9 LIQUID EFFLUENTS

CHAPTER CONTENTS

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SURFACE WATER RECHARGE BASINS

DQO START DATE	January 1, 2003
REVISION NUMBER/DATE	Rev. 5, November 5, 2007
IMPLEMENTATION DATE	January 1, 2008
POINT OF CONTACT	Robert Lee (631) 344-3148

SUMMARY OF PROPOSED CHANGES

Monitoring changes for 2008 include continuation of sediment/soil sampling in remaining recharge basins or stormwater discharges. All soil samples will be analyzed for inorganic and radiological parameters. Discharges to be sampled in 2008 include HZ and the CSF. Cost tables have been modified to reflect current analytical pricing. The cost increase, due to increased analytical fees and hourly recharge rates, is approximately $17,700.00.

DESCRIPTION AND TECHNICAL BASIS

Wastewater effluents are routinely generated as a result of BNL operations and research activities. A portion of the wastewater, mainly stormwater runoff and process wastewater, is directly discharged to groundwater via several recharge basins on site. These wastewater discharges have the potential to impact groundwater quality, aquatic and terrestrial organisms, and eventually public health via either direct ingestion of groundwater, or ingestion of aquatic or terrestrial organisms. In addition, any contaminants present in the discharge may be trapped and accumulate in the sediments within each recharge basin. Past sediment sampling has detected contaminants attributable to historic BNL operations and roadway runoff. Wastewater discharges to the on-site recharge basins and stormwater outfalls may contain volatile organic compounds (VOCs), oil and grease, inorganic compounds, metals, and radionuclides originating from process discharges, outdoor storage areas, and stormwater runoff from paved areas on site. To ensure that these discharges comply with regulatory requirements and pose minimal environmental impact, they are monitored on a periodic basis. Permanent monitoring stations have been established for each of these major point-source discharges. Discharges are monitored at the point of release to the environment to support documented compliance with the Laboratory's SPDES permit requirements and compliance with DOE Orders. The Laboratory discharges to the following recharge basins and stormwater outfalls:

- Outfall 002 (Recharge Basin HN) receives noncontact cooling water discharges, cooling tower blowdown, drainage from secondary containment and floor drains, and stormwater runoff from the CA-D complexes.
- Outfall 002B receives cooling tower blowdown from Buildings 1002 and 1004 within the CA-D complex (RHIC).
- Outfall 003 (Recharge Basin HO) receives once-through cooling water discharges, cooling tower blowdown, and stormwater runoff from the CA-D complex, storm water runoff from areas north and east of the HFBR, and once through cooling from the Energy, Environment and National Security building (Building 830).

- Outfall 004 (Recharge Basin HP) received once through cooling water discharges from the BMRR, which was shut down in 2000. This basin no longer receives process discharges, but does receive treated groundwater discharges from CERCLA remediation activities.
- Outfall 005 (Recharge Basin HS) receives predominately stormwater runoff and minimal cooling tower blowdown and once-through cooling water from the NSLS and the Chemistry Department.
- Outfall 006A (Recharge Basin HT-W) receives noncontact cooling water discharges, cooling tower blowdown, floor drain discharges, and stormwater runoff from the AGS complex.
- Outfall 006B (Recharge Basin HT-E) receives noncontact cooling water discharges, cooling tower blowdown, floor drain discharges, and stormwater runoff from the AGS complex.
- Outfall 007 (Recharge Basin HX) receives filter backwash water from the Waste Treatment Plant.
- Outfall 008 (Recharge Basin HW) receives stormwater runoff from the Warehouse area.
- Outfall 009 consists of numerous subsurface wastewater disposal systems that receive predominantly sanitary waste and steam and air compressor discharges. The Laboratory's SPDES permit does not require effluent monitoring at Outfall 009.
- Outfall 010 (CSF recharge basin) receives stormwater runoff from the CSF area.
- Outfall 011 (Former HWMF) formerly received stormwater runoff from the paved areas of the HWMF. The area has since been remediated, and all buildings and most roads demolished. This discharge currently redirects accumulated rainwater from one area to another. The Laboratory's SPDES permit does not require effluent monitoring at Outfall 011.
- Outfall 012 (Recharge Basin HZ) receives stormwater discharges from Building 197, 902, 905, and 941 in the CA-D complex.

DRIVERS FOR MONITORING BEING CONDUCTED UNDER THIS PROGRAM

__x__ Compliance
__x__ Support compliance
__x__ Surveillance
_____ Restoration

The Federal Water Pollution Control Act (also known as CAA) establishes a national permitting program that sets effluent standards for direct discharges to water's of the U.S. and pretreatment standards for indirect discharges of industrial wastes. Under the CWA, the EPA also develops quality-based water criteria. Wastewater discharges from Laboratory operations are subject to the CAA. BNL maintains a SPDES permit, issued by NYSDEC, which authorizes the Laboratory to implement CWA provisions under Part 750 of Title 6 of the NYCRR. The SPDES permit authorizes releases to the environment through 13 designated outfalls and specifies monitoring requirements for each, including frequency of monitoring and specification of analytical requirements. Effluent limitations specified for each analytical parameter are based upon the groundwater effluent water quality standards and are codified under 6 NYCRR Part 703. A map depicting the locations of each of the monitoring stations is provided in Chapter 3, Figure 3-3. As processes change, they are either added or removed from the Laboratory's SPDES permit through a permit modification, and the environmental monitoring program is revised as necessary.

