

EXPLORING EARTH'S MYSTERIES
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Alternating Gradient Synchrotron

Facility Environmental Monitoring Report

Calendar Year 2003



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Alternating Gradient Synchrotron Facility Environmental Monitoring Report

Summary of Results

High levels of tritium continue to be detected in groundwater downgradient of the g-2/VQ12 Magnet source area. Tritium concentrations up to 1,040,000 pCi/L were detected in samples collected in January 2003 from a monitoring well located approximately 150 feet downgradient of the source area. Tritium concentrations in this area decreased to 113,000 pCi/L by October 2003. Inspections of the impermeable cap installed over the VQ-12 Magnet area found it to be structurally sound. It is likely that the continued presence of high levels of tritium in groundwater is due to the release of residual tritium from the vadose zone following natural fluctuations in water table position.

Tritium concentrations downgradient of the former E-20 Catcher and former U-Line target 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 new 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 56 ± 16 mrem, 69 ± 19 mrem and 65 ± 27 mrem, respectively. The doses were similar to the site wide average of 64 ± 10 mrem. The reduced dose rates observed at this location can be associated with number of contributing factors such as, the completion of g-2 experiments in April 2001, the relocation of the Booster beam dump, and also to high intensity proton beam not being utilized during this time period.

There was one SPDES permit excursion for hydroxyethylidene-diphosphonic acid at Outfall 006 (HT), which was associated with AGS activities. Upon investigation, the excursion was attributed to a broken valve on a cooling tower chemical feed station. All levels of residual reagent returned to acceptable levels upon repair of the valve.

Environmental Monitoring Program

As required by DOE Order 450.1 (Environmental Protection Program), 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, 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, 2003a). 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 ER program's OU III Central Areas (see the annual *BNL Groundwater Status Report* for details on VOC groundwater contamination in the AGS area).

g-2 Experiment Area

Samples collected during 2003 from wells located approximately 150 feet downgradient of the VQ12 area indicate that tritium continues to be released to the groundwater, but at lower concentrations compared to than those observed in July 2002 when a tritium concentration of 3,440,000 pCi/L was observed in well 054-07. During 2003, tritium concentrations showed a steady decline from a maximum of 1,040,000 pCi/L (well 054-07) in January to 113,000 pCi/L (well 054-185) in October (Table 1). During 2003, 12 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 415,000 pCi/L, which was detected in Geoprobe well GP-20. Figure 3 shows the locations of the Geoprobe wells and the position of the g-2 tritium plume during 2003. The two segments of the plume are representative of two distinct periods of tritium

release (also referred to as slug releases). The leading segment of tritium contamination was released in 1999 prior to the installation of the cap over the VQ12 area, whereas the second slug is related to tritium released in 2001–2002. As discussed below, the 2001–2002 release appears to be related to the flushing of residual tritium from the vadose zone following a significant rise in the local water table.

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. The cap appears to be effective in preventing the infiltration of rainwater into the activated soil-shielding zone. The leading hypothesis at this time is that a natural rise in the water table may have released residual tritium from the unsaturated 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. Water levels in the central BNL area in mid-2000 and mid-2001 were near the highest observed in 49 years of record by the U.S. Geological Survey. 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 4). The groundwater travel time from beneath the source to the monitoring wells is about one year. Additional details on the vadose zone release hypothesis and possible remedial actions are provided in the Engineering Evaluation/Cost Analysis (EE/CA) for the g-2 tritium plume (BNL, 2003b).

Former E-20 Catcher Area

Following the 1999 installation of monitoring wells downgradient of the former E-20 Catcher, tritium and sodium-22 were detected at concentrations of 5,800 pCi/L and 219 pCi/L, respectively. To further evaluate the extent of contamination, four Geoprobe wells were installed in January 2000, and tritium and sodium-22 levels were found to exceed the drinking water standards, 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 2003, the maximum observed tritium concentration was 3,430 pCi/L in well 064-55 (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 2003 was 321 pCi/L in well 054-130 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 two additional permanent wells were installed to provide improved long-term monitoring. During 2001–2003, tritium concentrations in downgradient wells were well below the drinking water standard (Figure 7). During 2003, the maximum observed tritium concentration in wells closest to the target area was 577 pCi/L in well 054-128 (Table 4). Furthermore, low levels of tritium that are probably traceable to the former U-Line target and stop area were detected in upgradient well 055-14 (up to 1,060 pCi/L) and downgradient wells 055-31 and 055-32 (up to 3,510 pCi/L). Tritium detected in the Building 912 area wells is likely to have been released prior to capping the U-Line stop. For example, well 055-14 is located approximately 900 feet downgradient of the U-Line stop, and based upon distance of travel and rate of groundwater flow (~0.5 - 0.75 feet/day), the tritium detected in well 055-14 would have been released from the stop area three to four years ago.

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, groundwater surveillance data for 2003 indicate that appreciable levels of tritium are not being released from potential activated soils located beneath the experimental floor of Building 912. The g-2 tritium plume has been tracked from the VQ-12 magnet source, beneath a portion of Building 912, to an area located just to the southwest of the Waste Concentration Facility (Figure 3). Tritium from this plume was detected downgradient of Building 912 (in wells 065-121, 065-122, 065-123, and 065-124), with a maximum concentration of 476,000 pCi/L in the October sample from well 064-122. Furthermore, low levels of tritium that are probably traceable to the former U-Line target and stop area were detected in upgradient well 055-14 (up to 1,060 pCi/L) and downgradient wells 055-31 and 055-32 (up to 3,510 pCi/L). In areas not impacted by the g-2 tritium plume or former U-Line experimental areas, tritium was either not detectable or was only observed at trace levels.

Booster Beam Stop Area

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 at concentrations above the MDL during 2003 (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

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.

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 2003, the maximum tritium concentration was 822 pCi/L, in a sample from downgradient well 054-54 (Table 4).

J-10 Beam Stop Area

Beam-scraping activities at J-10 began in December 1999. Prior to the start of beam scraping activities at J-10, layers of styrofoam and soil-crete (a concrete soil mixture) controlled rainwater infiltration into soils covering this area of the AGS ring. 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 (up to 987 pCi/L) have been detected in downgradient well 054-64 (Figure 10). During 2003, the maximum tritium concentration was 450 pCi/L (Table 4). Although, low levels (<3 pCi/L) of sodium-22 (but not tritium) had been detected in this area of the AGS Ring even before beam-scraping activities at J-10 began in December 1999, the more recent detection of low levels of tritium suggests that some rainwater may be infiltrating some portions of the activated soils.

NSRL Beam Stop Area

Beam line operations began in 2003. Three wells are used to verify the effectiveness of the cap placed over the NSRL tunnel and beam stop. Tritium was not detected in any of the 2002 and 2003 preoperational samples collected from these wells (Table 4).

