

EXPLORING EARTH'S MYSTERIES
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Relativistic Heavy Ion Collider Facility

Facility Environmental Monitoring Report

Calendar Year 2003



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Relativistic Heavy Ion Collider

Facility Environmental Monitoring Report

Summary of Results

In CY 2003, no environmental impacts from RHIC operations were identified. As in past years, no tritium was detected in surface water and groundwater samples collected near potential soil activation areas.

The ambient external exposures were measured for the RHIC ring area using 23 environmental TLDs. The average quarterly exposures for locations around the RHIC ring were 15.8 ± 2.8 , 15.4 ± 2.2 , 14.2 ± 2.0 , and 16.9 ± 2.3 mrem, respectively. The variation was statistically insignificant for each quarter and exposures were within the natural background levels of the BNL site.

There were no SPDES permit excursions attributable to RHIC activities in 2003. A single permit excursion for hydroxyethylidene-di-phosphonic acid was recorded at Outfall 006 which was the result of a failed valve on a cooling tower chemical feed system associated with an AGS cooling tower.

Background

Beam line interaction with the Relativistic Heavy Ion Collider's (RHIC) collimators and beam stops will produce secondary particles that will interact with some of the soils surrounding the 8 o'clock and 10 o'clock portions of the RHIC tunnel, and at the W-Line stop. These interactions can result in the production of a variety of radionuclides, of which tritium and sodium-22 can be leached out of the soils by rainwater. BNL installed impermeable geotextile caps over these areas to prevent rainwater infiltration into the potentially activated soil shielding. Additionally, discharges from RHIC cooling systems have the potential to impact surface and groundwater quality. These discharges are monitored and regulated under New York's State Pollutant Discharge Elimination System (SPDES) permit program.

Environmental Monitoring Program

As required by DOE Order 450.1 (Environmental Protection Program), BNL has established an environmental monitoring program at the RHIC 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.

The environmental monitoring program for the RHIC facility is described in the *BNL Environmental Monitoring Plan* (BNL, 2003). The monitoring results and recommendations are summarized below.

Monitoring Results

Groundwater Monitoring

During 1999–2000, 13 wells were installed to provide a means of verifying that the operational and engineered controls (i.e., impermeable caps) implemented at the RHIC beam stops and collimators are effective in protecting groundwater quality. Six monitoring wells were installed in the Blue and Yellow Line beam stop area, six wells in the collimator area, and one well near the W-Line beam stop (Figure 1). Because tritium is the most easily leached radionuclide from activated soils, is highly mobile in groundwater, and has a long half-life compared to other soil activation products (12.3 years for tritium compared to 2.6 years for sodium-22), the primary focus of the monitoring program is the detection of tritium.

Groundwater samples were collected from the 13 RHIC monitoring wells on a semiannual schedule during 2003. These samples were analyzed for tritium (Table 1). As in all previous monitoring, tritium was not detected in any of the groundwater samples collected from the RHIC monitoring wells.

Surface Water Monitoring

Because the southern beam stop is located within 200 feet of the culvert for the Peconic River, surface water samples are collected to verify that potentially activated groundwater is not being discharged to the stream bed during high water table conditions. When surface water is present, water samples are collected at an upstream location near Upton Road (location HY) and a downstream location near the Ring Road (location HV).

During 2003, surface water samples were collected five times from upstream location HY and four times at downstream location HV. Tritium was not detected in these samples (Table 2). The HY surface water samples were elevated for a number of inorganic parameters. Chloride concentration had a maximum of 15,800 mg/L in April; this elevation could be attributed to winter roadway salt applications. Elevated concentrations of aluminum, iron, chromium, and lead occurred throughout the year. These elevated concentrations are attributed to road runoff and suspended sediment within the samples, since filtered samples from this location resulted in extremely lowered concentrations.