In addition to the federal and state water quality regulations, DOE Order 450.1, Environmental Protection Program (2003), requires that DOE sites not only comply with federal and state statutes and regulations, but also establish effluent monitoring and environmental surveillance programs. These programs ensure that DOE operations are conducted in a manner that minimizes impacts to public health and the environment, and anticipates and addresses potential environmental problems before causing adverse conditions. NYSDEC does not regulate radioactive effluents.

Suffolk County Sanitary Code, Article 12, Toxic and Hazardous Materials Storage and Handling Controls, requires the owner or operator of industrial facilities to cease discharges of toxic or hazardous materials (unless otherwise authorized, such as through a SPDES permit), and to reclaim, recover, dispose of, and restore the environment to the condition that existed prior to discharge. SOP 9-95, used in administering Article 12 of the Sanitary Code, provides guidance when remediating the environment. When a contaminant or a class of contaminants exceeds the "Action Level" found in the SOP, a cleanup or other action is required. As stated in the Sanitary Code, the goal of any remedial action required by SCDHS is to return the site to predischarge conditions. If this is not possible, at a minimum, the cleanup must ensure reasonable protection for public health and the drinking water supply. Therefore, under most conditions, the contaminant concentration in the soil after a cleanup should not exceed the values indicated in the SOP for "Cleanup Objectives". These guidelines are used when evaluating the results of sediment sampling completed for the on-site recharge basins.

BNL finalized a Natural Resource Management Plan in 2003 (BNL 2003a) to promote stewardship of the natural resources found at the Laboratory, as well as to integrate natural resource protection with BNL's mission. The plan incorporated input from EPA and NYSDEC Wildlife Branch. The environmental management strategy includes identification and mapping of natural resources, habitat protection or enhancement, environmental monitoring, population management, compliance assurance and potential impact assessment, education and public outreach, and research. The plan places special emphasis on the New York State endangered tiger salamander and the banded sunfish, a New York State species of special concern, by instituting focused programs that monitor, protect, and enhance their habitat to sustain and promote population growth. As part of the Natural Resource Management Plan, the Laboratory agreed to conduct water quality monitoring of the breeding areas on site that include many of the recharge basins.

Data Quality Objective Analysis

Step 1: State the Problem

The Laboratory is permitted to discharge liquid effluents under its SPDES permit; therefore, data are required to verify compliance with the permit limits. In addition, BNL conducts surveillance monitoring to detect unplanned releases of contaminants and to assure that New York State groundwater effluent standards are met for discharge constituents not covered by the permit. In addition, accumulation of contaminants in the recharge basin sediments may occur; therefore, periodic monitoring of contaminant levels in the sediments is required after establishing baseline levels.

Step 2: Identify the Decision

- Are all discharges in compliance with permit limits and/or New York State groundwater effluent standards?
- Have the characteristics of the effluents changed to justify changing the SPDES permit requirements?
- Have contaminants been found in the sediments at the recharge basins, at or above Suffolk County Article 12 Action Levels?
- Is the quality of discharges adequate to support tiger salamander habitats?

Step 3: Identify Inputs to the Decision

Inputs necessary to support the decisions in Step 2 include:

- SPDES permit limits or other New York State groundwater effluent standards, and relevant changes
- Suffolk County Article 12 Action Levels for soil cleanup
- BNL Natural Resource Management Plan
- Identification of process effluents and their variability contributing to discharges and process knowledge
- Identification of areas contributing to stormwater discharges
- Historical analyses of process discharges and direct discharges to groundwater through the recharge basins
- Appropriate analytical parameters for the processes generating the waste
- Collection and analysis of samples performed according to EPA, state, or other regulatory agency standards or guidelines
- Collection of samples performed as per the frequency and other requirements of the SPDES permit limits
- Collection of samples representative of routine discharges at appropriate monitoring locations
- Field Sampling instrumentation calibration and maintenance records
- Field Sampling personnel field logs and records
- Environmental Monitoring SOPs
- Documentation of the sampling and analysis program
- Collection and analysis of sediment samples
- Historic sediment sampling analytical results