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, has shown high dose rates in previous years. For example, during the first quarter of 2001 the dose rate at 054-TLD1 was 543 mrem (Figure 12). To better define the source of these high doses, two additional dosimeters (054-TLD2 and 054-TLD3) were posted in proximity to the AGS shield berm on the east and west side of the building 913B.

During 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 (Table 5). In CY 2003, the ambient dose at the AGS facility was similar to dose measured at other onsite and offsite locations. Statistically, it can be concluded that the ambient dose in the vicinity of AGS was in the realm of the natural background. The average ambient dose recorded on-site was 64 ± 10 mrem. The reduced dose rates in comparison to previous years observed at this location can be associated with a number of contributing factors such as, g-2 experiments were completed before April 2001, recent relocation of the Booster dump, and also likely due

to high intensity proton beam not utilized during this period. A comparison of dose rates and beam line operations suggests that when the Booster is in operation, the dose rate in the vicinity of 054-TLD1 vary from 62 to 100 mrem in a quarter.

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. The Bldg. 902 cooling tower discharge 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 experimental 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 2003, these outfalls were monitored for flow and pH on a weekly basis, and oil and grease on a monthly basis. The outfalls were also monitored for volatile organic compounds and cooling tower treatment reagent residuals, as required for each outfall.

During CY 2003 there was one SPDES permit excursion for hydroxyethylidene-diphosphonic acid at Outfall 006B (HT-E). Upon investigation, the excursion was attributed to a broken chemical feed valve used to administer corrosion control chemicals to a cooling tower. Upon discovery the valve was repaired and all residual chemical concentrations returned to acceptable levels. There were no other SPDES violations observed for the AGS discharges throughout 2003.

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)

During 2003, gross alpha and beta activity was detected in the discharges to Basin HN at concentrations ranging from below the method detection limit (MDL) to a maximum of 15.8 pCi/L for gross alpha and 2.02 to 13.4 pCi/L for gross beta. Tritium was detected in a single sample at a concentration of 323 pCi/L. There were no gamma emitting nuclides detected attributable to BNL operations, only natural products (principally K-40) were detected. Detections of alpha and beta activity are attributed to natural products, not BNL operations.

Although aluminum and iron have been detected above the NYSDEC effluent limit in the past, only iron was detected above discharge standards in 2003. The maximum concentration of 1.1 mg/L is attributable to native sediment carried by stormwater runoff or corrosion products associated with the piping for the cooling system. Selenium was also detected in a single sample at concentrations exceeding discharge standards, however, due to matrix interferences in the analytical laboratory, it's not considered a result of operations.

Low levels of trihalomethanes were sporadically detected in the discharges to Outfall 002. 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 in the analytical lab.

Outfall 003 (HO)

During 2003, no radionuclides related to Laboratory operations were detected in the discharges to Outfall HO. All gross alpha and beta concentrations were below the MDL, tritium was not detected in any of the samples, and there were no gamma-emitting radionuclides observed outside of natural products.

Analyses for metals and water chemistry parameters did not find any parameters above the NYS effluent standards with most 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 in the analytical lab.

Outfall 006A (HT-W)

During 2003, only very low levels of gross alpha activity were detected in the discharges to Outfall 006A. All gross beta and tritium concentrations were below the MDL. There were no gamma emitting nuclides detected attributable to BNL operations, only natural products (principally K-40) were detected. Detections of alpha activity are attributed to natural products, not BNL operations.

There were no metals detected in the discharges to this outfall at levels exceeding the NYS effluent standard. While low levels of some metals are detected, such as aluminum,

iron, copper, silver and zinc, they are in particulate form as evidenced by their absence or significantly lower concentrations in filtered samples. Particulates that settle in the basin do not pose a risk to groundwater. Sources of particulates include corrosion products associated with the cooling system piping or native sediments carried by stormwater runoff. Low levels of trihalomethanes were sporadically detected in the discharges to Outfall 003, 002, 006A and 006B. 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 in the analytical lab.

Outfall 006B (HT-E)

During 2003, no radionuclides related to BNL operations were detected in the discharges to basin HT-E. The majority of the gross alpha and beta concentrations were below the MDL. The maximum alpha concentration was 1.8 pCi/L, and the maximum beta concentration was 6.4 pCi/L. Tritium was not detected in any of the samples, and only naturally occurring gamma-emitting radionuclides were observed.

Although aluminum and iron have been detected above the NYSDEC effluent limit in the past, levels for both metals were well within the limits during 2003 sampling. As with other discharges to recharge basins, low levels of metals are present but are in particulate form, which ultimately settle in the basin and do not pose risk to groundwater quality. Their presence are related to native sediment carried by stormwater runoff or to corrosion products associated with the cooling system piping.

Low levels of trihalomethanes were sporadically detected in the discharges to Outfall 003, 002, 006A and 006B. 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 in the analytical lab.

Outfall 012 (HZ)

Discharge to the outfall began in late 2002. This 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 receives principally stormwater runoff from the 902 area and some nominal once through cooling water. Low levels of gross alpha and beta activity were detected in this discharge, which are attributed to natural products and not BNL operations. There was no tritium or gamma-emitting nuclides detected in this discharge.

As with other recharge basin discharges low levels of metallic elements are detectable in this discharge but at levels less than NYS effluent standards. With regard to organic compounds only low levels of trihalomethanes were detected which are attributed to potable water disinfection.

Future Actions

The following actions are either in progress or need to be completed:

- Work with regulatory agencies to determine remediation strategy for the g-2 tritium plume.
- Continue quarterly monitoring of wells used to track the g-2 tritium plume.
- 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.
- Continue to perform quarterly monitoring of all recharge basins as part of the SPDES compliance and Environmental Surveillance Program.

References

BNL. 2003a. *Brookhaven National Laboratory Environmental Monitoring Plan, Triennial*. BNL-52676. Brookhaven National Laboratory, Upton, NY. January 2003.

BNL. 2003b. *g-2 Tritium Plume – AOC 16T. Engineering Evaluation/Cost Analysis*. Brookhaven National Laboratory, Upton, NY. December 2003.