Environmental TLDs

The main purpose of ambient external exposure monitoring is to measure the dose members of the public and uninvolved workers receive from direct gamma radiation

sources. These exposure measurements are also used to estimate ambient external dose to living organisms in the vicinity of RHIC. Twenty-three environmental thermoluminescent dosimeters (TLDs) are placed at strategic locations around the RHIC ring (Figure 2) to measure direct penetrating radiation exposures.¹

TLD results were compared with average on-site exposures to estimate the dose contribution, if any, from RHIC operations above the natural background levels of radiation. The average quarterly exposures for all the locations around RHIC ring were 15.8 ± 2.8 , 15.4 ± 2.2 , 14.2 ± 2.0 , and 16.9 ± 2.3 mrem, respectively (Table 3). The variation was statistically insignificant for each quarter and the exposures were within the natural background levels of the BNL site.

SPDES Monitoring

The SPDES permit authorizes discharges from the Sewage Treatment Plant (STP) to the Peconic River, and discharges of cooling water and stormwater to recharge basins. In the past, some sanitary wastes from the RHIC area were discharged to subsurface wastewater disposal systems. In 2001, a project to connect the entire RHIC site to BNL's sanitary sewer was completed. Monitoring of the site sanitary system is performed at the treated effluent discharge to the Peconic River.

Experimental cooling towers located at Buildings 1006, 1008, 1010, and 1002, cryogen cooling towers at 1005, and RF cooling systems at 1004 routinely discharge "blowdown" to either the ground surface or to the site stormwater collection system. Discharges from the Cryogenic Plant at Bldg. 1005, and Buildings 1006, 1008 and 1010 are conveyed to Basin HN (Outfall 002) (Figure 3). Discharges from Buildings 1002 and 1004 are conveyed to Outfall 002B. The discharges from these systems are regulated under the SPDES permit program. During 2003, these outfalls were monitored for flow and pH on a weekly basis and for residual corrosion control agents, oil and grease, volatile organic compounds, and aluminum, as required. In late 2002, the flume at Outfall 002 was lowered by two feet as part of an effort to prevent stormwater discharges from backing up into the AGS ring complex and a new recharge basin was completed in the inner ring forested area to permit better drainage.

During CY 2003, there were no SPDES permit excursions associated with RHIC operations. A single permit excursion was recorded for Outfall 006 (Basin HT) but this was associated with the failure of a chemical feed system for an AGS cooling tower.

¹ In 2002, the on-site TLD location identifiers were modified to improve data identification and recovery from Environmental Information Management System. Although the actual locations of TLDs did not change, the system for identifying them changed as follows: The existing grid numbers were retained, but the number after the hyphen was changed to reflect the TLD number in that particular sector. For example, the designator 011-400 was changed to 011-TLD1.

Environmental Surveillance Monitoring

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 2003, 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 2003. Since there were no gamma emitting nuclides detected these are being attributed to natural radioactive materials. Tritium was barely detected in one of the four samples collected in 2003. The maximum tritium concentration recorded for 2003 was 323 pCi/L.

In the past, aluminum and iron have been detected above the NYSDEC effluent limit, possibly attributable to native sediment carried by stormwater runoff and/or corrosion products associated with piping for the cooling system. In 2003, only iron was detected above limits. Low levels of Trihalomethanes (< 10 µg/L) 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.

Future Monitoring Actions

The following changes are recommended or in progress:

- Continue to sample groundwater monitoring wells semiannually, and analyze samples for tritium only. If tritium is detected in any of the samples, resume gamma analyses for sodium-22.
- Continue to monitor RHIC discharges per SPDES permit requirements and as part of the BNL surveillance program.

References

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

Table 1. Groundwater Monitoring: Tritium and Sodium-22 Results at the RHIC, CY 2003.

Building/Facility	Well	Feb. 5- Mar. 12, 2003	Aug. 7-28, 2003
		-----pCi/L-----	
Northern Beam Stop Area	025-04	H3= <352	H3= <279
	025-07	H3= <363	H3= <370
	025-08	H3= <364	H3= <371
Southern Beam Stop Area	025-03	H3= <352	H3= <278
	025-05	H3= <364	H3= <379
	025-06	H3= <364	H3= <371
Northern Collimator	034-05	H3= <352	H3= <368
Southern Collimator	034-06	H3= <352	H3= <364
Downgradient of Collimator Area	043-01	H3= <377	H3= <367
	043-02	H3= <377	H3= <367
	044-13	H3= <364	H3= <372
	044-14	H3= <364	H3= <394
W-Line Beam Stop	044-29	H3= <377	H3= <277

Notes:

"<" preceding a value (e.g., <383) indicates that the measured value was less than the MDL.