Step 4: Define the Study Boundaries

The study boundaries incorporate all watersheds that drain into the recharge basins. The Laboratory's SPDES permit contains specific monitoring requirements, including analytical methods, effluent limitations, and sampling frequencies. Two monitoring programs have been established to collect the necessary water quality data needed to assess the impact of BNL's direct discharges to groundwater at the recharge basins and stormwater outfalls. Monitoring in support of the Laboratory's SPDES permit relies on the collection and analysis of flow-proportional composite and grab samples and is conducted either monthly or quarterly depending on the parameter as set out in the permit. The surveillance monitoring program relies on both real-time analysis of wastewater streams and collection and analysis of flow-proportional composite and grab-samples. Due to the highly variable nature of the quality of stormwater and process discharges, surveillance monitoring has been conducted quarterly based on professional judgment. Historically, surveillance monitoring has been conducted during dry weather conditions. This does not, however, capture discharges of contaminants introduced through stormwater runoff. Therefore, sampling is also conducted during wet weather.

Discharges of contaminants in wastewater will eventually result in accumulation in the basin sediments. The accumulation of contaminants in the recharge basin sediments is, however, slow and the sampling frequency is longer than for wastewater. Historically, sediment sampling was performed periodically rather than on a routine basis. Beginning in 2000, a biennial sediment sampling program was instituted to assess accumulation of any contaminants in the discharged wastewater to the recharge basins. Samples were collected in 2000 and 2002/2003. Results to date have shown that there is little impact on sediment quality. Concentrations of some sediment contaminants are above the Suffolk County Article 12 Cleanup Objectives, but below the Action

Levels; consequently, no remediation is required. Since there is minimal impact on soils, sampling will be conducted every 5 years, with the next scheduled sampling in 2007. Samples are collected from 0 to 6 inches in depth and separated into 2-inch intervals for analysis. Sampling may be conducted under the oversight of the SCDHS.

Step 5: Develop the Decision Rule

Decision 1

Are all discharges in compliance with permit limits and/or groundwater effluent standards?

Analytical data generated from the recharge basin monitoring programs are continuously compared to SPDES permit limits or New York State groundwater effluent standards.

If the comparison shows the data to be consistently below regulatory limits or standards, **then** the monitoring will be maintained.

If the comparison yields an exceedance of either a permit limit or water quality standard, **then** an evaluation will be conducted under the Environmental Event Response Procedure to determine the source of contamination, and additional samples will be collected to define the extent (i.e., duration and magnitude) of the exceedance and identify any necessary corrective actions.

Decision 2

Have the characteristics of the effluents changed to justify changing the SPDES requirements?

Analytical data collected from the recharge basins are evaluated and compared with historical levels to ensure the wastewater is sufficiently characterized and of consistent quality.

If the analytical data are typical of historical levels, **then** the monitoring program will be maintained.

If the evaluation reveals that a contaminant is present at levels approaching or above New York State groundwater effluent standards, **then** the monitoring frequency will be increased and an evaluation conducted to determine the source of the contaminant**.**

If the contaminant source is determined to be a routine source, **then** the contaminant will either be added to the routine compliance-monitoring program and the SPDES permit amended and/or corrective actions pursued to decrease the levels of the containment in the discharge.

Decision 3

Have contaminants been found in recharge basin sediments, at or above Suffolk County Article 12 Action Levels, and therefore are in need of remediation?

Analytical data from the sediment sampling conducted at the recharge basins are compared with historical levels and with the Action Levels contained in SOP No. 9-95 in administration of Article 12 of the Suffolk County Sanitary Code.

If the contaminant is detected at concentrations below the Action Levels, **then** the surveillance monitoring will be continued every 5 years.

If this evaluation reveals that a contaminant is present at concentrations above the Action Levels, **then** an evaluation will be conducted under the Environmental Event Response Procedure to determine the extent of contamination and the necessary corrective actions.

Decision 4

Is the water quality of discharges adequate to support tiger salamander habitats?

Analytical data collected from the recharge basin surveillance monitoring will be compared against action levels developed by the Natural and Cultural Resources Manager to determine adequate water quality for tiger salamander habitat.

If the comparison reveals that the action levels have not been exceeded, **then** monitoring will continue.

If the comparison reveals that the action levels have been exceeded, **then** an evaluation will be conducted under the Environmental Event Response Procedure to determine the source of the water quality degradation and any corrective actions.

Step 6: Specify Acceptable Error Tolerances

The Laboratory possesses a large amount of historical data generated from the recharge basin compliance and surveillance monitoring programs. Metals are the most commonly detected analyte; concentrations are usually below regulatory limits and groundwater effluent standards. Sporadic detections of water treatment byproducts, oil, and grease at or above regulatory limits have been experienced, but are not common. The Laboratory's SPDES permit limits and the associated New York State groundwater effluent standards incorporate a margin of safety. (The limits are below the concentration of contaminants that would produce deleterious effects to human health and the environment.) Therefore, the risk to human health and the environmental is relatively low for the contaminants detected in the effluents, and the sampling frequency presently employed is sufficient to detect possible problems with contaminant discharge levels. The sampling and analytical methods employed in the compliance and surveillance programs are those required by regulation or the Laboratory's SPDES permit, or accepted as industry standard. The methods have been developed to include an acceptable level of error in the resultant analytical data.