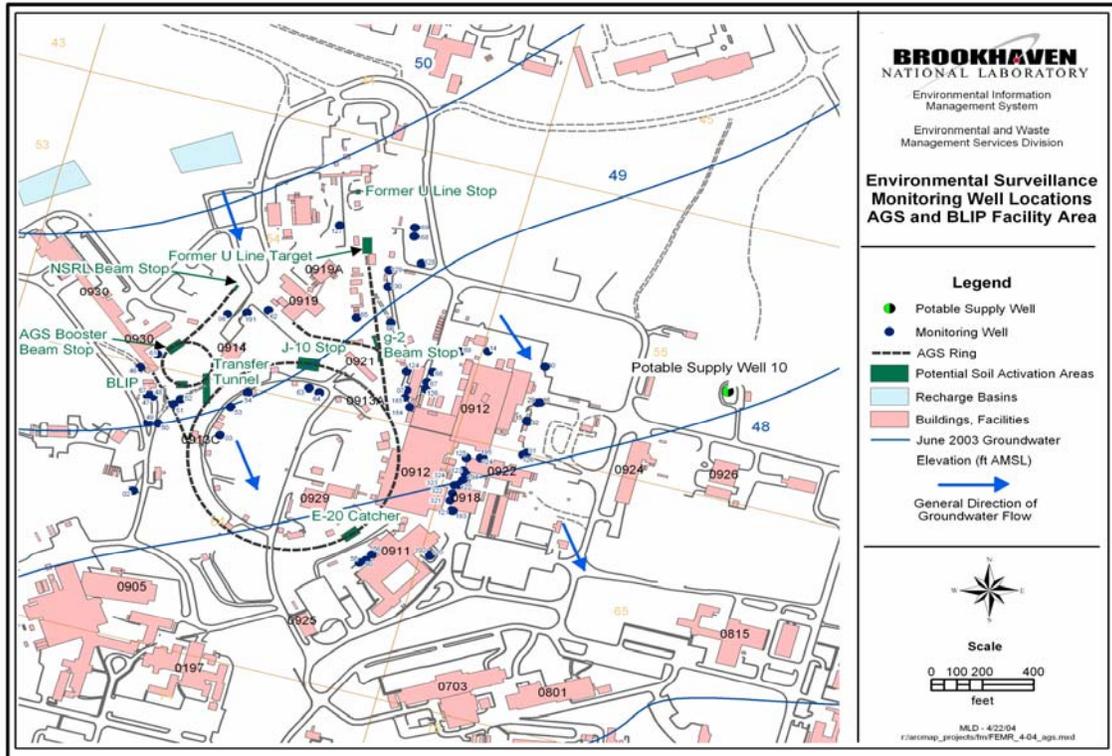


Figure 1. Locations of Groundwater Monitoring Wells in the AGS Area.

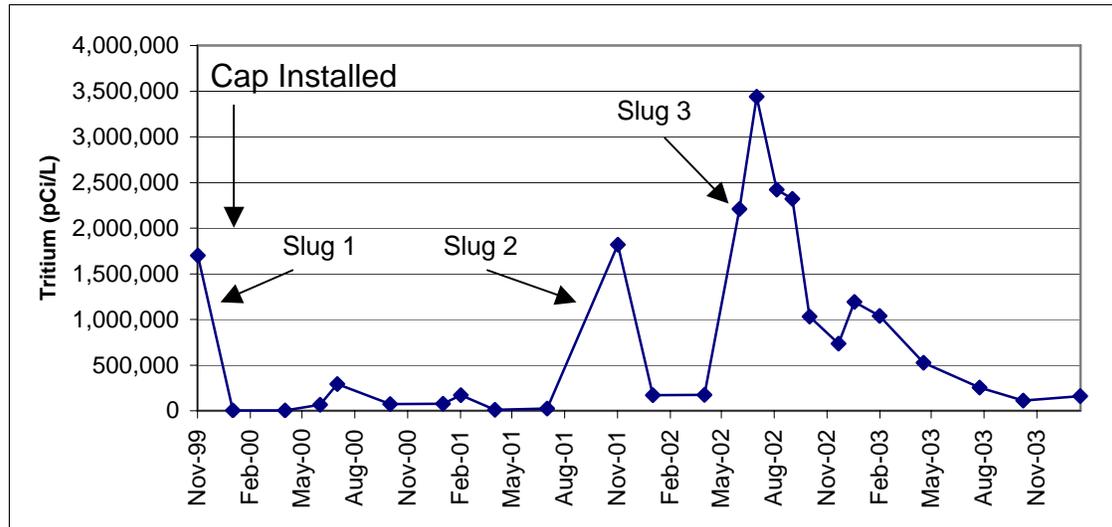


Figure 2. Maximum Tritium Concentrations Observed in Temporary and Permanent Monitoring Wells 1999-2003. These wells are approximately 150 feet downgradient of the VQ12 source area.

