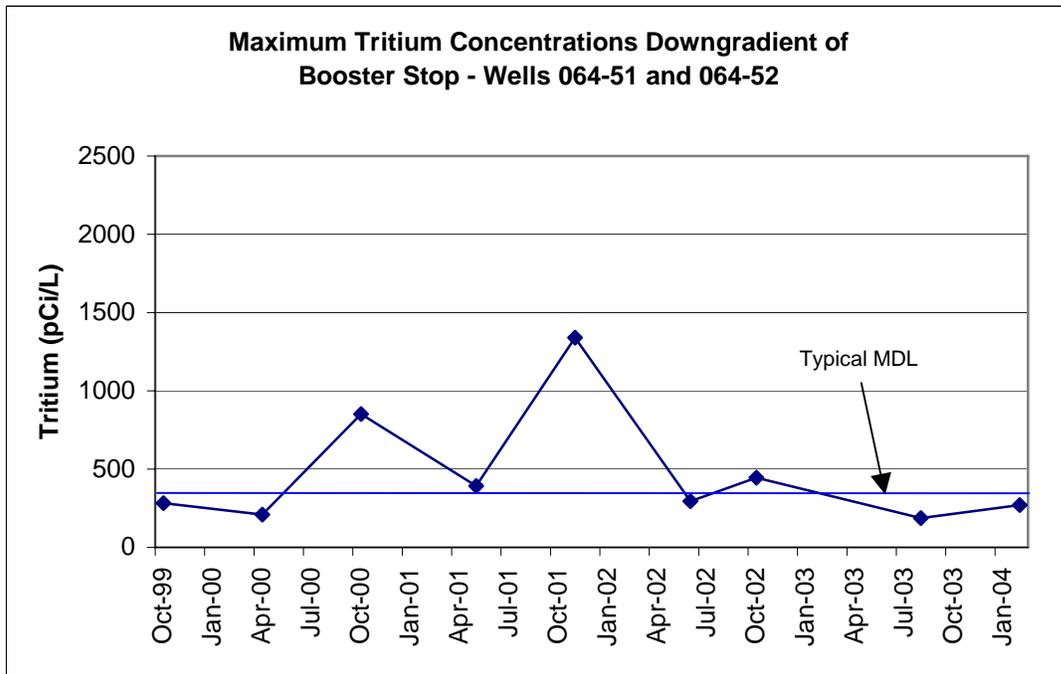


Figure 8: Maximum tritium concentrations observed in monitoring wells 064-51 and 064-52 located downgradient of the Booster Beam Stop.