Table 2. Peconic River Tritium Concentrations at the RHIC, CY 2003.

Location	Collection Date	Result (pCi/L)
HY: Upstream of RHIC Beam Stop Area (025-650)	January	H3= < 317
	February	H3 = < 362
	April	H3= < 313
	July	H3= < 300
	October	H3= < 267
HV: Downstream of RHIC Beam Stop Area (026-650)	January	H3= < 317
	April	H3= < 313
	July	H3= < 302
	October	H3= < 342

Notes:

Ability to collect surface water samples is limited to periods of high water table position when there is base flow in the river..

"<" Preceding a value (e.g., <316) indicates that the measured value was less than the MDL.

Table 3. Quarterly Ambient Radiation at the RHIC, CY 2003.

TLD #	Location	1 st Quarter	2 nd Quarter	3 rd Quarter	4 th Quarter
		-----mrem-----			
011-TLD1	N. Firebreak	14.3	NP	14.8	15.2
P2	P-2	14.3	12.6	11.7	15.4
025-TLD1	B#1010 St.1	16.9	14.3	12.6	15.8
025-TLD4	B# 1010 St. 4	20.0	14.2	15.4	16.3
027-TLD1	B#1002A South	13.5	13.8	13.0	14.7
027_TLD2	B#1002D East	13.5	15.9	14.0	15.9
034-TLD1	B#1008 C2	16.1	15.7	13.7	17.2
034-TLD2	B#1008 C4	16.3	16.1	15.0	16.3
036_TLD1	B#1004B East	15.1	13.8	12.2	15.9
036-TLD2	B#1004 East	17.3	18.9	15.6	19.7
037-TLD1	S-13	16.4	14.4	13.3	17.2
043-TLD1	N. Access Rd	16.8	15.5	14.9	18.1
043-TLD2	N. Met	18.4	15.5	16.7	17.7
044-TLD1	B #1006	20.0	15.0	14.3	16.6
044-TLD2	South of B# 1000E	14.5	15.4	13.8	17.2
044-TLD3	South of B#1000P	14.7	15.7	13.5	16.0
044-TLD4	B#1006N-NE1000P	16.0	17.4	15.0	17.9
044-TLD5	B#1006N-N 1000P	14.8	16.5	14.3	17.2
045-TLD1	B#1005S	16.4	15.3	14.6	17.8
045-TLD2	East of B#1005S	15.8	17.4	14.8	21.5
045-TLD3	S/E of B#1005S	15.2	17.3	15.1	17.9
045-TLD4	S/W of B#1005S	14.3	14.7	15.6	16.5
045-TLD5	WS/W of B# 1005S	13.1	13.8	11.8	14.9
Mean		15.8 ± 2.8	15.4 ± 2.2	14.2 ± 2.0	16.9 ± 2.3

NP = Not Posted.