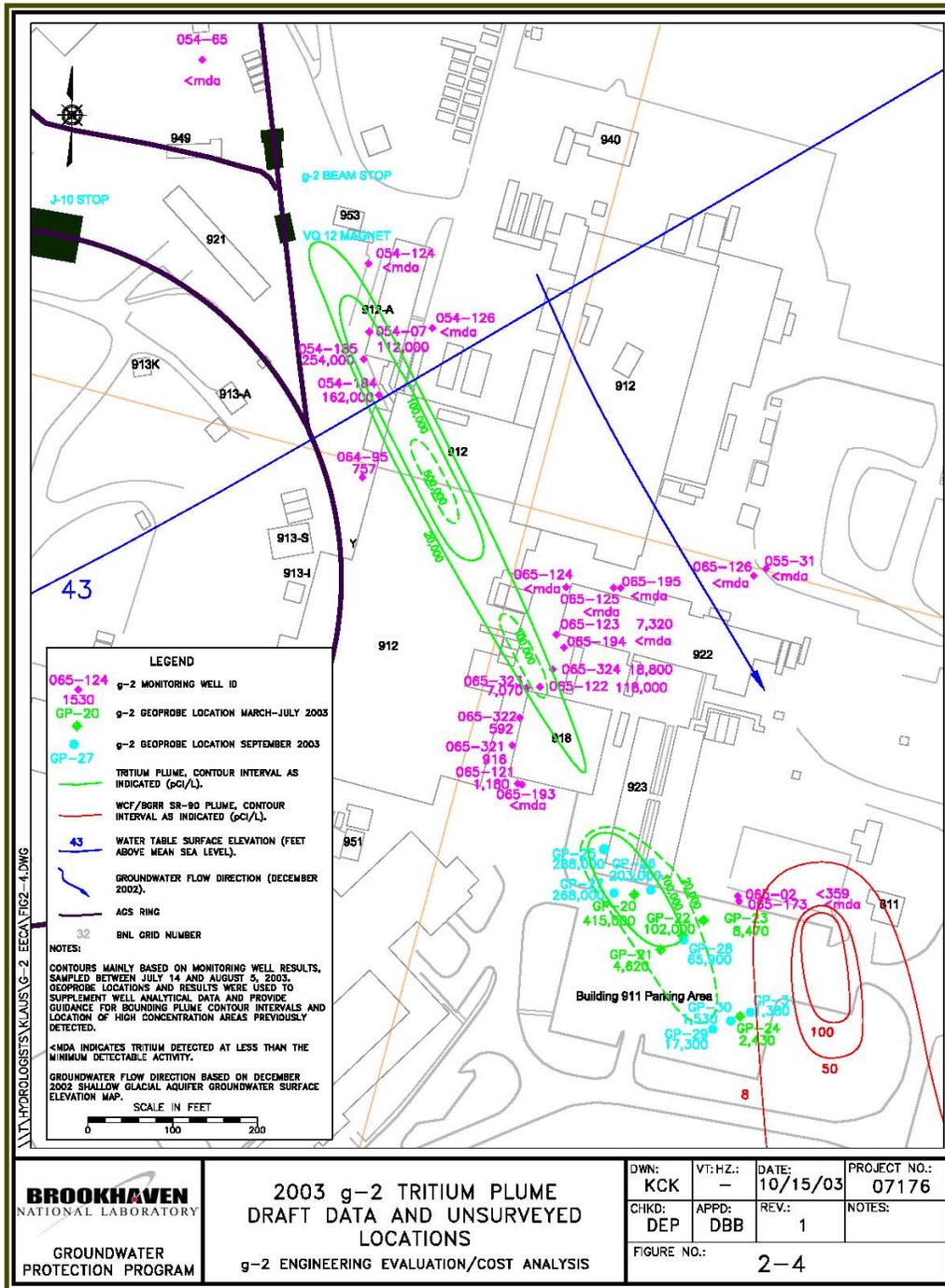


Figure 3: Extent of g-2 tritium plume. Note that the g-2 tritium plume distribution is based upon a combination of monitoring data from permanent wells and temporary wells.

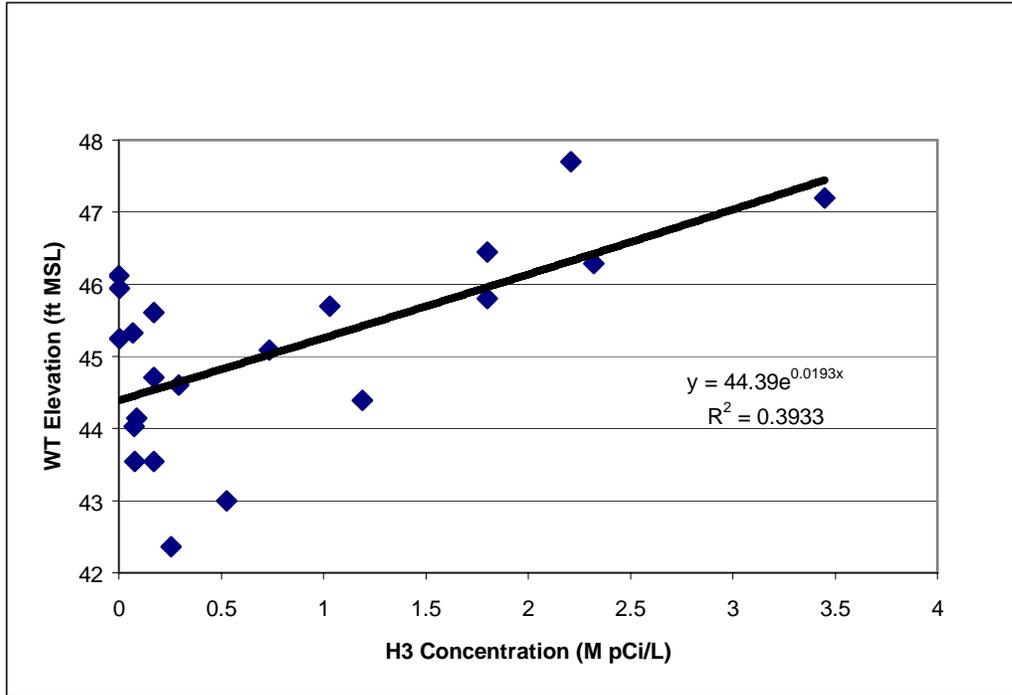


Figure 4. This figure illustrates the water table elevation in the g-2 area (left axis) and the tritium concentrations detected in monitoring wells one year later.

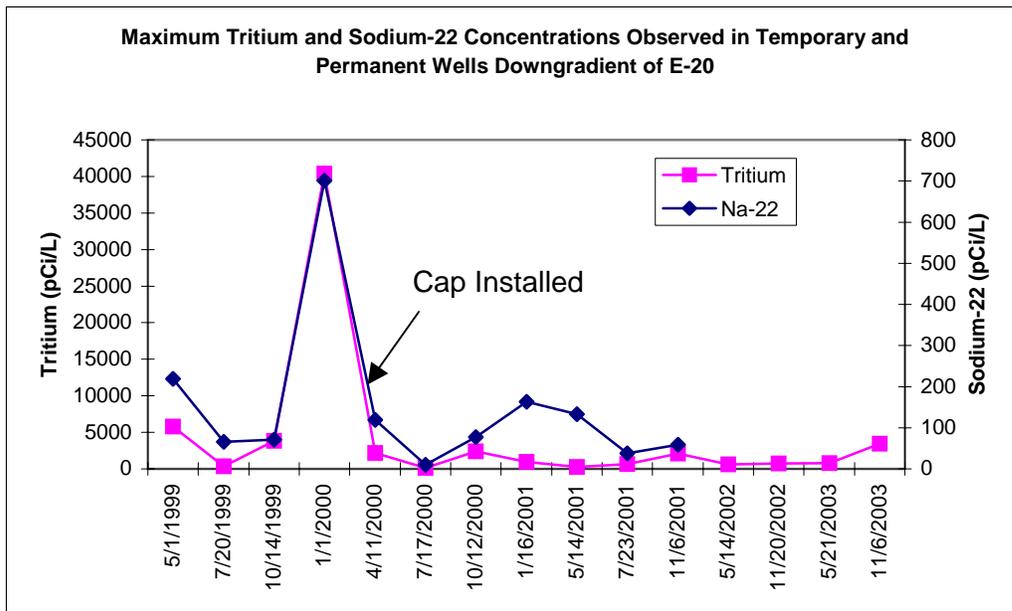


Figure 5. Maximum tritium and sodium-22 concentrations observed in temporary and permanent monitoring wells located approximately 100 feet downgradient of the former E-20 Catcher.