As outlined in the Natural Resource Management Plan, the Laboratory monitors water quality at the recharge basins on site to support tiger salamander viability. Currently, the quality of water discharged to the basins provides a good environment for the tiger salamander and promotes breeding. Degradation in the water quality may lead to health problems with the tiger salamander population on site. In addition, inadvertent spills of oil or other hazardous materials during certain periods of the year may have a greater impact to the salamander population due either to direct health effects or effects on breeding success.

Permit excursions and the oversight regarding contaminated sediments due to historic operations are the greatest liability to the Laboratory due to the possible loss of public and regulatory confidence in Laboratory operations. Past permit excursions have been attributable to sampling technician errors, analytical laboratory errors, and contributions from road runoff. These have been addressed through SOPs, including spill response. It is difficult to predict the frequency of such occurrences and their effect on public and regulatory confidence.

Step 7: Optimize the Design

BNL is required by its SPDES permit to conduct monthly or quarterly monitoring of the effluents it discharges to the groundwater recharge basins (outfalls) on site. This is done to ensure the Laboratory's compliance with the discharge limits of the permit, which are set to ensure human health and safety and to prevent detrimental environmental impacts. To supplement this program and to comply with DOE Order 450.1 (2003), BNL has established a quarterly surveillance monitoring program at each of the recharge basins. This program ensures that all contaminants within the discharges have been identified and monitoring conducted accordingly. New contaminants identified through the surveillance monitoring program are either added to the SPDES permit through permit modification or corrective actions are taken to reduce the levels of the contaminant in discharges to the environment.

There have been no changes to the SPDES permit monitoring requirements since 2004, consequently monitoring of recharge basins remain unchanged in 2007. The monitoring requirements for each outfall are summarized below:

Outfall 002 (Recharge Basin HN)

Effluent Parameter	Discharge Limitations, Daily Avg.	Discharge Limitations, Daily Max	Measurement Frequency	Sample Type
Flow	NA	Monitor MGD	Monthly	Recorded
pH (range)	NA	Monitor – 9.0 SU	Monthly	Grab
Oil and Grease	NA	15 mg/L	Monthly	Grab
1,1,1-Trichloroethane	NA	5 µg/L	Quarterly	Grab
Chloroform	NA	7 µg/L	Quarterly	Grab
Bromodichloro-methane	NA	50 µg/L	Quarterly	Grab
HEDP	NA	0.5 mg/L	Quarterly	Grab
Tolytriazole	NA	0.2 mg/L	Quarterly	Grab
Aluminum, Total	NA	2.0 mg/L	Quarterly	Grab

Outfall 002B

Effluent Parameter	Discharge Limitations, Daily Avg.	Discharge Limitations, Daily Max	Measurement Frequency	Sample Type
Flow	NA	Monitor MGD	Monthly	Recorded
pH (range)	NA	Monitor – 9.0 SU	Monthly	Grab
Oil and Grease	NA	15 mg/L	Monthly	Grab
HEDP	NA	0.5 mg/L	Quarterly	Grab
Tolytriazole	NA	0.2 mg/L	Quarterly	Grab

Outfall 003: With the demolition of the HFBR cooling towers and the change of the AGS main magnet secondary-cooling source water (from AGS wells to domestic water), all monitoring requirements for Outfall 003 have been deleted from the SPDES permit. Since the outfall still receives storm water runoff and noncontact cooling water discharges, monitoring will be continued under the environmental surveillance program.

Outfall 004: With the permanent shutdown of the BMRR, all cooling water discharges to Outfall 004 ceased as of June 2001. Therefore, all monitoring requirements have been deleted from the permit.

Outfall 005 (Recharge Basin HS)

Effluent Parameter	Discharge Limitations, Daily Avg.	Discharge Limitations, Daily Max	Measurement Frequency	Sample Type
Flow	NA	Monitor MGD	Monthly	Recorded
pH (range)	NA	Monitor – 8.5 SU	Monthly	Grab
Oil and Grease	NA	15 mg/L	Monthly	Grab
HEDP	NA	0.5 mg/L	Quarterly	Grab
Tolytriazole	NA	0.2 mg/L	Quarterly	Grab
Total Copper	NA	1.0 mg/L	Quarterly	Grab

Outfall 006A (Recharge Basin HT-W)

Effluent Parameter	Discharge Limitations, Daily Avg.	Discharge Limitations, Daily Max	Measurement Frequency	Sample Type
Flow	NA	Monitor MGD	Monthly	Recorded
pH (range)	NA	Monitor – 9.0 SU	Monthly	Grab
Oil and Grease	NA	15 mg/L	Monthly	Grab
HEDP	NA	0.5 mg/L	Quarterly	Grab
Tolytriazole	NA	0.2 mg/L	Quarterly	Grab