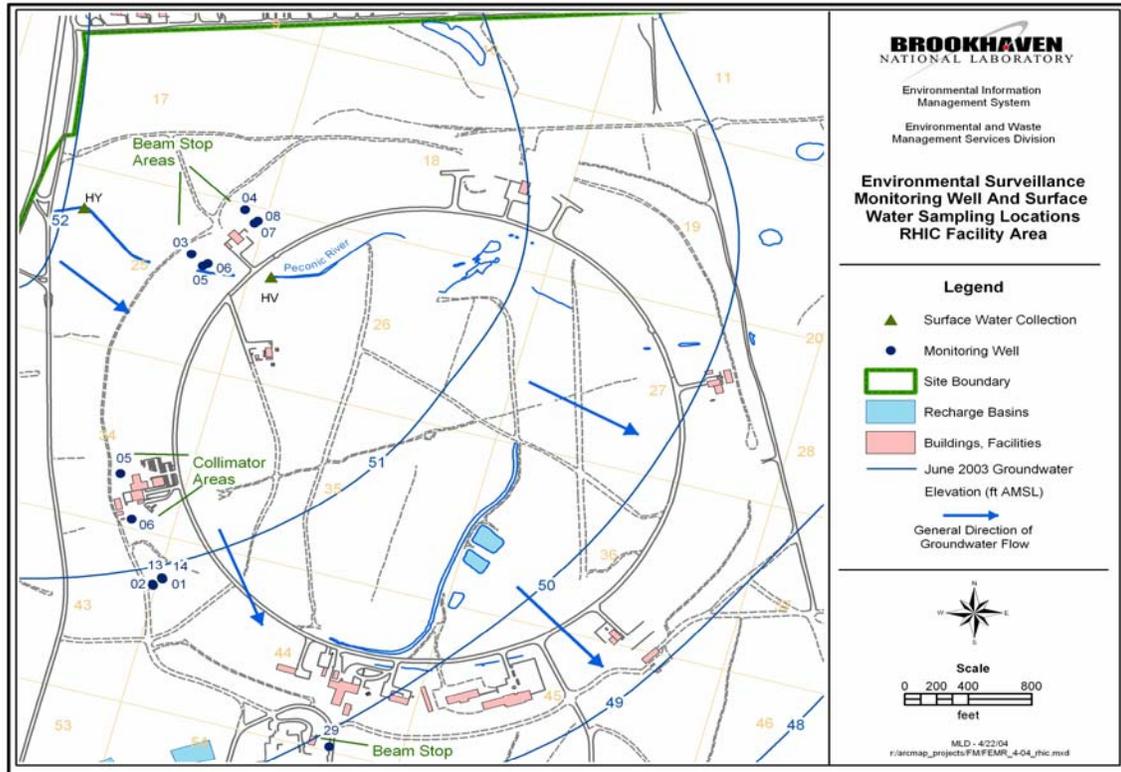


Figure 1. Location of RHC Facility Groundwater Monitoring Wells.

