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Relativistic Heavy Ion Collider Facility

Facility Environmental Monitoring Report

Calendar Year 2002

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Relativistic Heavy Ion Collider

Facility Environmental Monitoring Report

Summary of Results

In CY 2002, no environmental impacts from RHIC operations were identified. As in past years, no tritium or sodium-22 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 11 environmental TLDs. The average quarterly exposures for locations around the RHIC ring were 19.4, 15.8, 15.4, and 18.1 mrem, respectively. The variation was statistically insignificant for each quarter and exposures were within the natural background levels of the BNL site.

There was one SPDES permit excursion for pH, at Outfall 002 (HN). The excursion was detected on December 20, 2002, and upon investigation was attributed to stormwater runoff from a construction site within the AGS/RHIC complex. The pH of the stormwater runoff was elevated due to its interaction with newly poured concrete and a crushed-concrete parking lot base. The pH returned to normal levels, 8.1 SU, when checked on December 23rd.

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 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. Because the BNL site is located over an EPA-designated sole-source aquifer system, BNL has implemented a number of engineered and operational controls to reduce the potential impact to environmental quality. Additionally, discharges from RHIC cooling systems are regulated under New York's State Pollutant Discharge Elimination System (SPDES) permit program.

Environmental Monitoring Program

As required by DOE Order 5400.1, 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, 2000 and 2002). 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 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 had a longer half-live (12.3 years as opposed 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 2002. These samples were analyzed for tritium (Table 1). Tritium was not detected in any of the groundwater samples.

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 the monitoring period, surface water samples were collected three times from upstream location HY and twice at downstream location HV. No tritium or sodium-22 was 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 748 mg/L in January; 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. Eleven 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 19.4, 15.8, 15.4, and 18.1 mrem (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 are conveyed to Basin HN (Outfall 002) (Figure 3). The discharges from these systems are regulated under the SPDES permit program. During 2002, 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.

During CY 2002, there was one SPDES permit excursion for pH, at Outfall 002. Upon investigation, the excursion was attributed to stormwater runoff. On Friday December 20, heavy rain (1.53 inches) resulted in significant runoff from developed portions of the site. At the radiological storage building construction site on Thompson Road, the pH of the runoff from newly poured concrete and a crushed-concrete parking lot base was measured at 10 SU. This runoff, combined with other runoff from non-construction areas within the AGS/RHIC complex, resulted in a pH of 9.4 SU measured at the outfall. When NYSDEC was notified of the excursion, as the SPDES permit requires, they did not require any mitigating action. The pH returned to normal levels, 8.1 SU, when checked on December 23 as requested by NYSDEC.

[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.

The Environmental and Waste Management Services Division (EWMSD) held two Lessons Learned meetings regarding the excursion. Action items from the first meeting included trending the pH at the outfall, reviewing Plant Engineering (EP) flow models completed for the outfall, reviewing cooling tower treatment chemical additions, sampling the crushed-concrete parking lot base, reviewing erosion control at construction sites, and reviewing the Plant Engineering's ESH-500A and NEPA checklists for stormwater environmental impacts. At the second meeting, additional improvements NA = Not analyzed for. were identified; these improvements included adding stormwater runoff to Plant Engineering's ESH 500-A form as a potential liquid effluent for review during EP projects. In addition, Plant Engineering personnel agreed to review their standard contract language regarding erosion control to ensure it states that contractors must adequately control stormwater discharges when using crushed-concrete paving base. Finally, EWMSD is requiring EP to perform more formal enforcement and application of erosion control measures, especially those that impact stormwater drainage systems. The excursion triggered EWMSD's Environmental Event Response procedure. All details regarding the excursion are documented on Environmental Event Response Documentation Form 02-03.

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 2002, no radionuclides related to Laboratory operations were detected in the discharges to basin HN. Three of the eight gross alpha and beta analyses results were below the minimum detection limit (MDL). The maximum alpha concentration was 2.4 pCi/L, detected in April, and the maximum beta concentration was 3.5 pCi/L, detected in October. Tritium was not detected in any of the samples, and only naturally occurring gamma-emitting radionuclides were observed.

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 2002, levels for both metals were well within the limits. Low levels of Trihalomethanes (< 3.1 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.
- In late 2001, BNL petitioned NYSDEC to modify the Laboratory's SPDES discharge permit for RHIC Outfall 002A. These changes were approved by NYSDEC and a revised SPDES permit was received in February 2002. Monitoring at Outfall 002A is no longer required because cooling water discharges have been rerouted to Outfalls 002 and 002B. Total aluminum was added to the monitoring parameters for Outfall 002.

