EXPLORING EARTH'S MYSTERIES
...PROTECTING ITS FUTURE

Brookhaven National Laboratory
Alternating Gradient Synchrotron Facility

Facility Environmental Monitoring Report

Calendar Year 2001

BROOKHAVEN
NATIONAL LABORATORY

April 23, 2002

Prepared by:
D. Paquette, B. Hooda, R. Lee and M. Allocco
Environmental Services Division

GW61ER.02

AGS Facility Environmental Monitoring Report
Calendar Year 2001

Summary of Results: *High levels of tritium continue to be detected in groundwater downgradient of the g-2/VQ12 Magnet area. Tritium concentrations up to 1,820,000 pCi/L were detected in samples collected in November 2001 from temporary wells installed approximately 100 feet downgradient of the activated soil shielding. Following this finding, the impermeable cap that was installed over the VQ-12 Magnet area in December 1999 was inspected and was found 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 a natural rise in water table position that occurred during 2000.*

Groundwater monitoring during 2001 indicates that tritium concentrations downgradient of the former E-20 Catcher and former U-Line target have dropped to below the 20,000 pCi/L drinking water standard, indicating that the impermeable caps have been effective in preventing additional residual activation from entering the groundwater. Groundwater monitoring results for other soil activation areas such as the Booster Beam Stop, Building 914, Building 912 and the J-10 stop indicate only low to non-detectable levels of tritium and sodium-22.

The environmental TLD 054-400, located at Bldg. 914 (near the new BAF facility) showed elevated dose rate in the first quarter. The TLD measurements indicated a 237 mrem dose rate for the first quarter. Second quarter TLD was not recovered for reading, however, the third and fourth quarter TLD showed dose of 35 mrem for each quarter. The high readings may be attributed to the sky-shine phenomenon during the operation of the g-2 experiment, which ran during the first quarter of 2001.

During CY 2001, there were three apparent SPDES permit excursions for hydroxyethylidene-diphosphonic acid (HEDP) at outfalls contributed to by AGS discharges. However, due to anomalies in the analytical data, and subsequent comparison with split sample results from a second contractor laboratory, the detection of HEDP could not be verified.

Environmental Monitoring Program

As required by DOE Order 5400.1, BNL has established an environmental monitoring program at the Alternating Gradient Synchrotron (AGS) facility to evaluate potential

impacts to environmental quality from its operation, and to demonstrate compliance with DOE requirements and applicable federal, state and local laws and regulations.

Operations at the AGS facility have the potential to impact soil and groundwater quality. The primary environmental concern is beam line interaction with the AGS's beam stops and targets. Secondary particles created in these areas may interact with the soil shielding surrounding these areas. These interactions can result in the production of tritium and sodium-22, which could be leached out of the soils by rainwater. In addition, various routine cooling water, floor drain, and stormwater discharges from the AGS complex have the potential to impact surface water quality via discharge to the BNL sewage treatment plant. In addition, discharges from once through cooling water systems and cooling towers have the potential to impact groundwater quality via recharge basins.

The environmental monitoring program for the AGS area is described in the BNL Environmental Monitoring Plan (Daum *et al*. 2000; BNL, 2000). These monitoring programs are summarized below.

Monitoring Results

Groundwater Program

Activated soils have been created near a number of AGS experimental areas as the result of secondary particles (primarily neutrons) produced at beam targets and beam stops. Radionuclides, such as tritium and sodium-22, have been produced by the interaction of these secondary particles with the soils that surround these experimental areas. Between January 1999 and January 2000, BNL installed 51 permanent and 31 temporary groundwater monitoring wells to evaluate the impact of current and historical operations at the AGS's beam stop and target areas. The locations of permanent 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 annual BNL Site Environmental Report for details on VOC groundwater contamination in the AGS area).

g-2 Experiment Area: In November 1999, monitoring wells located approximately 250 feet downgradient of the g-2 experimental area detected the presence of a tritium and sodium-22 plume originating from activated soil shielding. A sample from Well 054-067 collected in October 1999 had a tritium concentration of 41,700 pCi/L (approximately twice the drinking water standard of 20,000 pCi/L). A groundwater investigation conducted during November-December 1999 revealed a narrow plume of approximately 20-30 feet wide and 250-300 feet long. The maximum radionuclide concentrations were detected in temporary Well 054-116, located approximately 70 feet downgradient of the

g-2 beam line, with a tritium concentration of 1,800,000 pCi/L and sodium-22 concentration of 60 pCi/L (or 15% of the 400 pCi/L drinking water standard).