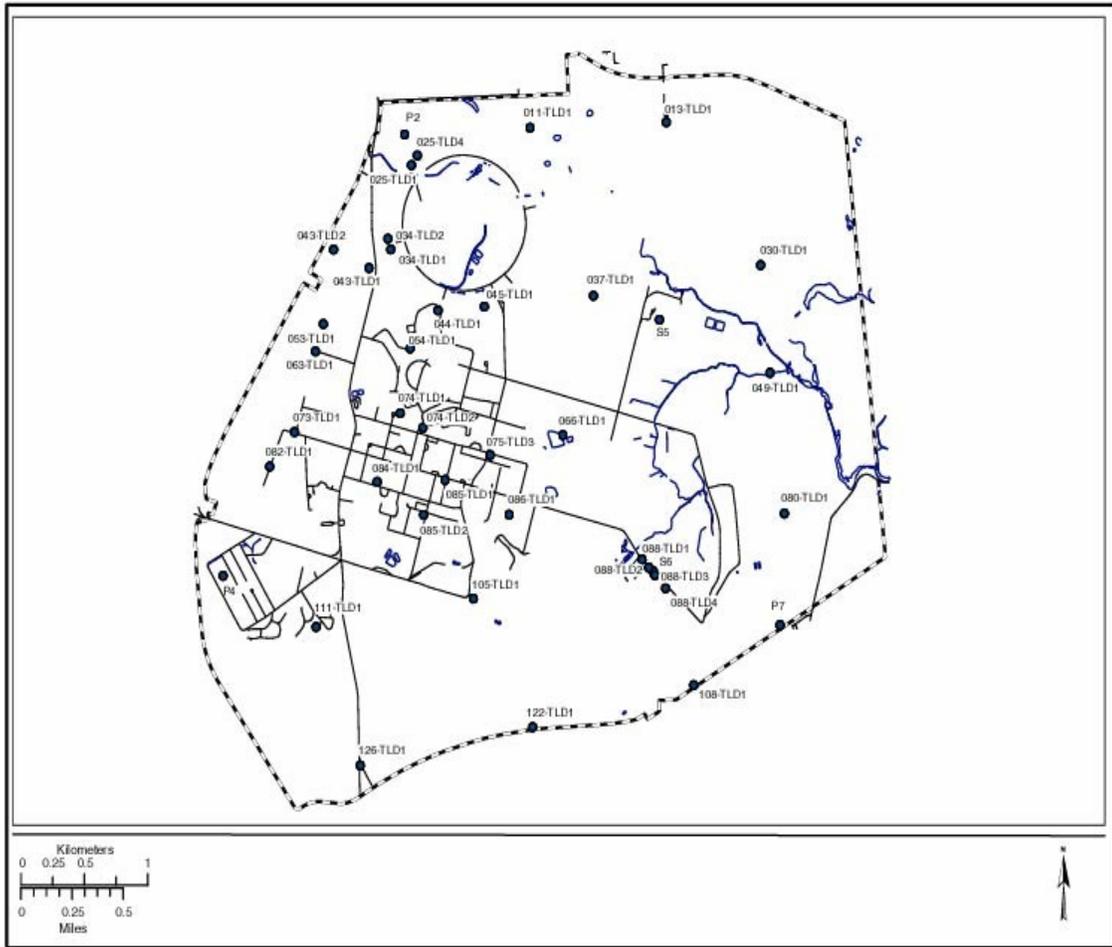


Figure 2. Locations of Environmental TLDs for the BNL Site.

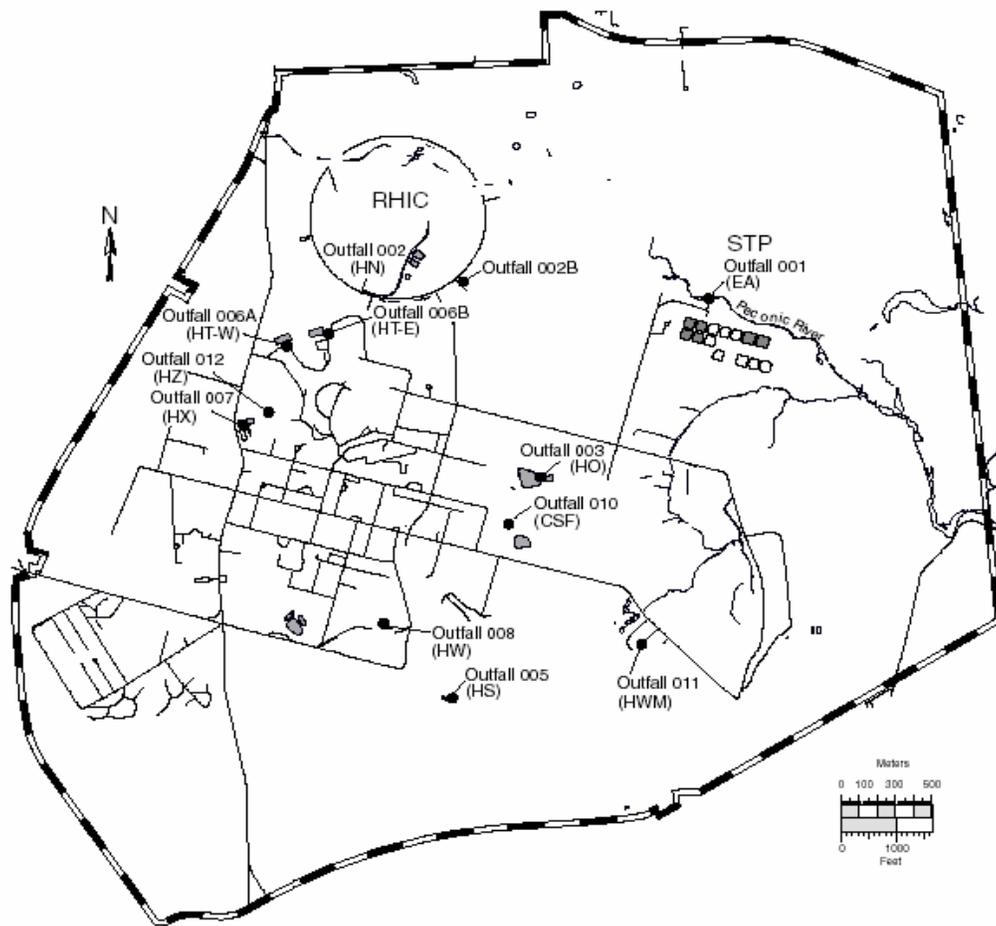


Figure 3. Location of SPDES-Permitted Outfalls.