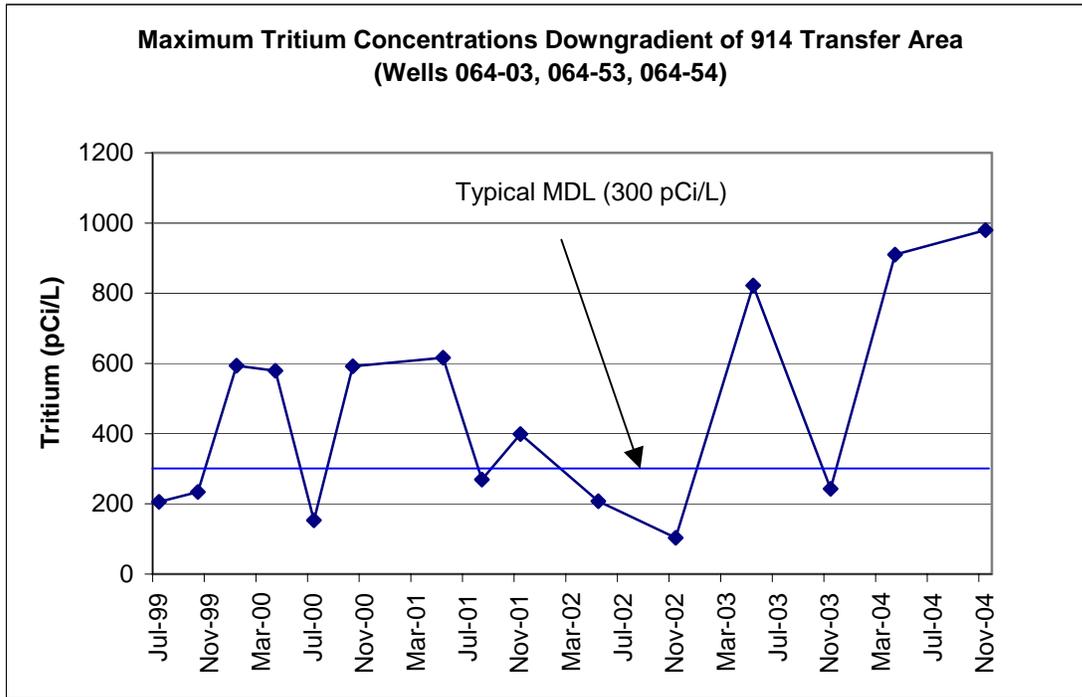


Figure 9: Maximum tritium concentrations observed in monitoring wells 064-03, 064-53 and 064-54 located downgradient of the Building 914 Transfer Tunnel.

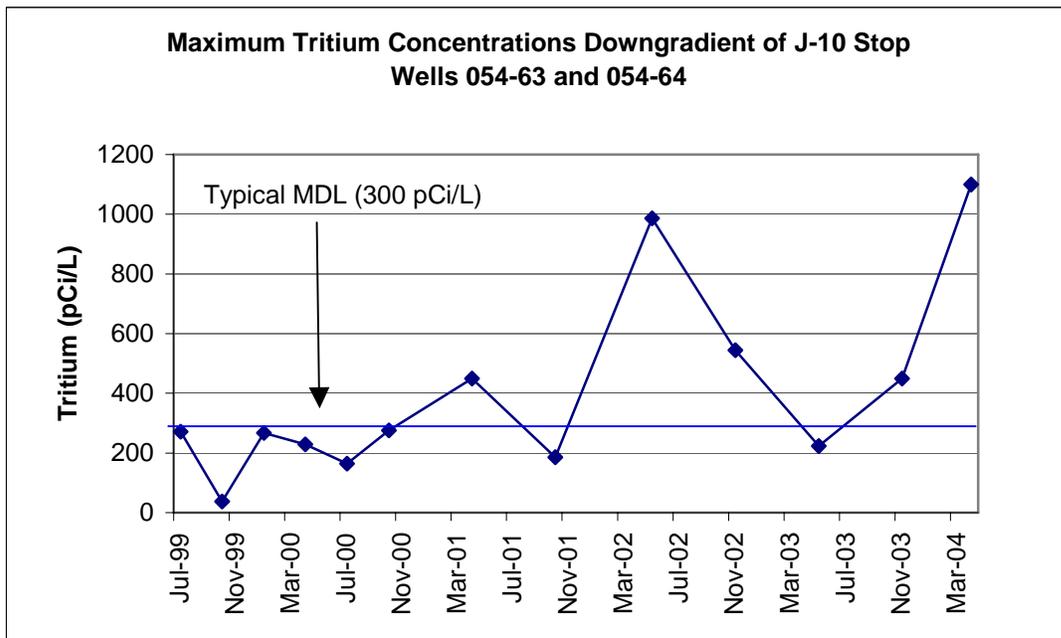


Figure 10: Maximum tritium concentrations observed in monitoring wells 054-63 and 054-64 located downgradient of the J-10 Beam Stop.