Outfall 006B (Recharge Basin HT-E)

Effluent Parameter	Discharge Limitations, Daily Avg.	Discharge Limitations, Daily Max	Measurement Frequency	Sample Type
Flow	NA	Monitor MGD	Monthly	Recorded
pH (range)	NA	Monitor – 9.0 SU	Monthly	Grab
Oil and Grease	NA	15 mg/L	Monthly	Grab
HEDP	NA	0.5 mg/L	Quarterly	Grab
Tolytriazole	NA	0.2 mg/L	Quarterly	Grab

Outfall 007 (Recharge Basin HX)

Effluent Parameter	Discharge Limitations, Daily Avg.	Discharge Limitations, Daily Max	Measurement Frequency	Sample Type
Flow	NA	Monitor GPD	Monthly	Instantaneous
pH (range)	NA	Monitor – 9.0 SU	Monthly	Grab

Outfall 008 (Recharge Basin HW)

Effluent Parameter	Discharge Limitations Daily Avg.	Discharge Limitations, Daily Max	Measurement Frequency	Sample Type
Flow	NA	Monitor GPD	Monthly	Instantaneous
pH (range)	NA	Monitor – 9.0 SU	Monthly	Grab
Oil and Grease	NA	15 mg/L	Monthly	Grab
1,1,1-Trichloroethane	NA	5 µg/L	Monthly	Grab
1,1-Dichloroethane	NA	5 µg/L	Monthly	Grab
Aluminum, Disolved	NA	2.0 mg/L	Quarterly	Grab

Outfall 009: Outfall 009 consists of numerous subsurface wastewater disposal systems that receive predominantly sanitary waste, and steam and air compressor discharges. BNL's SPDES permit does not require effluent monitoring at Outfall 009.

The Laboratory sampled the soil at Outfall 010 in 2000 as part of the environmental surveillance program. Samples collected from the area around Outfall 010 contained elevated concentrations of metals, principally lead. In addition, surface water samples collected from this outfall in 1999 had high metal concentrations. In October 2001, NYSDEC requested that lead, vanadium, aluminum, and copper be added to the sampling requirements for this outfall. These requirements were incorporated in the *BNL 2002 Environmental Monitoring Plan*. In 2006, all contaminated soils were removed from the Outfall and surrounding area. Lead concentrations in this discharge are expected to return to background levels.

Outfall 010 (Recharge Basin CSF)

Effluent Parameter	Discharge Limitations, Daily Avg.	Discharge Limitations, Daily Max	Measurement Frequency	Sample Type
Flow	NA	Monitor GPD	Monthly	Instantaneous
pH (range)	NA	Monitor – 8.5 SU	Monthly	Grab
Oil and Grease	NA	15 mg/L	Monthly	Grab
Aluminum, Dissolved	NA	2.0 mg/L	Quarterly	Grab
Copper, Dissolved	NA	1.0 mg/L	Quarterly	Grab
Vanadium, Dissolved	NA	Monitor	Quarterly	Grab
Lead, Dissolved	NA	0.05 mg/L	Quarterly	Grab

Outfall 011: Outfall 011 receives stormwater runoff from the former HWMF storage yard. Due to low permeable soils, surface runoff from grassy areas and paved roadways comprised a significant portion of flow through this channel. In 2005, the former HWMF was completely remediated and all facilities and contaminated soils were removed in accordance with the OU I ROD and the Remedial Action Work Plan. Low-level subsurface radiological contamination remains in some areas. These areas have been filed with clean soils (nominal 3”) and the area seeded, thereby minimizing the risk of contaminants in the runoff. While the original intent was to remove this discharge, low permeable soils forced the continued use of this man-made channel to direct water flows from the facility. BNL's SPDES permit does not require effluent monitoring at Outfall 011.

Outfall 012 (HZ): Outfall 012 receives noncontact cooling water discharges from Building 902 in the CA-D complex, as well as stormwater discharges from the surrounding area. Quarterly sampling for oil and grease is performed at Outfall 012 under the wastewater surveillance monitoring program.

Historical surveillance monitoring results show that VOCs are usually not present in the Laboratory's discharges above the MDL. Due to the discharge of chlorinated tapwater, trihalomethanes are detected occasionally. Acetone and methylene chloride are also sporatically detected in samples, but at very low levels. Due to the ubiquitous nature of these two contaminants in the contract analytical laboratory, most times the detection is attributed to laboratory cross-contamination. Although the detection of other VOCs is infrequent and quarterly sampling is performed under the compliance program for those stations with a known source term, sampling for these analytes will continue. Monitoring supports the Natural Resource Management Program efforts to protect tiger salamander breeding areas.