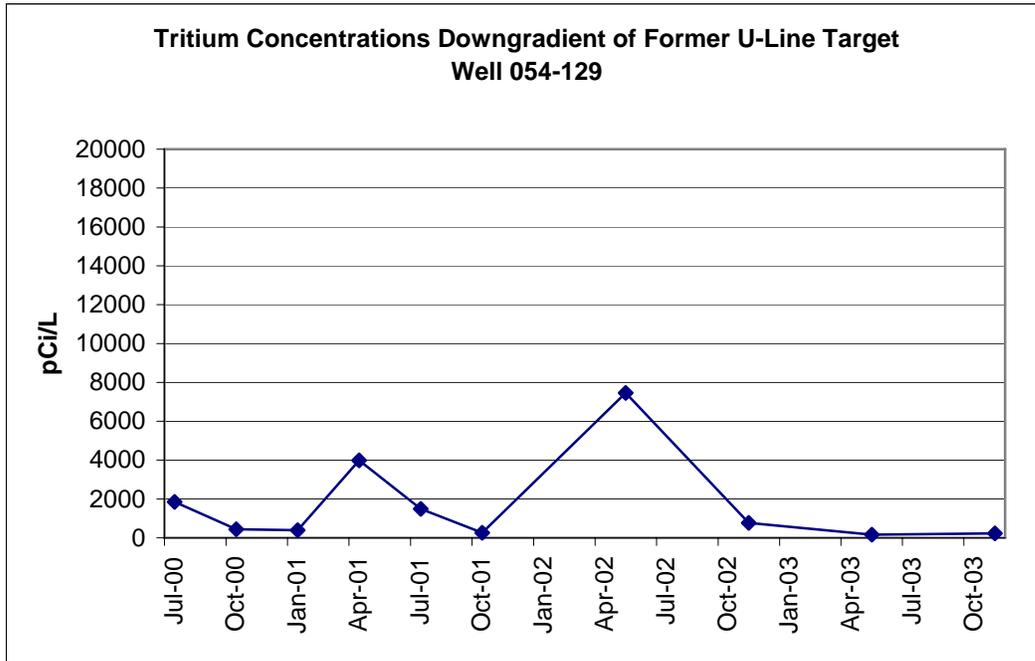


Figure 6: Maximum tritium concentrations observed in monitoring well 054-129 located downgradient of the former U-Line Target.

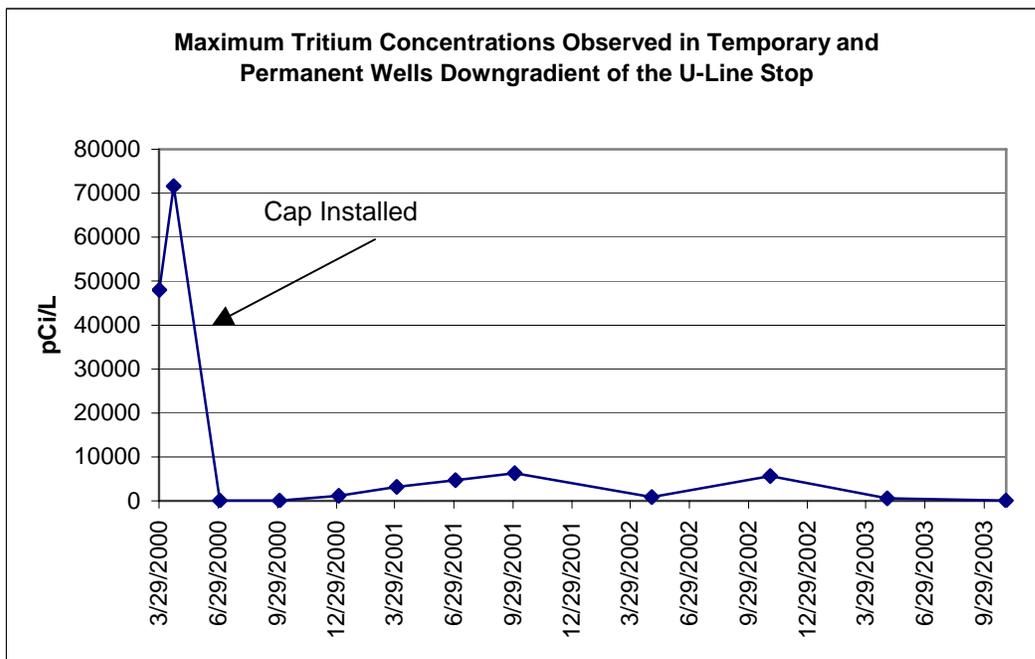


Figure 7. Maximum tritium concentrations observed in temporary and permanent monitoring wells located downgradient of the former U-Line Stop.

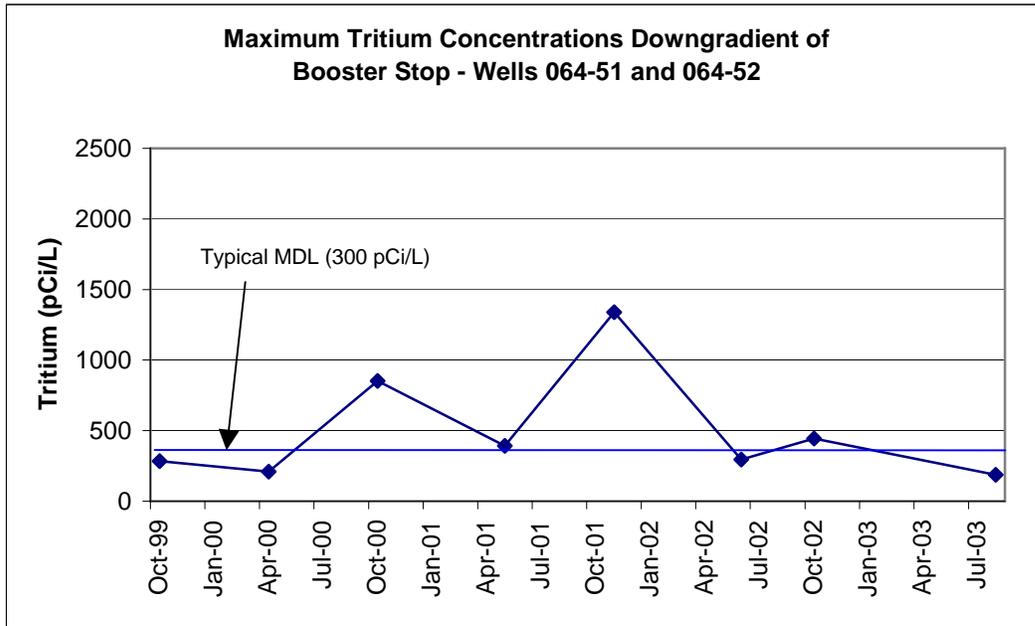


Figure 8: Maximum tritium concentrations observed in monitoring wells 064-51 and 064-52 located downgradient of the Booster Beam Stop.