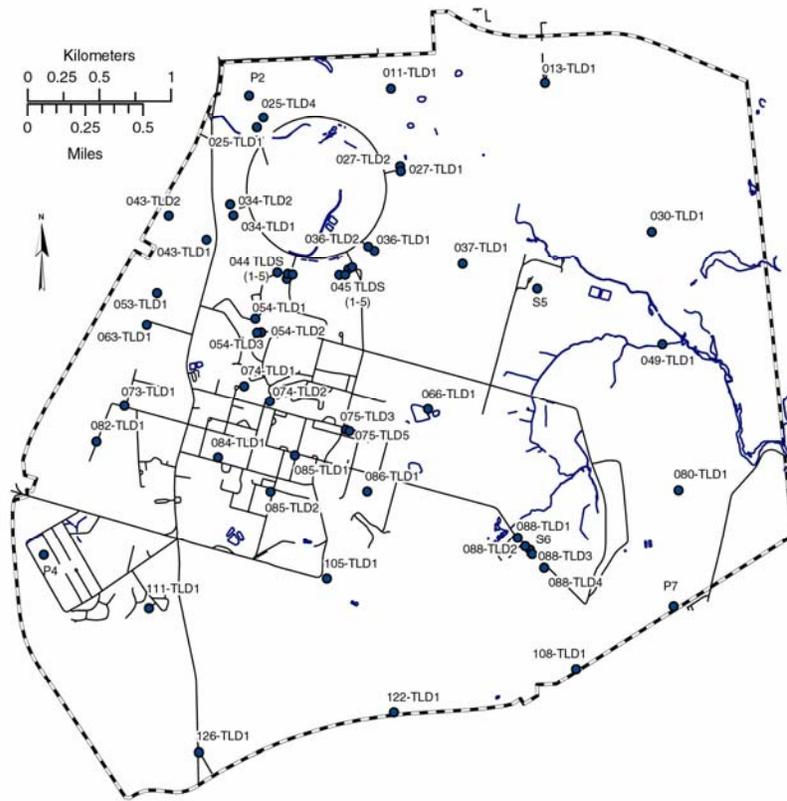


Figure 11: Locations of Environmental TLDs for the BNL Site.