Following the discovery, an investigation into the source of the contamination revealed that the tritium originated from activated soil shielding located adjacent to the g-2 Experiment's VQ-12 Magnet. In December 1999, an impermeable cap was installed over the g-2 soil activation area to prevent rainwater infiltration and the continued leaching the radionuclides out of the soils and into groundwater. In September 2000, the activated soil shielding and the associated tritium plume were designated as new sub-Area of Concern 16T. Following this designation, DOE agreed to prepare an Engineering Evaluation/Cost Analysis (EE/CA) to evaluate the adequacy of the corrective actions taken to date, and the need for further actions. During 2001, BNL conducted additional characterization work designed to obtain the necessary plume concentration and position data required to prepare the EE/CA.

In February 2001, BNL installed eight temporary Geoprobe wells. The effort focused on two main areas, the area just west of Building 912A and the area just east of Building 912. The results from the temporary well samples taken west and south of Building 912A indicated tritium concentrations up to 170,000 pCi/L. During this same period, the tritium concentration in nearby permanent well 054-07 was 77,100 pCi/L. The results from the temporary well samples collected east of Building 912 indicated tritium concentrations up to 67,500 pCi/L at location GP8. Based upon these results, the leading edge of the g-2 tritium plume was found to be situated to the east of Building 912, and positioned entirely within the shallow zone (50 ft) of the Upper Glacial aquifer. However, because very high levels of tritium (nearly 1.8 M pCi/L) had been detected in late 1999 directly downgradient of the source area, it was presumed that the highest concentration portion of the tritium plume was still residing beneath Building 912.

In anticipation that higher levels of tritium would eventually migrate to the east of Building 912, it was determined that it was premature to formally commit to a remedial action. In September 2001, BNL obtained regulatory agency concurrence that an additional year of monitoring was required before a final EE/CA and Action Memorandum would be prepared. BNL prepared a detailed work plan that detailed the proposed groundwater monitoring program, which included the installation of additional temporary wells to verify the position of the plume.

In November 2001, BNL installed nine additional Geoprobe wells. The effort again focused on two main areas, the area just west of Building 912A and the area just east of Building 912. The results from the temporary well samples taken west of Building 912A indicated tritium concentrations up to 1,820,000 pCi/L. Following this finding, questions arose as to the integrity of the cap. The cap was thoroughly inspected, and was found to be in excellent condition. It is likely that the continued presence of high levels of tritium in groundwater directly downgradient of the source area is due to the release of residual tritium from the vadose zone following a natural rise in water table position that occurred during 2000. The results from the temporary well samples collected east of Building 912 indicated that the leading edge of the g-2 tritium plume was located approximately 100

feet to the southwest of the Waste Concentration Facility, a distance of approximately 1,000 feet from the VQ-12 source area (Figure 1). Tritium concentrations up to 79,500 pCi/L were observed at Geoprobe location G2-GP-11 located directly to the east of Building 912, and tritium concentrations up to 25,500 pCi/L were detected in G2-GP-16 located approximately 100 feet to the southwest of the Waste Concentration Facility. Based upon these findings, BNL installed two additional permanent monitoring wells near Building 912A. BNL and the regulatory agencies determined that additional monitoring of the permanent wells would be required before completing the g-2 tritium plume EE/CA and Action Memorandum.

Former E-20 Catcher Area: In late 1999, tritium and sodium-22 were detected in wells located approximately 100 feet downgradient of the former E-20 Catcher. The highest levels of tritium and sodium-22 were 5,800 pCi/L and 219 pCi/L, respectively. To further evaluate the extent of contamination, four Geoprobe wells were installed in January 2000. Tritium and sodium-22 levels in the temporary wells 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 soil activation area to prevent rainwater infiltration and the continued leaching the radionuclides out of the soils and into groundwater. A permanent cap was constructed by October 2000, and one additional well (Well 064-80) was installed for improved long-term monitoring the source area. During 2001, all tritium and sodium-22 concentrations were found to be below applicable drinking water standards, with a maximum tritium concentration of 2,070 pCi/L, and a maximum sodium-22 concentration of 163 pCi/L (Table 4).