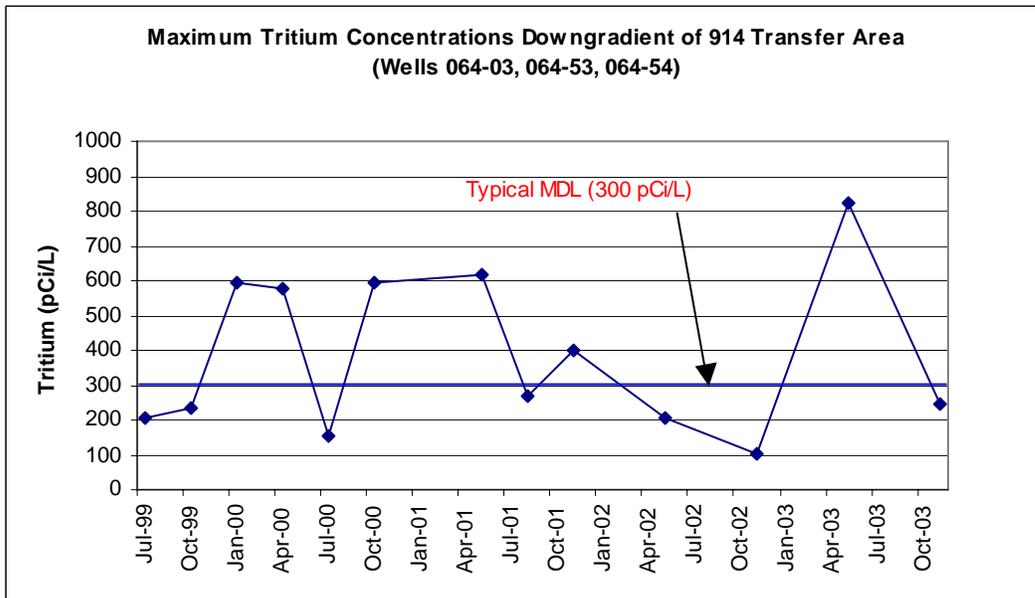


Figure 9: Maximum tritium concentrations observed in monitoring wells 064-03, 064-53 and 064-54 located downgradient of the Building 914 Transfer Tunnel.

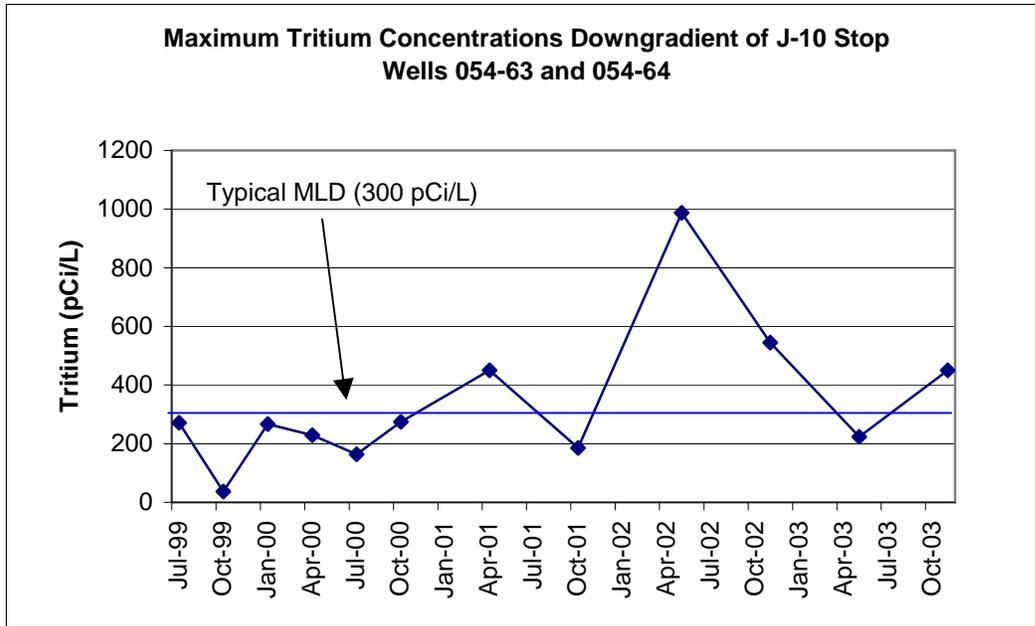


Figure 10: Maximum tritium concentrations observed in monitoring wells 054-63 and 054-64 located downgradient of the J-10 Beam Stop.

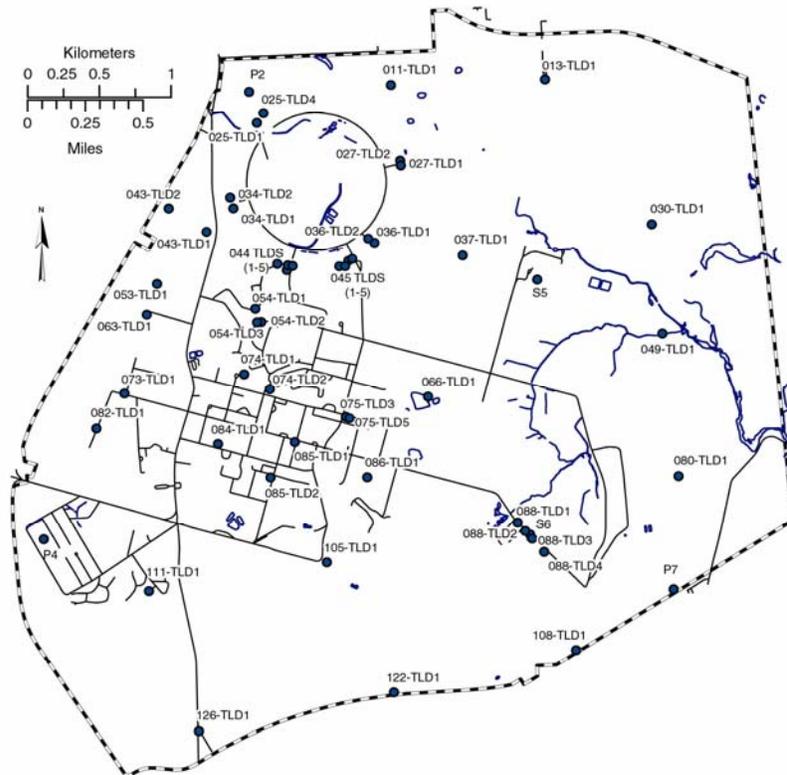


Figure 11: Locations of Environmental TLDs for the BNL Site.