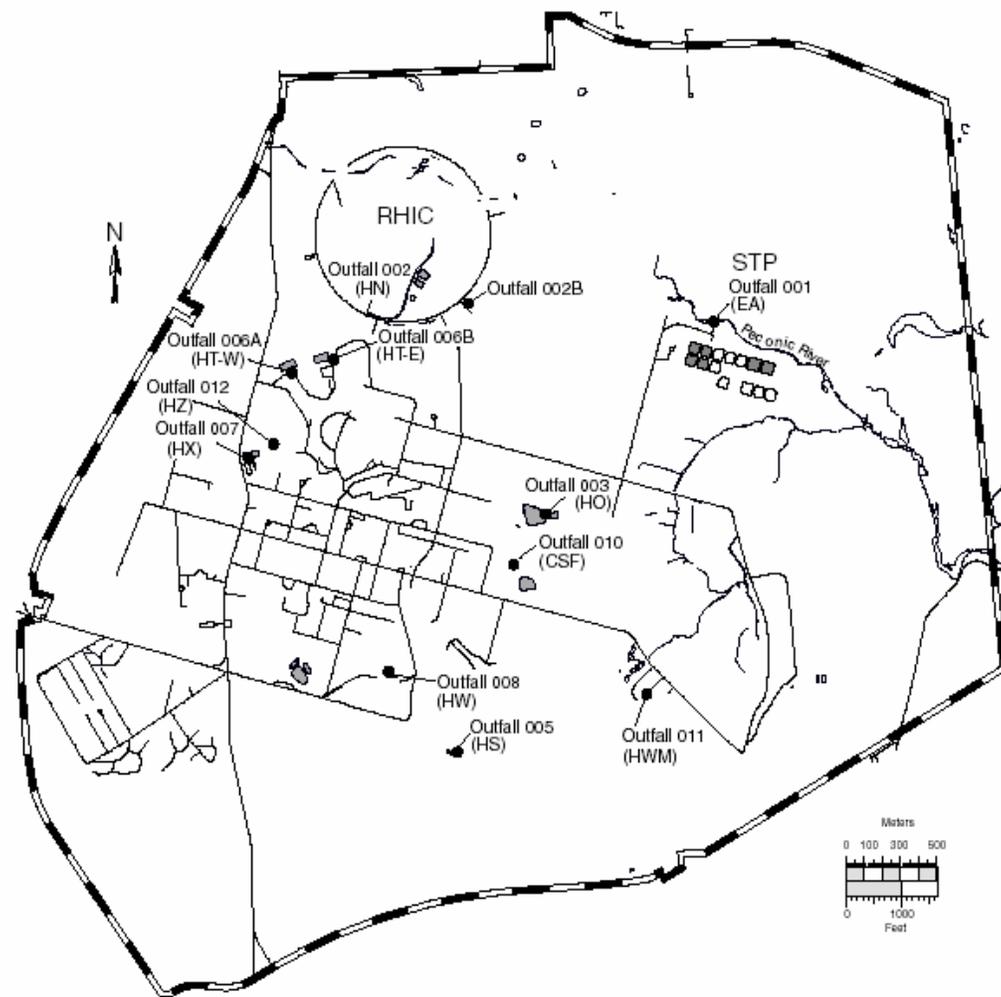


Figure 12: Locations of SPDES-Permitted Outfalls.

Table 1. g-2 Tritium Plume, Summary of Tritium Results for CY 2004.

Location	Well	Screen Depth (feet bls)	January 13-22, 2004	April 6-8, 2004	June 16, 2004	July 20-21, 2004	October 18-26, 2004
<----- pCi/L ----->							
West and South of Building 912A	054-65 (a)	18'-33'	H3= <259	Not Sampled	NS	H3= <310	H3= <210
	054-124	25'-40'	H3= 376 +/- 171	H3= <420	NS	H3= 3,450 +/- 540	H3= 93,200 +/- 9,500
	054-07	30'-40'	H3= 3,200 +/- 285	H3= 380,000 +/- 38,000	H3= 101,000 +/- 10,000	H3= 73,700 +/- 7,600	H3= 6,620 +/- 860
	054-184	35'-45'	H3= 159,000 +/- 3,220	H3= 6,620 +/- 930	NS	H3= 500 +/- 230	H3= 300 +/- 190
	054-185	29'-39'	H3= 154,000 +/- 3,120	H3= 3,560 +/- 620	H3= 930 +/- 370	H3= 450 +/- 220	H3= <270
	064-95	38'-48' (GP well)	H3= 1,500 +/- 360	H3= 2,060 +/- 430	NS	H3= 2,230 +/- 410	H3= 2,650 +/- 460
East of Building 912A	054-126	25'-40'	H3= <258	H3= <450	NS	H3= <310	H3= <270
East of Building 912	065-121	19'-34'	H3= 579 +/- 214	H3= 670 +/- 260	NS	H3= 650 +/- 240	H3= 1,220 +/- 280
	065-193	50'-60'	H3= <312	H3= <320	NS	H3= <290	H3= <210
	065-321	27'-37'	H3= 825 +/- 234	H3= <440	NS	H3= 950 +/- 270	H3= 840 +/- 260
	065-322	27'-37'	H3= 1,930 +/- 308	H3= 2,580 +/- 520	NS	H3= 620 +/- 240	H3= 422 +/- 210

(a): Well located upgradient of VQ-12 Area.

Note 1: Drinking water standard for tritium = 20,000 pCi/L.

Note 2: "<" preceding a number, means that the tritium result was less than the stated detection limit.

Table 1 (Continued): g-2 Tritium Plume, Summary of Tritium Results for CY 2004.