Former U-Line Target and Stop Areas: Low levels of tritium and sodium-22 are routinely detected in wells located downgradient of the former U-Line target (Table 4). The tritium and sodium-22 concentrations are well below the applicable drinking water standards. The highest tritium concentration during 2001 was 3,960 pCi/L in Well 054-129 located approximately 200 feet downgradient of the target area. The highest sodium-22 concentration was 26.6 pCi/L in Well 054-69 located approximately 550 feet downgradient of the target area. Low-level contamination from the former U-Line area can be traced to Well 055-32, located approximately 1,000 feet downgradient of the target area. The maximum tritium and sodium-22 concentrations detected in this well was 3,820 pCi/L and 7.5 pCi/L, respectively.

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 stop soil activation area to prevent rainwater infiltration and the continued leaching the 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 (054-168 and 054-169) were installed to provide long-term monitoring. During 2001, the maximum tritium and sodium-22 concentrations were observed in downgradient well 054-128, with concentrations of 3,960 pCi/L and 1.9 pCi/L, respectively.

Building 912 Area: Other than tritium and sodium-22 contamination that is traceable to several upgradient sources, groundwater surveillance data for 2001 do not indicate that appreciable levels of tritium or sodium-22 are being released from potentially activated soils located beneath the experimental floor. As noted above, 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. Elevated levels of tritium from this plume have been detected in several downgradient wells (especially wells 065-121, 065-122, 065-123 and 065-124). Furthermore, low levels of tritium that are traceable to the Former U-Line Target area have been detected in downgradient well 055-32. In areas not impacted by the g-2 tritium plume or Former U-Line experimental areas, tritium and sodium-22 was either non-detectable (<300 pCi/L) or were only observed at trace levels.

Booster Beam Stop Area: Low levels of tritium were detected in downgradient well 064-52. The highest tritium and sodium-22 levels were detected in the October/November sample, at concentrations of 1,340 pCi/L at 12.5 pCi/L, respectively. The low-levels of tritium and sodium-22 could be related to a short-term uncovering of activated soil shielding near the Booster Beam Stop during the construction of the tunnel leading from the Booster to the Booster Applications Facility. 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.[1]

Building 914 Transfer Area: Low levels of tritium (616 pCi/L) were detected in one sample from downgradient well 064-53. Low levels of sodium-22 (up to 20.6 pCi/L) were detected in all three downgradient wells (064-03, 064-53 and 064-54).

J-10 Beam Stop Area: Low levels of tritium (450 pCi/L) were detected in one sample from downgradient well 054-64). Low levels of sodium-22 (up to 5.6 pCi/L) were detected in both downgradient wells (054-63 and 054-64). Low levels of sodium-22 have been detected in this area before beam-scraping activities at J-10 began in December 1999. Therefore, the low-levels of tritium and sodium-22 may be related to historical low-level activation of soils along this section of the beam line.

Environmental Dosimeters

Environmental thermoluminescent dosimeters (TLDs) are used to measure direct penetrating radiation in the field. These TLDs measure ambient external dose to living organisms. There were three TLDs (074-450, 074-451, and 054-400) in the vicinity of the AGS that are used to establish ambient dose rates (Table 5). These monitoring locations are shown on Figure 2.

[1] Before construction of the BAF 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.

Ambient dose for first and second quarters of CY 2001 was similar to the background at Bldg. 197 (TLD# 074-450) and Bldg. 907 (TLD #074-451). Environmental TLD # 054-400 located at Building 914, near the new BAF facility had 237 mrem dose rate for the first quarter. Second quarter TLD was not recovered for reading, however, the third and fourth quarter TLD showed dose of 35 mrem for each quarter. The high readings may be attributed to the sky-shine phenomenon during the operation of the g-2 experiment, which ran during the first quarter of 2001.