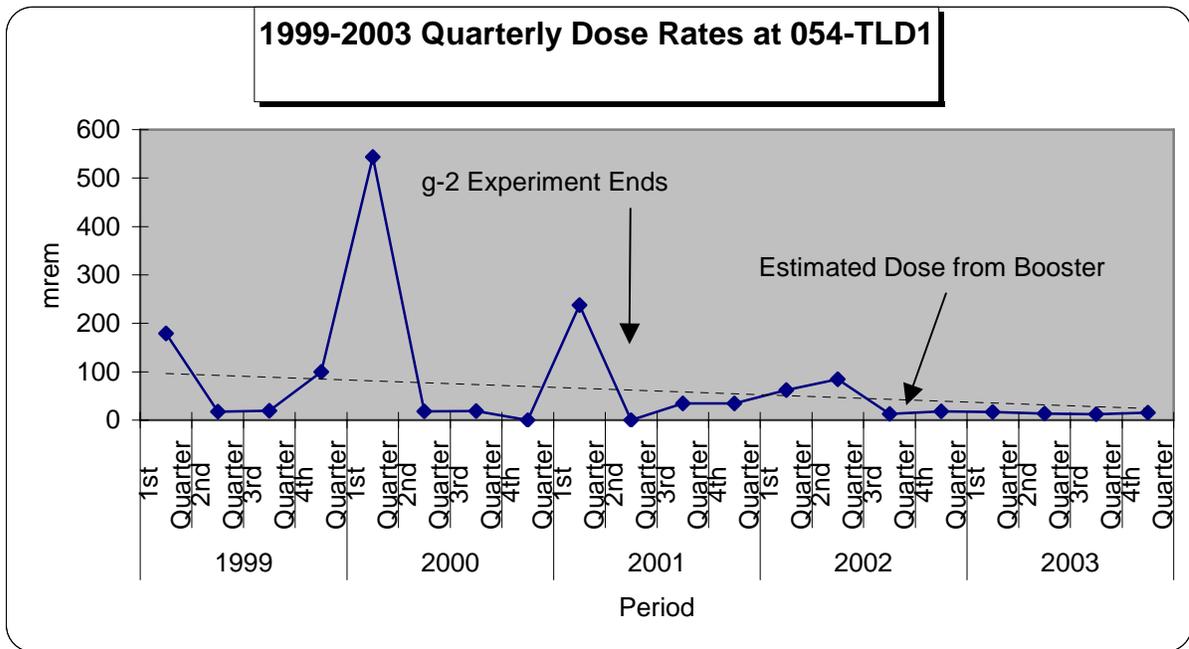


Figure 12: Plot of dose rates measured at 054-TLD1.

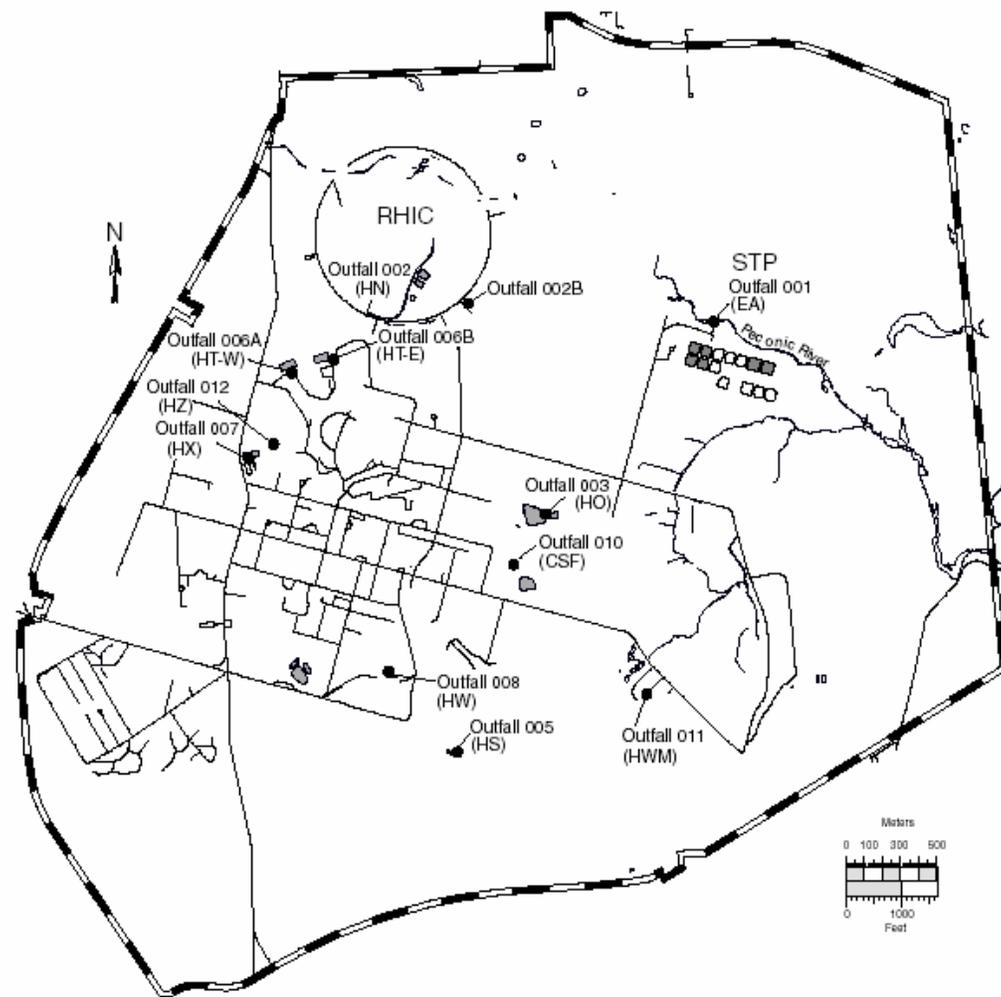


Figure 13: Locations of SPDES-Permitted Outfalls.

Table 1. g-2 Tritium Plume, Summary of Tritium Results for CY 2003.

Location	Well	Screen Depth (bls)	January 18-21, 2003	April 16-22, 2003	July 14-24, 2003	October 6-8, 2003
<----- pCi/L ----->						
West and South of Building 912A	054-65 (a)	18'-33'	H3= <382	H3= <275	H3= <295	H3= <352
	054-124	25'-40'	H3= 923 +/- 281	H3= <339	H3= <357	H3= <294
	054-07	30'-40'	H3= 1,040,000 +/- 21,000	H3= 82,800 +/- 1,690	H3= 112,000 +/- 2,260	H3= 27,500 +/- 793
	054-184	35'-45'	H3= 3,160 +/- 382	H3= 490,000 +/- 9,890	H3= 162,000 +/- 3,270	H3= 102,000 +/- 2,070
	054-185	29'-39'	H3= 3,370 +/- 388	H3= 525,000 +/- 10,600	H3= 254,000 +/- 5,130	H3= 113,000 +/- 2,290
	064-95	38'-48' (GP well)	H3= 1,270 +/- 300	H3= 865 +/- 234	H3= 757 +/- 265	H3= 415 +/- 256
East of Building 912A	054-126	25'-40'	H3= <382	H3= <339	H3= <295	H3= <295
East of Building 912	065-121	19'-34'	H3= 938 +/- 255	H3= 2,000 +/- 287	H3= 1,180 +/- 261	H3= 1,460 +/- 315
	065-193	50'-60'	H3= <331	H3= <273	H3= <304	H3= <343
	065-321 (MW-4)	27'-37'	H3= 1,650 +/- 273	H3= 869 +/- 240	H3= 916 +/- 251	H3= 900 +/- 289
	065-322 (MW-5)	27'-37'	H3= 1,100 +/- 252	H3= 936 +/- 245	H3= 592 +/- 269	H3= 1,140 +/- 303

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

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

Note 2: Drinking water standard for tritium = 20,000 pCi/L; for sodium-22 = 400 pCi/L.

Table 1 (Continued): g-2 Tritium Plume, Summary of Tritium Results for CY 2003.