References

BNL. 2000. *Brookhaven National Laboratory Environmental Monitoring Plan 2000*. BNL-52584. Brookhaven National Laboratory, Upton, NY. March 2000.

BNL. 2002. *Brookhaven National Laboratory Environmental Monitoring Plan CY2002 Update*. BNL-52584 (Update). Brookhaven National Laboratory, Upton, NY. January 2002.

Table 1. Groundwater Monitoring: Tritium and Sodium-22 Results at the RHIC, CY 2002.

		Feb. 14, 2002	Aug. 13–14, 2002
Building/Facility	Well	----------pCi/L----------	
Northern Beam Stop Area	025-04	H3= <383	H3= <345
	025-07	H3= <383	H3= <343
	025-08	H3= <383	H3= <343
Southern Beam Stop Area	025-03	H3= <383	H3= <345
	025-05	H3= <383	H3= <345
	025-06	H3= <383	H3= <345
Northern Collimator	034-05	H3= <383	H3= <345
Southern Collimator	034-06	H3= <383	H3= <345
Downgradient of Collimator Area	043-01	H3= <383	H3= <343
	043-02	H3= <383	H3= <343
	044-13	H3= <383	H3= <343
	044-14	H3= <383	H3= <343
W-Line Beam Stop	044-29	H3= <383	H3= <345

Notes:

Sodium-22 was monitored by gamma analysis.

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

Table 2. Surface Water Tritium and Sodium at the RHIC, CY 2002.

Location	Collection Date	Result (pCi/L)
HY: Upstream of RHIC Beam Stop Area	January	H3= <316
		Na-22= ND
	April	H3= <375
		Na-22= ND
	December	H3= <393
		Na-22= ND
HV: Downstream of RHIC Beam Stop Area	April	H3= <375
		Na-22= ND
	December	H3= <393
		Na-22= ND

Notes:

Ability to collect surface water samples is limited to periods of high water table position when there is base flow in the river. Thus, at Location HV there was no January sample.

ND = Not Detected

"<" 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 2002.

TLD #	Location	1st Quarter	2nd Quarter	3 rd Quarter	4 th Quarter
		----------mrem----------			
011-TLD1	N. Firebreak	19.6	15.4	12.7	NR
P2	P-2	17.8	13.6	14.0	16.0
025-TLD1	B#1010 St.1	20.0	13.8	21.8	17.8
025-TLD4	B# 1010 St. 4	19.2	13.7	14.7	18.8
034-TLD1	B#1008 C2	19.7	17.5	14.0	17.8
034-TLD2	B#1008 C4	18.5	14.3	17.2	18.9
037-TLD1	S-13	17.1	14.9	14.1	17.0
043-TLD1	N. Access Rd	19.6	18.3	14.6	19.0
043-TLD2	N. Met	21.2	18.5	16.7	18.7
044-TLD1	Bldg. #1006	21.5	17.8	14.5	18.1
045-TLD1	Bldg. #1005	19.4	15.8	15.3	19.1
Mean		19.4	15.8	15.4	18.1

NR = Dose was not reported due to lost TLD.