SPDES Monitoring

Sanitary wastes from AGS facilities are discharged to the BNL sanitary sewer system. Cooling tower blowdown from Building 902 is also discharged to the sanitary sewer. The Building 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 sewer is performed at the treated effluent discharge to the Peconic River. In March 2001 Magnet Division employees reported a loss of approximately 20 gallons of UCON heat transfer fluid. Examination of the tower basin revealed that it had been impacted by this release as evidenced by floating heat transfer fluid and significant foaming of the basin. The sewage treatment plant was immediately placed into a diversion mode to prevent release of the material to the Peconic River. However, examination of the sewage treatment plant effluent showed that some of the material had passed through the plant and that there was evidence of foaming in the Peconic. The release was reported to the New York State Department of Environmental Conservation and the Suffolk County Department of Health Services. There were no violations issued as a result of the release.

In addition, various cooling water, floor drain, and stormwater discharges from the AGS complex are monitored at four recharge basin outfalls (Figure 3). Outfall 003 (Basin HO) receives AGS non-contact cooling water discharged from the main magnet heat exchanger located in Building 911. Outfall 006A (Basin HT-W) receives LINAC non-contact cooling water, cooling tower blowdown, and floor drain and stormwater runoff. Outfall 006B (Basin HT-E) receives Building 919 cooling tower blowdown, non-contact cooling water, as well as floor drain and stormwater discharges. Outfall 002 (Basin HN) receives experimental cooling tower blowdown from Building 912, and stormwater runoff. During 2001, 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 on a quarterly basis.

During CY 2001, there were five apparent SPDES permit excursions for hydroxyethylidene-diphosphonic acid (HEDP) at outfalls 002, 002B, 005, 006A and 006B. The AGS contributes wastewater to three of these discharges (002, 006A and 006B). However, due to anomalies in the analytical data provided by CHEMTEX, Inc. and comparison with split sample results from H2M Labs, Inc., the presence of HEDP could not be verified. Historically, HEDP has not been detected at these basins.

Environmental Surveillance Monitoring: In addition to SPDES monitoring, all discharges are monitored quarterly for radionuclides, metals, volatile organic compounds and water chemistry parameters.

During 2001, no radionuclides related to Laboratory operations were detected in the discharges to outfalls 006A or 006B. The maximum gross alpha concentration detected was 4.2 pCi/L at outfall 006B in January. The maximum gross beta concentration detected was 3.4 pCi/L at outfall 006B in July. Tritium was not detected at any of the outfalls, and only naturally occurring gamma emitting radionuclides (e.g., potassium-40) were observed.

In addition, the monitoring program detected elevated levels of iron and aluminum at outfalls 002, 006A and 006B. The maximum concentration of aluminum and iron was 4.8 mg/L and 2.7 mg/L respectively at outfall 006A in October. Although the iron concentration is greater than the corresponding NYSDEC effluent limitations of 0.6 mg/L, this sample was unfiltered and therefore this result may not be representative of the true dissolved iron concentration. The levels of aluminum and iron detected in the other surveillance samples (ranging from 0.7 to 0.8 mg/L and 0.6 to 0.7 mg/L, respectively) may be related to native sediment carried by storm water run off and/or natural corrosion products associated with the cooling system piping.

Low levels of trihalomethanes (< 3.5 ppb) were detected sporadically in the AGS discharges to Outfalls 002, 003, 006A and 006B. These compounds are present as a potable water disinfection by-products and are, therefore not attributable to AGS operations.

Future Actions

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

- An Engineering Evaluation/Cost Analysis will be finalized for the g-2 tritium plume. This information will be used to develop a long-term monitoring and management strategy for the plume. BNL will continue to sample wells used to track the g-2 /VQ12 tritium plume on a quarterly basis.
- Based upon groundwater data collected during CY 2001, BNL will reduce monitoring schedule to semiannual for many of the wells used to monitor the former E-20 Catcher, former U-line Target and Stop areas, Building 912, J-10 Stop, the 914 Transfer area, and the Booster Stop.
- A new monitoring well will be installed downgradient of the BAF beam stop during the summer of 2002, and pre-operational monitoring will commence in late 2002.
- In late 2001, the Laboratory petitioned the NYSDEC to modify the Laboratory's SPDES discharge permit. This modification was approved in early 2002. Monitoring at outfall 003 (HO) located behind the Central Steam Facility was removed. Outfall 012, designed to receive cooling water discharges from the BAF facility and located

west of the BLIP facility, was added to the list of SPDES permitted outfalls. Although the NYSDEC is not requiring monitoring at these outfalls, BNL will perform quarterly monitoring of the water discharges as part of the Laboratory's environmental surveillance program.