Historical anionic analyses of the recharge basin discharges shows that chlorides, sulfates, and nitrates have been detected, but usually only slightly above the respective MDL. Chloride concentrations between January 2000 and September 2005 ranged from less than the MDL of 2 mg/L to a high of 2,810 mg/L (the NYSDEC effluent standard is 500 mg/L). The high result of 2,810 mg/L was detected at recharge basin HW for the February 2004 sampling. This can be attributed to the mixture of salt and sand applied to the roadways of the Laboratory to prevent icing conditions.

Sulfate concentrations range from less than the MDL of 4 mg/L to 107 mg/L (the NYSDEC standard is 500 mg/L). Nitrate concentrations range from less than the MDL to 3.9 mg/L (the effluent standard is 10 mg/L). Although the concentrations of these inorganic compounds are low and the source term (except for road runoff) is minimal, sampling for these analytes will continue.

Historical metal analysis has shown a wide variability depending on the metal species in question, the recharge basin from which the samples were taken, and whether the sample was filtered (dissolved concentration) or unfiltered (total concentration). High concentrations of iron, aluminum, and lead are typically found in unfiltered samples, while almost all concentrations are well within effluent standards in filtered samples. Particulates (native soils) entrained in the runoff are the most likely contributors of these contaminants. There are elevated lead levels in the sediments at the CSF recharge basin due to historical operations at this facility. Mitigative measures taken, including cleaning of upstream storm water manholes and installation of geotextile at the outfall, have reduced the lead found in the CSF discharge. In 2006, the CSF outfall was remediated to remove all soils with lead concentrations greater than 400 ppm. Approximately 1400 cubic yards of soil were removed and disposed off site.

Historically, radiological analyses of the discharge to the on-site recharge basins included gross alpha, gross beta, tritium, and gamma analyses. The maximum gross alpha concentration detected from January 1999 through September 2005 was 15.8 pCi/L at recharge basin HN in October 2003 (the drinking water standard is 15 pCi/L). The maximum gross beta concentration detected during this same period was 53.9 pCi/L at recharge basin HN in February 2000 (the drinking water standard is 50 pCi/L). When either the gross alpha or gross beta limit is exceeded, isotopic analysis must be completed. Gamma analysis was done on all of the elevated samples; potassium-40 was the only radionuclide identified. No radionuclides attributable to BNL operations were detected during this period in any of the recharge basins. The maximum tritium concentration detected during the January 1999 through September 2004 period was 2,280 pCi/L at recharge basin HN in February 2000 (the drinking water standard is 20,000 pCi/L). Tritium is produced through the interaction of high-energy protons and secondary radiation (due to beam/target interactions) with the cooling water within the CA-D beam complex. The collection of radiological samples will continue at the recharge basins in 2006 and beyond, due to the possibility of releases in cooling water discharges.

In 2003, the collection of recharge basin samples during rain events was introduced. Previously, quarterly sampling was performed during dry weather conditions except at basins that receive predominantly stormwater discharges. This practice did not capture the contribution of contaminants within the majority of the stormwater discharges on site. Due to the difficulty in collecting samples during a rain event, many samples have not been collected since 2003. The sampling protocol to collect samples during rain events to properly characterize the contribution of stormwater discharges to the recharge basins on site will be continued.

TOTAL SAMPLING AND ANALYSIS COSTS

There are significant cost increases in 2008 due to increased analytical costs used for SPDES compliance analyses and increases in field sampling labor rates. Soil samples have been added to several recharge basins for 2008.

See Appendix B for the monitoring program for this DQO.

2008 RECHARGE BASIN MONITORING PROGRAM COSTS			
Compliance Program			
Wastewater	Frequency/Year	Unit Cost	Total Cost
TAL Metals	32 analyses	$168	$5,378
Copper	4 analyses	$21	$84
Oil and Grease	84 analyses	$57	$4,788
Volatile Organics	16 analyses	$114	$1,824
HEDP and TTA	20 analyses	$345	$6,900
QA/QC Samples		20%	$3,795
Compliance Monitoring Costs			$22,769
Environmental Surveillance			
Wastewater	Frequency/Year	Unit Cost	Total Cost
Metals	48 analyses	$110	$5,280
Anions	32 analyses	$40	$1,280
Volatile Organics	28 analyses	$80	$2,240
Radiological (gross alpha, gross beta, and tritium)	28 analyses	$70	$1,960
Gamma Analysis	28 analyses	$70	$1,960
Oil and Grease	4 analyses	$45	$180
QA/QC Samples		20%	$2,580
Wastewater Surveillance Costs			$15,408
Soil	Frequency/Year	Unit Cost	Total Cost
Gamma Analysis	4 Analyses	$60	$240
Semi-VOCs	4 Analyses	$170	$680
Pesticides and PCBs	4 Analyses	$140	$560
Metals	4 Analyses	$104	$416
QA/QC		20%	$380
Sediment Surveillance Costs			$2,276
TOTAL Analytical Program Costs			$40,453