Location	Well	Screen Depth (feet bls)	January 13-22, 2004	April 6-8, 2004	July 20-21, 2004	October 18-26, 2004
			<----- pCi/L ----->			
East of Building 912 (Continued)	065-323	25'-35'	H3= 30,400 +/- 948	H3= 2,640 +/- 520	H3= 4,090 +/- 600	H3= 2,300 +/- 420
	065-324	23'-33'	H3= 64,000 +/- 1,340	H3= 118,000 +/- 12,000	H3= 11,800 +/- 1,400	H3= 550 +/- 230
	065-122	19'-34'	H3= 451,000 +/- 9,070	H3= 166,000 +/- 17,000	H3= 5,970 +/- 800	H3= 1,170 +/- 270
	065-123	18'-33'	H3= 881 +/- 261	H3= 1,510 +/- 410	H3= 45,400 +/- 4,700	H3= 7,470 +/- 940
	065-194	45'-55'	H3= <335	H3= <430	H3= <290	H3= 2,130 +/- 380
	065-124	18'-33'	H3= 529 +/- 235	H3= <430	H3= 2,010 +/- 390	H3= 9,600 +/- 1,200
	065-125	18'-33'	H3= 421 +/- 238	H3= <440	H3= 370 +/- 210	H3= 380 +/- 210
	065-195	45'-55'	H3= 355 +/- 239	H3= <420	H3= <290	H3= <280
	065-126	18.5'-33.5'	H3= <345	H3= <320	H3= <310	H3= 620 +/- 230
	055-31	45'-55'	H3= 681 +/- 191	H3= 680 +/- 260	H3= <310	H3= <280
SW of WCF	065-02	55'-65'	H3= NS	H3= <420	H3= 11,800 +/- 1,400	H3= No Access
	065-173	35'-45'	H3= NS	H3= <420	H3= <300	H3= No Access

Table 2. Alternating Gradient Synchrotron (Building 912) Summary of Tritium Results for CY 2004.

Building/Facility	Well	Screen Depth (feet bls)	January 13-22, 2004	April 6 - May 20, 2004	July 20-21, 2004	October 21-November 9-23, 2004
			<----- pCi/L ----->			
Building 912 Beam Targets and Stops	054-67 (a)	18-33	NS	H3= <310	NS	H3= <260
	054-68 (a)	17-32	NS	H3= <310	NS	H3= <260
	054-69 (b)	17-32	NS	H3= <430	NS	H3= <260
	055-14 (b)	38-42	NS	H3= <310	NS	H3= <260
	055-15	18-33	NS	H3= <250	NS	H3= <260
	055-16	18-33	NS	H3= <250	NS	H3= <260
	055-29	47-57	NS	H3= <250	NS	H3= <260
	055-30	20-35	NS	H3= 260 +/- 170	NS	H3= <220
	055-31	45-55	H3 = 681 +/- 191	H3= 680 +/- 260	H3= <310	H3= <280
	055-32	40-55	NS	H3= 490 +/- 220	NS	H3= <260
	065-120	22-37	NS	H3= 420 +/- 210	NS	H3= 340 +/- 170
	065-121	19-34	H3 = 579 +/- 214	H3= 670 +/- 260	H3= 650 +/- 240	H3= 1,220 +/- 280
	065-122	19-34	H3 = 451,000 +/- 9,070	H3= 166,000 +/- 17,000	H3= 5,970 +/- 800	H3= 1,170 +/- 270
	065-123	18-33	H3= 881 +/- 261	H3= 1,510 +/- 440	H3= 45,400 +/- 4,700	H3= 7,470 +/- 940
	065-124	18-33	H3= 529 +/- 235	H3= <430	H3= 2,010 +/- 390	H3= 9,600 +/- 1,200
	065-125	18-33	H3= 421 +/- 238	H3= <440	H3= 370 +/- 210	H3= 380 +/- 210
	065-126	18-33	H3= <345	H3= <320	H3= <310	H3= 620 +/- 230
	065-192	50-60	NS	H3= <270	NS	H3= 340 +/- 170
	065-193	50-60	H3= <312	H3= <320	H3= <290	H3= <210
	065-194	45-55	H3= <335	H3= <430	H3= <290	H3= 2,130 +/- 380
	065-195	45-55	H3= 355 +/- 239	H3= <240	H3= <290	H3= <280

(a): Upgradient well for monitoring area

NS: Well not sampled during this period

Table 3. Building 914, Former U-Line Target and Beam Stop and g-2 Beam Stop Tritium Results for CY 2004.