References

BNL, 2001. Brookhaven National Laboratory Environmental Monitoring Plan, CY 2001 Update (January 2001). BNL Report 52584 Update.

Daum, M., Dorsch, W., Fry, J., Green, T., Lee, R., Naidu, J., Paquette, D., Scarpitta, S., and Schroeder, G., 2000. Brookhaven National Laboratory, Environmental Monitoring Plan 2000 (March 31, 2000). BNL Report 52584.

BNL Facility Groundwater Monitoring Program
Alternating Gradient Synchrotron: g-2 Tritium Plume and g-2 Beam Stop Area
Summary of Tritium and Sodium-22 Results for CY 2001
(pCi/L)
Table 1

Location	Well	January	April/May	**June**	**July**	**October/November**
Upgradient Wells	054-65	H3= <351 Na-22= ND	H3= <366 Na-22= ND	NS	NS	H3= <380 Na-22= ND
	054-66	H3= <289 Na-22= ND	H3= <339 Na-22= ND	NS	NS	H3= <380 Na-22= ND
Downgradient of VQ12 Magnet	054-07	H3= 77,100 +/- 1,570 Na-22= 75.8 +/- 6.8	H3= 9,810 +/- 507 Na-22= 80.0 +/- 6.9	NS	H3= 26,400 +/- 884 Na-22= 35.6 +/- 3.5	H3= 5,750 +/- 468 Na-22= 38.7 +/- 4.0
	054-124	H3= 1,940 +/- 302 Na-22= ND	H3= 1,560 +/- 265 Na-22= 2.7 +/- 1.1	NS	H3= 718 +/- 266 Na-22= 3.3 +/- 1.5	H3= 579 +/- 302 Na-22= 2.8 +/- 1.2
	G2-GP-09	NI	NI	NI	NI	H3= 1,820,000 Na-22=
	G2-GP-17	NI	NI	NI	NI	H3= 1,770,000 Na-22=
Downgradient of g-2 Beam Stop	054-67	H3= <337 Na-22= ND	H3= 725 +/- 256 Na-22= ND	NS	NS	H3= <380 Na-22= ND
	054-68	H3= 722 +/- 243 Na-22= 1.2 +/- 1.1	H3= <355 Na-22= ND	NS	NS	H3= <380 Na-22= 3.3 +/- 1.4
	054-125	H3= <337 Na-22= 2.4 +/- 1.8	H3= <339 Na-22= ND	NS	NS	H3= <380 Na-22= ND
	054-126	H3= <365 Na-22= ND	H3= <339 Na-22= ND	NS	H3= <375 Na-22= ND	H3= <380 Na-22= ND

NS: Well not sampled during this period.
NA: Not analyzed for this radionuclide.
NI: Well, not installed during this sample period.
Note A: Drinking water standard for tritium = 20,000 pCi/L; for sodium-22 = 400 pCi/L.
Note B: Temporary Geoprobe Wells G2-GP-09 and G2-GP-17 were installed as part of the g-2 EE/CA in November 2001. Permanent wells were installed at these locations in early 2002.

BNL Facility Groundwater Monitoring Program
Alternating Gradient Synchrotron: g-2 Tritium Plume and g-2 Beam Stop Area
Summary of Tritium and Sodium-22 Results for CY 2001
(pCi/L)
Table 1 (Continued)