2008 SAMPLING COSTS			
Program	Frequency/Year	Unit Cost	Total Cost
Wastewater Sampling	128 Sampling Events	$81	$10,368
Sediment Sampling*	4 Sampling Events	$81	$324
Flowchart Exchange	364 Exchanges per year	$40.50	$14,742
		TOTAL Costs	$25,434

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SEWAGE TREATMENT PLANT

DQO START DATE January 1, 2003

REVISION NUMBER/DATE Rev. 1, October 27, 2004

IMPLEMENTATION DATE January 1, 2005

POINT OF CONTACT Robert Lee (631) 344-3148

SUMMARY OF PROPOSED CHANGES

There are no proposed changes for CY2008. Cost tables have been modified to reflect current analytical pricing. The cost increase, due to increased analytical fees and hourly recharge rates, is approximately $5,000.00

DESCRIPTION AND TECHNICAL BASIS

The STP receives the majority of the wastewater generated by site operations and treats these wastes prior to discharging them to the Peconic River. Approximately 500,000 gallons of wastewater per day are processed by the STP. The treatment process includes separation of heavy inert matter (sand, grit, and other inorganic matter); removal of floatables (e.g., oils); aerobic treatment of the wastewater using a suspended-growth, activated-sludge process; and partial nitrogen removal via oxygen minimization during aeration. The treated waste is then settled, filtered, and treated by ultraviolet disinfection prior to discharge to the Peconic River. Wastewater streams received at the STP include sanitary wastes (kitchen and bathroom wastes); process wastes (industrial cleaning operations, photographic developing rinse water, cooling tower blowdown, air conditioning, and air compressor condensate); glassware cleaning wastewater (plating and metal cleaning rinse water; boiler blowdown, floor drain discharges, etc.); and noncontact cooling water used in experimental and mechanical systems. Radionuclides and chemical constituents are present in these wastewaters as a result of research facility operations, nonregulated releases associated with medical patients, and routine maintenance operations.

In addition to the contaminants released from routine operations, contaminants are also present in deposited sludge from former BNL operations that still reside in the building piping systems and the main sewage collection piping. These contaminants slowly leach into the main wastewater stream and become a component of the STP discharge. Analysis of this sludge has shown it to contain mercury and other inorganics, cesium-137, and other manmade and natural radionuclides. In 2005, several manholes upstream of the STP were cleaned out to mitigate concentrations of radionuclides and metals. The results of this cleanup will be assessed using typical STP analyses.

Potential contaminants entering the STP include all chemicals used in a laboratory setting. The list of contaminants is exhaustive and includes acids and bases, inorganics (metals and salts thereof), volatile and semivolatile organic compounds, conventional pollutants such as nitrogen bearing compounds (organic and inorganic nitrogen compounds, nitrates, nitrites, etc.), phosphates, radioisotopes, oils, as well as others. While administrative procedures are in place to limit the release of chemicals to the STP, accidental releases are possible and routine releases of residual chemicals during glassware cleaning is probable.

In addition to monitoring liquid effluents at the point of release to the environment, several processes that generate and routinely discharge wastewater to the sewage treatment plant are monitored at the source to ensure that the discharge does not compromise the quality of the STP effluent. These sources include photographic developing operations, metal cleaning, and electroplating facilities. The sewage collection system is also monitored in real-time using a gross beta and gamma detection system to ensure that no unplanned releases enter the STP influent/effluent. Discharges are monitored to support documented compliance with the Laboratory's SPDES permit requirements and compliance with DOE Orders. Two monitoring programs are established to meet these requirements. Compliance monitoring specifically addresses SPDES compliance, whereas surveillance monitoring is conducted to meet DOE requirements for radiological releases, improve knowledge of influent and effluent variability, and determine the overall effectiveness of pollution prevention initiatives and engineered controls.

DRIVERS FOR MONITORING BEING CONDUCTED UNDER THIS PROGRAM

__x__ Compliance
__x__ Support compliance
__x__ Surveillance
_____ Restoration

The Federal Water Pollution Control Act (also known as the CAA) establishes a national permitting program, specifies minimum treatment levels for sewage treatment plants, establishes pretreatment standards for indirect discharges of industrial wastes, and develops quality-based water criteria. Wastewater discharges from BNL operations are subject to regulation under the CAA. BNL maintains a SPDES permit issued by NYSDEC, which has been authorized to implement the CWA provisions under Part 750 of Title 6 of the NYCRR (6 NYCRR Part 750). The SPDES permit authorizes releases to the environmental through 13 designated outfalls and specifies the frequency of monitoring and specification of analytical requirements. Effluent limitations specified for each analytical parameter are based on the Peconic River water classification (Class C) and the corresponding water quality standards. Water quality standards are codified under 6 NYCRR Parts 700-705. A map showing the locations of each of the monitoring stations is provided in Chapter 3, Figure 3-3.