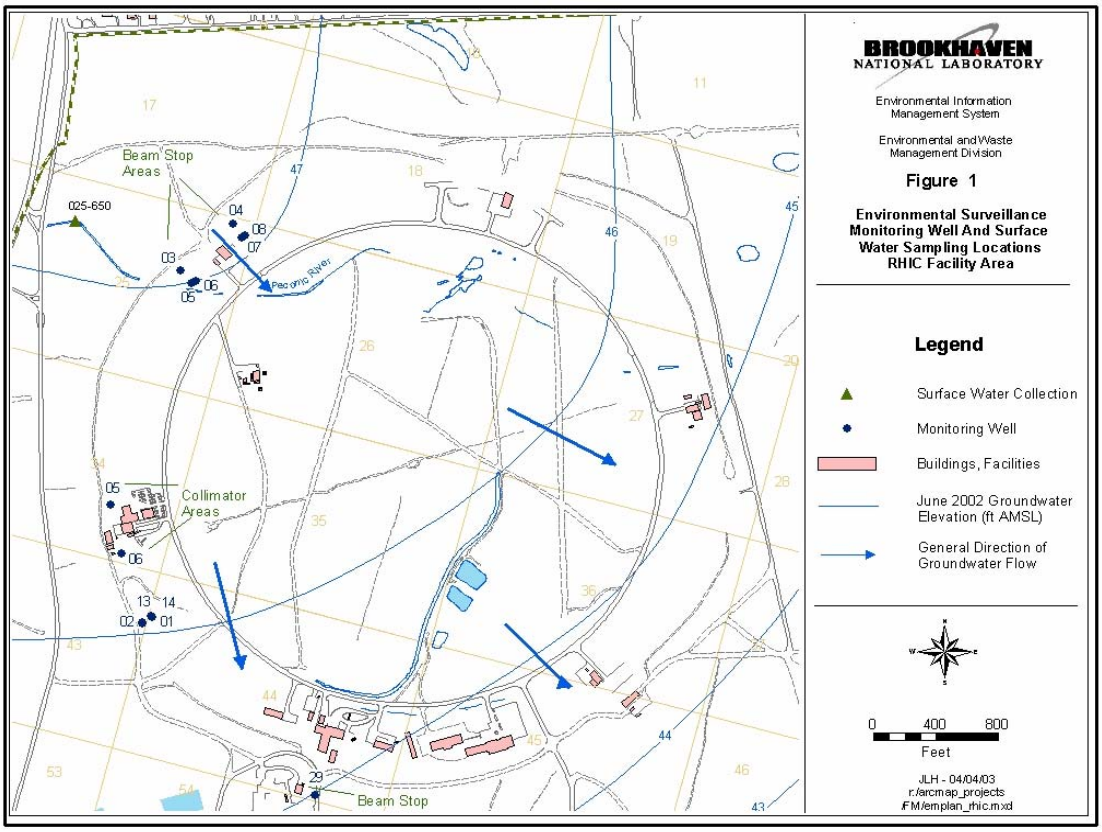

Figure 1. **Location of RHIC Facility Groundwater Monitoring Wells.**

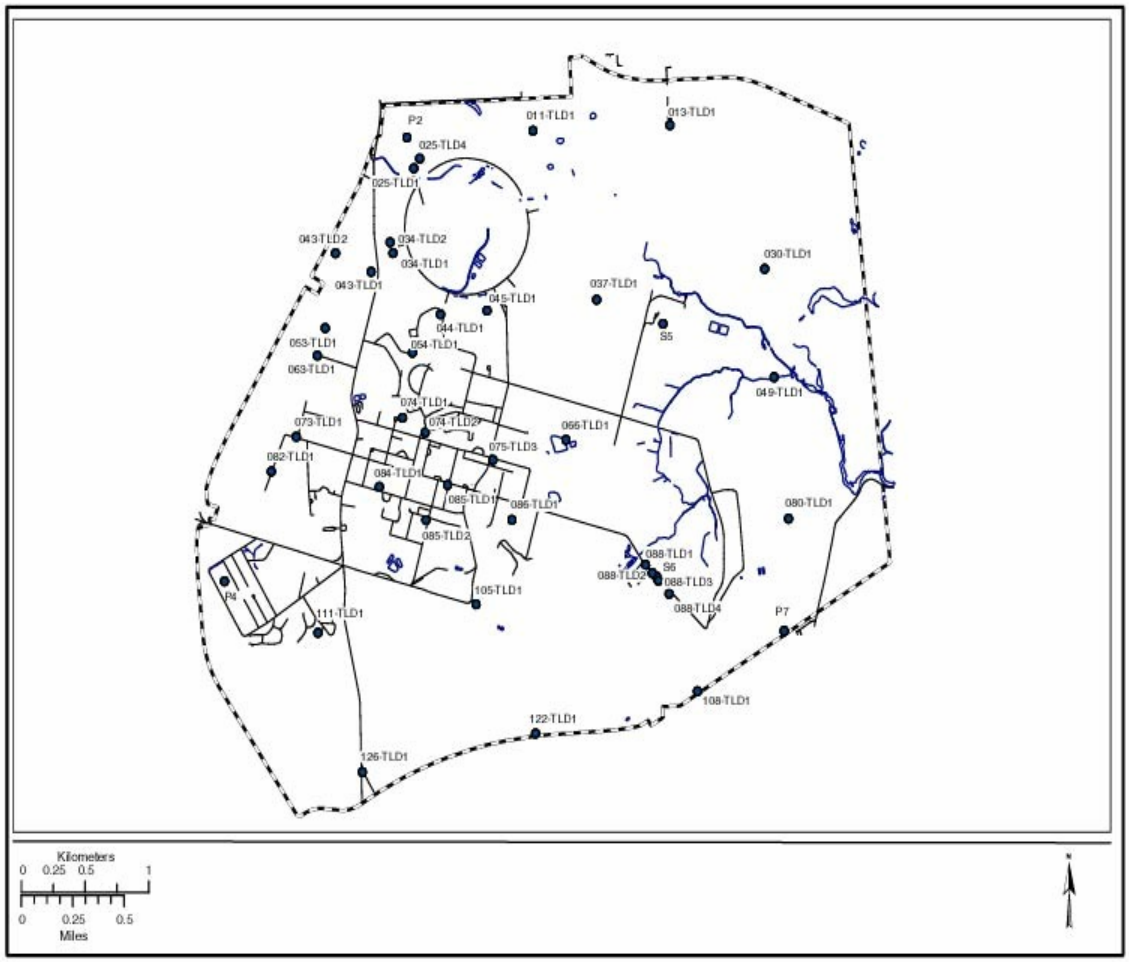