Location	Well	January	April/May	**June**	**July**	**October/November**
East of Building 912	065-121	H3= 575 +/- 218 Na-22= 2.6 +/- 1.7	H3= 926 +/- 225 Na-22= 2.9 +/- 1.7	NS	H3= 603 +/- 249 Na-22= ND	H3= 864 +/- 324 Na-22= 3.0 +/- 1.2
	065-193	H3= <351 Na-22= +/- ND	H3= <335 Na-22= ND	NS	H3= <375 Na-22= ND	H3= <381 Na-22= ND
	065-122	H3= 2,590 +/- 328 Na-22= 10.5 +/- 1.8	H3= 59,100 +/- 1,210 Na-22= 4.8 +/- 1.3	H3 = 79,700 +/- 1,620 Na-22 = 2.9 +/- 1.4	H3= 22,700 +/- 793 Na-22= 4.9	H3= 18,900 +/- 819 Na-22= 3.5 +/- 1.3
	065-123	H3= 9,580 +/- 532 Na-22= ND	H3= 1,330 +/- 245 Na-22= 1.6 +/- 0.9	NS	H3= 560 +/- 242 Na-22= 6.4 +/- 1.6	H3= 479 +/- 266 Na-22= 2.6 +/- 1.0
	065-194	H3= <315 Na-22= ND	H3= <335 Na-22= ND	NS	H3= <375 Na-22= ND	H3= <381 Na-22= ND
	065-124	H3= 3,190 +/- 351 Na-22= 9.3 +/- 1.8	H3= 516 +/- 207 Na-22= 1.9 +/- 1.0	NS	H3= <375 Na-22= ND	H3= <405 Na-22= ND
	065-125	H3= 893 +/- 255 Na-22= 2.2 +/- 1.6	H3= 701 +/- 218 Na-22= ND	NS	H3= 527 +/- 247 Na-22= ND	H3= <405 Na-22= ND
	065-195	H3= 3,340 +/- 359 Na-22= ND	H3= <335 Na-22= ND	NS	H3= <375 Na-22= ND	H3= <405 Na-22= ND
	065-126	H3= <365 Na-22= ND	H3= <335 Na-22= ND	NS	H3= <375 Na-22= ND	H3= <380 Na-22= ND
	055-31	H3= <365 Na-22= ND	H3= <366 Na-22= ND	NS	H3= <375 Na-22= ND	H3= <409 Na-22= ND
	G2-GP-12	NI	NI	NI	NI	H-3 = 79,500 Na-22 = NA
SW of WCF	065-02	NS	NS	NS	H3= 898 +/- 235 Na-22= ND	H3= 9,430 +/- 601 Na-22= ND
	065-173	NS	NS	NS	H3= <300 Na-22= ND	H3= <381 Na-22= ND
	G2-GP-16	NI	NI	NI	NI	H3 = 25,500 Na-22 = NA

NS: Well not sampled during this period.
NA: Not analyzed for this radionuclide.

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

BNL Facility Groundwater Monitoring Program
Alternating Gradient Synchrotron: Building 912 Beam Targets and Stops
Summary of Tritium and Sodium-22 Results for CY 2001
(pCi/L)
Table 2

Location	Well	January	April/May	**June**	**July**	**October/November**
Upgradient of Building 912	054-67 (a)	H3= <337 Na-22= ND	H3= 725 +/- 256 Na-22= ND	NS	NS	H3= <380 Na-22= ND
	054-68 (a)	H3= 722 +/- 243 Na-22= 1.2 +/- 1.1	H3= <355 Na-22= ND	NS	NS	H3= <380 Na-22= 1.6 +/- 1.1
	054-69 (b)	H3= 866 +/- 254 Na-22= 26.6 +/- 3.0	H3= <339 Na-22= 16.8 +/- 2.1	NS	NS	H3= <380 Na-22= 3.3 +/- 1.4
	055-14 (b)	H3= <289 Na-22= ND	H3= <339 Na-22= ND	NS	NS	H3= 1,720 +/- 359 Na-22= ND
Downgradient of Building 912	055-15	NS	H3= 441 +/- 239 Na-22= 7.1 +/- 1.5	NS	NS	H3= <380 Na-22= ND
	055-16	NS	H3= <355 Na-22= ND	NS	NS	H3= <380 Na-22= ND
	055-29	NS	H3= 405 +/- 237 Na-22= ND	NS	NS	H3= 453 +/- 306 Na-22= ND
	055-30	NS	H3= <339 Na-22= ND	NS	NS	H3= <409 Na-22= 4.0 +/- 1.4
	055-31	H3= <365 Na-22= ND	H3= <366 Na-22= ND	NS	H3= <375 Na-22= ND	H3= <409 Na-22= ND
	055-32	NS	H3= 3,820 +/- 346 Na-22= 7.5 +/- 2.1	NS	NS	H3= 1,320 +/- 301 Na-22= 7.7 +/- 1.8
	065-120	NS	H3= 330 Na-22= ND	NS	NS	H3= 473 +/- 255 Na-22= ND
	065-121	H3= 575 +/- 218 Na-22= 2.6 +/- 1.7	H3= 926 +/- 225 Na-22= 2.9 +/- 1.7	NS	H3= 603 +/- 249 Na-22= ND	H3= 864 +/- 324 Na-22= 3.0 +/- 1.2

NS: Well not sampled during this period.
NA: Not analyzed for this radionuclide.
NI: Well, not installed during this sample period.
Note A: Drinking water standard for tritium = 20,000 pCi/L; for sodium-22 = 400 pCi/L.