Location	Well	Screen Depth (bls)	January 18-21, 2003	April 16-22, 2003	July 14 – 24, 2003	October 6-8, 2003
<-----pCi/L----->						
East of Building 912 (Continued)	065-323 (MW-6)	25'-35'	H3= 1,830 +/- 279	H3= 2,670 +/- 313	H3= 7,070 +/- 509	H3= 8,640 +/- 567
	065-324 (MW-7)	23'-33'	H3= 4,200 +/- 358	H3= 29,700 +/- 795	H3= 18,800 +/- 781	H3= 22,600 +/- 864
	065-122	19'-34'	H3= 40,100 +/- 936	H3= 171,000 +/- 3,450	H3= 118,000 +/- 2,380	H3= 476,000 +/- 9,600
	065-123	18'-33'	H3= 4,950 +/- 382	H3= 4,080 +/- 336	H3= 7,320 +/- 516	H3= 1,230 +/- 308
	065-194	45'-55'	H3= <331	H3= <250	H3= <356	H3= <353
	065-124	18'-33'	H3= 1,920 +/- 285	H3= 422 +/- 196	H3= <358	H3= <353
	065-125	18'-33'	H3= 457 +/- 228	H3= <250	H3= <295	H3= 734 +/- 282
	065-195	45'-55'	H3= 461 +/- 234	H3= 320 +/- 194	H3= <295	H3= <356
	065-126	18.5'-33.5'	H3= <331	H3= <339	H3= <302	H3= <342
	055-31	45'-55'	H3= 380 +/- 232	H3= <339	H3= <301	H3= 431 +/- 259
SW of WCF	065-02	55'-65'	H3= <382	H3= 361 +/- 207	H3= <302	H3= 514 +/- 256
	065-173	35'-45'	H3= <382	H3= <275	H3= <303	H3= <339

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

Note 2: Drinking water standard for tritium = 20,000 pCi/L; for sodium-22 = 400 pCi/L.

Table 2. Alternating Gradient Synchrotron (Building 912) Summary of Tritium Results for CY 2003.

Building/Facility	Well	January 2003	April- May 2003	July 2003	October-November 2003
<----- pCi/L ----->					
Building 912 Beam Targets and Stops	054-67 (a)	NS	H3= <273	NS	H3= <366
	054-68 (a)	NS	H3= <291	NS	H3= <365
	054-69 (b)	NS	H3= <290	NS	H3= <360
	055-14 (b)	NS	H3= 1,060 +/- 273	NS	H3= 453 +/- 244
	055-15	NS	H3= <326	NS	H3= 586 +/- 233
	055-16	NS	H3= <326	NS	H3= <356
	055-29	NS	H3= <326	NS	H3= <358
	055-30	NS	H3= <290	NS	H3= <356
	055-31	H3 = 380 +/- 232	H3= <339	<301	H3= 431 +/- 259
	055-32	NS	H3= 437 +/- 242	NS	H3= 3,510 +/- 363
	065-120	NS	H3= <292	NS	H3= <361
	065-121	H3 = 938 +/- 255	H3= 2,000 +/- 287	1,180 +/- 261	H3= 1,460 +/- 315
	065-122	H3 = 40,100 +/- 936	H3= 171,000 +/- 3,450	118,000 +/- 2,380	H3= 476,000 +/- 9,600
	065-123	4,950 +/- 382	H3= 4,080 +/- 336	7,320 +/- 516	H3= 1,230 +/- 308
	065-124	1,920 +/- 285	H3= 422 +/- 196	<358	H3= <353
	065-125	461 +/- 234	H3= <250	<295	H3= 734 +/- 282
	065-126	NS	H3= <339	<302	H3= <342
	065-192	NS	H3= <291	NS	H3= <358
	065-193	<331	H3= <273	<304	H3= <343
	065-194	<331	H3= <250	<356	H3= <353
	065-195	NS	H3= <250	<295	H3= <356

(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 3. Building 914, Former U-Line Target and Beam Stop and g-2 Beam Stop Tritium Results for CY 2003.

Building/Facility	Well	January 2003	April –May 2003	July 2003	October-November 2003
<----- pCi/L ----->					
U-Line Target	054-127 (a)	NS	H3= <334	NS	H3= <369
	054-66	NS	H3= <334	NS	H3= <359
	054-68	NS	H3= <291	NS	H3= <365
	054-129	NS	H3= <277	NS	H3= <281
	054-130	NS	H3= 321 +/- 190	NS	H3= <284
U-Line Stop	054-128	NS	H3= 577 +/- 202	NS	H3= <287
	054-168	NS	H3= <276	NS	H3= <290
	054-169	NS	H3= <273	NS	H3= <285
	054-69	NS	H3= <290	NS	H3= <360
	055-14	NS	H3= 1,060 +/- 273	NS	H3= 453 +/- 244
g-2 Beam Stop	054-65 (a)	<382	H3= <275	H3 = <295	H3= <352
	054-66	NS	H3= <334	NS	H3= <359
	054-67	NS	H3= <273	NS	H3= <366
	054-68	NS	H3= <291	NS	H3= <365
	054-125	NS	H3= <273	NS	H3= <369

(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 2003.

Building/Facility	Well	January 2003	April-May 2003	July 2003	October-November 2003
<----- pCi/L ----->					
E-20 Beam Catcher	064-55	NS	H3= 472 +/- 251	NS	H3= 3,430 +/- 379
	064-56	NS	H3= 404 +/- 250	NS	H3= 877 +/- 271
	064-80	NS	H3= 766 +/- 265	NS	H3= <357
J-10 Beam Stop	054-62 (a)	NS	H3= <290	NS	H3= <343
	054-63	NS	H3= <290	NS	H3= <355
	054-64	NS	H3= <317	NS	H3= 450 +/- 246
Booster Beam Stop	064-51	NS	No Access	H3 = <287	No Access
	064-52	NS	No Access	H3 = <289	No Access
Building 914 (Transfer Line)	054-08 (a)	NS	No Access	H3= <286 (Sampled 8/5)	H3= <298
	064-03	NS	H3= <290	NS	H3= <364
	064-53	NS	H3= <290	NS	H3= <363
	064-54	NS	H3= 822 +/- 244	NS	H3= <357
NSRL	054-08	NS	No Access	H3= <286 (sampled 8/5)	No Access
	054-191	NS	H3= <292	NS	H3= <342

(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 2003.

TLD #	Location	1 st Quarter	2 nd Quarter	3 rd Quarter	4 Quarter	Average	Annual Dose
Mrem							
054-TLD1	Bldg. 914	17.2	13.7	12.5	15.7	15 ± 4	59 ± 16
054-TLD2	N/E of Bldg. 913B	16.5	16.0	15.6	20.7	17 ± 5	69 ± 19
054-TLD3	N/W of Bldg.913B	15.1	15.4	13.2	21.3	16 ± 7	65 ± 27
074-TLD1	Bldg. 197	19.1	17.4	15.1	17.9	17 ± 3	70 ± 13
074-TLD2	Bldg. 907	16.6	15.6	15.6	16.5	16 ± 1	64 ± 4