Figure 2. **Locations of Environmental TLDs for the BNL Site.**

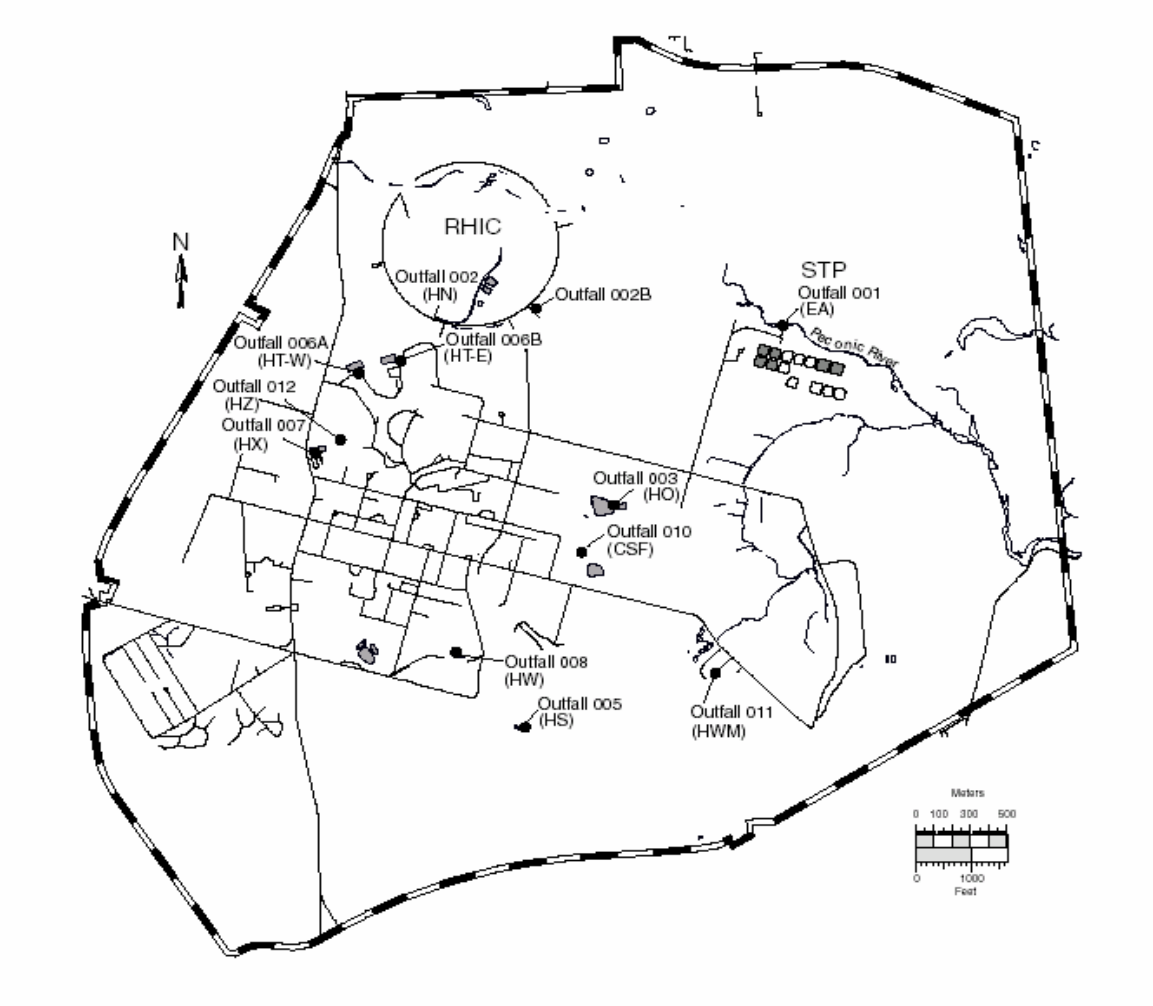

Figure 3. **Location of SPDES-Permitted Outfalls**.