Building/Facility	Well	Screen Depth (feet bls)	January 21, 2004	April 29–May 25, 2004	July 21, 2004	October 21–November 9–23, 2004
			<----- pCi/L ----->			
U-Line Target	054-127 (a)	22-37	NS	H3= <330	NS	H3= <269
	054-66	18-33	NS	H3= <310	NS	H3= <260
	054-68	17-32	NS	H3= <310	NS	H3= <260
	054-129	21-36	NS	H3= 2,400 +/- 470	NS	H3= 600 +/- 200
	054-130	22-37	NS	H3= 580 +/- 250	NS	H3= <270
U-Line Stop	054-128	22-37	NS	H3= <270	NS	H3= <260
	054-168	17-32	NS	H3= <260	NS	H3= 1,230 +/- 240
	054-169	17-32	NS	H3= <270	NS	H3= <260
	054-69	17-32	NS	H3= <430	NS	H3= <260
	055-14	38-42	NS	H3= <310	NS	H3= <260
g-2 Beam Stop	054-65 (a)	18-33	H3= <259	H3=	H3 = <310	H3= <210
	054-66 (a)	18-33	NS	H3= <310	NS	H3= <260
	054-67	18-33	NS	H3= <310	NS	H3= <260
	054-68	17-32	NS	H3= <310	NS	H3= <260
	054-125	25-40	NS	H3= <310	NS	H3= <260

(a): Upgradient well for monitoring area

NS: Well not sampled during this period

Note 1: “<” preceding a number, means that the tritium result was less than the stated detection limit.

Table 4. E-20 Catcher, J-10 Stop, Booster Stop, 914 Transfer, and NSRL Stop Tritium Results for CY 2004.

Building/Facility	Well	Screen Depth (feet bls)	February 18, 2004	April 28-May 25, 2004	July 2004	November 10-23, 2004
			<----- pCi/L ----->			
E-20 Beam Catcher	064-55	23-38	NS	H3= 680 +/- 270	NS	H3= 420 +/- 180
	064-56	22-37	NS	H3= <310	NS	H3= <260
	064-80	22-37	NS	H3= 1,490 +/- 370	NS	H3= 390 +/- 180
J-10 Beam Stop	054-62 (a)	18-33	NS	H3= <430	NS	H3= <260
	054-63	42-57	NS	H3= 1,100 +/- 310	NS	H3= <260
	054-64	42-57	NS	H3= 610 +/- 240	NS	H3= 750 +/- 220
Booster Beam Stop	064-51	38-53	H3= <290	No Access	NS	No Access
	064-52	42-57	H3= <310	No Access	NS	No Access
Building 914 (Transfer Line)	054-08 (a)	27-47	NS	No Access	NS	No Access
	064-03	38-58	NS	H3= <140	NS	H3= 340 +/- 180
	064-53	32-47	NS	H3= 910 +/- 280	NS	H3= 980 +/- 260
	064-54	33-48	NS	H3= 350 +/- 210	NS	H3= <260
NSRL	054-08	27-47	NS	No Access	H3=	No Access
	054-191	21-36	NS	H3= <150	NS	H3= <260

(a): Upgradient well for the monitoring area.

NS: Well not sampled during this period

Note: Well 054-08 is an upgradient well for Building 914 and downgradient well for NSRL.

Note 1: “<” preceding a number, means that the tritium result was less than the stated detection limit.

Table 5. Environmental TLD Ambient Dose for CY 2004.

TLD #	Location	1 st Quarter	2 nd Quarter	3 rd Quarter	4 Quarter	Average	Annual Dose
		mRem					
054-TLD1	Bldg. 914	18.1	13.4	13.8	16.5	15 ± 4	62 ± 18
054-TLD2	N/E of Bldg. 913B	45.3	16.5	15.5	52.6	32 ± 38	130 ± 151
054-TLD3	N/W of Bldg.913B	27.2	15.8	14.1	16.5	18 ± 12	74 ± 47
074-TLD1	Bldg. 197	17.4	17.1	17.8	20.0	18 ± 3	72 ± 10
074-TLD2	Bldg. 907	17.4	13.7	15.2	16.5	16 ± 3	63 ± 13