BNL Facility Groundwater Monitoring Program
Alternating Gradient Synchrotron: Building 912
Summary of Tritium and Sodium-22 Results for CY 2001
(pCi/L)
Table 2 (Continued)

Location	Well	January	April/May	**June**	**July**	**October/November**
Downgradient of Building 912 (Cont.)	065-122	H3= 2,590 +/- 328 Na-22= 10.5 +/- 1.8	H3= 59,100 +/- 1,210 Na-22= 4.8 +/- 1.3	H3 = 79,700 +/- 1,620 Na-22 = 2.9 +/- 1.4	H3= 22,700 +/- 793 Na-22= 4.9	H3= 18,900 +/- 819 Na-22= 3.5 +/- 1.3
	065-123	H3= 9,580 +/- 532 Na-22= ND	H3= 1,330 +/- 245 Na-22= 1.6 +/- 0.9	NS	H3= 560 +/- 242 Na-22= 6.4 +/- 1.6	H3= 475 +/- 266 Na-22= 2.6 +/- 1.0
	065-124	H3= 3,190 +/- 351 Na-22= 9.3 +/- 1.8	H3= 516 +/- 207 Na-22= 1.9 +/- 1.0	NS	H3= <375 Na-22= ND	H3= <405 Na-22= ND
	065-125	H3= 893 +/- 255 Na-22= 2.2 +/- 1.6	H3= 701 +/- 218 Na-22= ND	NS	H3= 527 +/- 247 Na-22= ND	H3= <405 Na-22= ND
	065-126	H3= <365 Na-22= ND	H3= <335 Na-22= ND	NS	H3= <375 Na-22= ND	H3= 423 +/- 220 Na-22= ND
	065-192	NS	H3= <330 Na-22= ND	NS	NS	H3= <405 Na-22= ND
	065-193	H3= <351 Na-22= +/- ND	H3= <335 Na-22= ND	NS	H3= <375 Na-22= ND	H3= <381 Na-22= ND
	065-194	H3= <315 Na-22= ND	H3= <335 Na-22= ND	NS	H3= <375 Na-22= ND	H3= <381 Na-22= ND
	065-195	H3= 3,340 +/- 359 Na-22= ND	H3= <335 Na-22= ND	NS	H3= <375 Na-22= ND	H3= <405 Na-22= ND

NS: Well not sampled during this period.
NA: Not analyzed for this radionuclide.
Note: Drinking water standard for tritium = 20,000 pCi/L; for sodium-22 = 400 pCi/L.

BNL Facility Groundwater Monitoring Program
Alternating Gradient Synchrotron: Building 914, Booster Beam Stop and J-10 Beam Stop
Summary of Tritium and Sodium-22 Results for CY 2001
(pCi/L)
Table 3

Location	Well	January	April/May	**June**	**July**	**October/November**
Building 914 (Transfer Line)	064-03	NS	H3= <303 Na-22= 1.9 +/- 1.3	NS	NS	H3= <405 Na-22= 13.1 +/- 1.9
	064-53	NS	H3= 616 +/- 222 Na-22= 20.6 +/- 2.5	NS	NS	H3= <405 Na-22= 2.9 +/- 1.6
	064-54	NS	H3= <303 Na-22= 8.5 +/- 1.5	NS	NS	H3= <405 Na-22= 17.2 +/- 2.5
Booster AF	054-08	NS	NS	NS	NS	BAF - To be added in CY2002
Booster Beam Stop	064-51	NS	H3= <335 Na-22= ND	NS	NS	H3= <310 Na-22= ND
	064-52	NS	H3= 393 +/- 202 Na-22= 6.2 +/- 1.8	NS	NS	H3= 1,340 +/- 261 Na-22= 12.5 +/- 1.8
J-10 Beam Stop	054-62	NS	H3= <336 Na-22= ND	NS	NS	H3= <380 Na-22= ND
	054-63	NS	H3= <336 Na-22= 2.6 +/- 1.1	NS	NS	H3= <380 Na-22= 5.2 +/- 1.5
	054-64	NS	H3= 450 +/- 218 Na-22=2.6 +/- 1.4	NS	NS	H3= <380 Na-22= ND

NS: Well not sampled during this period.
NA: Not analyzed for this radionuclide.
Note: Drinking water standard for tritium = 20,000 pCi/L; for sodium-22 = 400 pCi/L.

BNL Facility Groundwater Monitoring Program
Alternating Gradient Synchrotron: Former U-Line Target and Beam Stop and E-20 Catcher Areas
Summary of Tritium and Sodium-22 Results for CY 2001
(pCi/L)
Table 4

Location	Well	January	April/May	**June**	**July**	**October/November**
U-Line Target	054-127	H3= <289 Na-22= ND	H3= <366 Na-22= ND	NS	NS	H3= <380 Na-22= ND
	054-129	H3= 295 +/- 191 Na-22= 5.6 +/- 1.5	H3= 3,960 +/- 328 Na-22= 4.7 +/- 1.4	NS	H3= 1,490 +/- 288 Na-22= 3.7 +/- 1.4	H3= <397 Na-22= 16.8 +/- 2.5
	054-130	H3= 317 +/- 187 Na-22= 1.1 +/- 1.0	H3= 530 +/- 243 Na-22= 2.6 +/- 0.9	NS	H3= <375 Na-22= 1.4 +/- 1.0	H3= <380 Na-22= ND
	054-69	H3= 866 +/- 254 Na-22= 26.6 +/- 3.0	H3= <339 Na-22= 16.8 +/- 2.1	NS	NS	H3= <380 Na-22= 3.3 +/- 1.4
U-Line Stop	054-128	NS - Well Damaged	H3= 3,250 +/- 309 Na-22= 1.9 +/- 0.9	NS	H3= 4,710 +/- 411 Na-22= 0.9 +/- 0.8	H3= 6,330 +/- 529 Na-22= ND
	055-14	H3= <289 Na-22= ND	H3= <339 Na-22= ND	NS	NS	H3= 1,720 +/- 359 Na-22= ND
	054-168	H3= 1,130 +/- 230 Na-22= ND	H3= <314 Na-22= ND	NS	H3= <375 Na-22= ND	H3= <381 Na-22= ND
	054-169	H3= <289 Na-22= ND	H3= <314 Na-22= ND	NS	NS	H3= <381 Na-22= ND
E-20 Beam Catcher	064-55	H3= 972 +/- 232 Na-22= 163 +/- 14.0	H3= <330 Na-22= 73.8 +/- 6.7	NS	H3= <300 Na-22= 37.8 +/- 3.9	H3= <405 Na-22= 48.7 +/- 4.7
	064-56	H3= <351 Na-22= ND	H3= <330 Na-22= 15.0 +/- 1.2	NS	H3= 633 +/- 274 Na-22= 9.4 +/- 1.6	H3= 2,070 +/- 292 Na-22= 42.5 +/- 4.0
	064-80	H3= 548 +/- 207 Na-22= 51.0 +/- 4.9	Sampled in June	H3= <292 Na-22= 11.8 +/- 2.1	H3= 355 +/- 235 Na-22= 10.9 +/- 1.7	H3= 613 +/- 230 Na-22= 58.6 +/- 5.1

NS: Well not sampled during this period.
NA: Not analyzed for this radionuclide.
Note: Drinking water standard for tritium = 20,000 pCi/L; for sodium-22 = 400 pCi/L.

BNL Facility Environmental Monitoring Report
Alternating Gradient Synchrotron Facility
Environmental TLD Results for CY 2001
Table 5

Location	TLD #	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
		mrem			
Bldg. 197	074 –450	21.2	19.9	25.5	21.2
Bldg. 907	074 –451	23.6	17.5	18.2	18.9
Bldg. 914	054 –400	237.4	NR	34.7	34.7

NR = TLD Not recovered