In addition to the federal and state water quality regulations, DOE Order 450.1 (2003) requires that DOE sites not only comply with federal and state statutes and regulations, but also establish effluent monitoring and environmental surveillance programs. These programs ensure that DOE operations are conducted in a manner that minimizes impacts public health and the environment, and anticipates and addresses potential environmental problems before causing adverse conditions. Because NYSDEC does not regulate radioactive effluents, DOE Order 450.1 is used as justification for monitoring the STP effluent for radioactivity. With the shutdown of the Laboratory's two research reactors, releases of radioactive components have declined drastically. The Laboratory has implemented procedures and guidelines to maintain releases of radioactivity to the Peconic to a maximum of 25 percent of the drinking water standard.

DATA QUALITY OBJECTIVE ANALYSIS

Step 1: State the Problem

Laboratory operations have the potential to impact the environment either through direct or indirect discharge of wastewater to the environment. Impacts include contamination of drinking water and freshwater ecosystems, including associated aquatic and terrestrial flora and fauna that rely on these water systems for survival. To ensure that wastewater effluents discharged to the environment pose minimal impact to surface waters and groundwater, a sampling and analysis program has been developed that evaluates concentrations of natural and BNL-contributed contaminants and compares them to background levels and established water quality standards. This program has been designed to ensure that:

- BNL complies with regulatory permit monitoring requirements
- Collection and analysis of samples is performed according to EPA, state, or other regulatory agency standards or guidelines
- Samples are representative of routine discharges and monitoring locations are appropriate
- Analytical parameters are appropriate to the processes generating the waste
- Treatment systems remain efficient and effective
- The sampling and analysis program is well documented

The effluent monitoring program relies on both real-time analysis of wastewater streams and collection and analysis of grab and flow-proportional composite samples.

Step 2: Identify the Decisions

The desired decisions for this STP monitoring program can be formulated as questions.

- Are all discharges in compliance with permit limits or ambient water quality standards (or both)? In other words, is no action required?
- Are treatment systems effective at removing or immobilizing contaminants to prevent their release to the environment (i.e., operating as designed)?
- Are radiological releases remaining ALARA and continuing to decline as institutional controls are implemented and enforced?
- Are pollution prevention initiatives effective, and is the quality of the effluent continually improving?

Step 3: Identify Inputs to the Decisions

- Identification of process effluents and their variability contributing to discharges and process knowledge
- Historical and current analyses of process discharges and the STP influent and effluent
- Collection and analysis of samples performed according to EPA, state, or other regulatory agency standards or guidelines
- Collection of samples performed as per the frequency and other requirements of the SPDES permit limits
- Collection of samples representative of routine discharges at appropriate monitoring locations
- STP Operators' logs and records
- STP Operators' instrumentation calibration and maintenance records
- Field Sampling instrumentation calibration and maintenance records
- Field Sampling personnel field logs and records
- Environmental Monitoring SOPs
- Documentation of the sampling and analysis program
- SPDES permit limits or other New York State ambient water quality standards
- Real-time radiological monitoring system data

Step 4: Define the Study Boundaries

This study incorporates all BNL operations that contribute wastewater to the STP, including from the point of generation (e.g., sink) and contributions from the collection system. These operations include facility operations (mechanical systems operations and maintenance), process discharges (metal cleaning operations, photographic developing), and research activities (including bench-top and pilot scale).

DQOs for the liquid effluent monitoring program are derived largely by permit condition or regulatory guidance. The SPDES permit contains specific monitoring requirements, including references to analytical methods, effluent limitations, and sampling frequencies. Identification of analytical parameters is based on known BNL operations and processes, chemical inventories, and historical analyses of wastewater effluents. Effluent limitations directly influence the methodology detection limits and are directly related to established water quality standards. Similarly, the effluent limits and ambient water quality standards are also the basis for the monitoring implemented under the environmental surveillance program. In the case of radiological parameters, the drinking water standard has been utilized as the comparative standard regardless of the potential pathway analysis of the effluent.

Review of the past five years of analytical data shows the quality of the STP effluent to be very consistent, with most volatile and semivolatile organic compounds being nondetectable. In accordance with permit conditions, VOCs are analyzed several times monthly. Annual analysis for semivolatile organic compounds should be adequate to verify characterization. Metallic elements are the only routinely detected contaminants, some of which have been found to occasionally exceed established effluent limits. In 2005, nitrogen was found to exceed permit limits on two occasions, and copper on one. All were attributable to a leaking bypass valve on the primary clarifier, which resulted in untreated waste being discharged to the sand filters. Effluent samples are collected several times monthly in accordance with SPDES permit requirements.

Influent analyses similarly show that only inorganics are routinely detected at concentrations that could potentially exceed SPDES permit limits if they were to pass through the treatment process. Monitoring for inorganics is conducted in conjunction with effluent monitoring so that plant performance can be evaluated. Additionally, monitoring for biological oxygen demand and total suspended solids is also conducted in conjunction with effluent monitoring to assess plant performance.

Surveillance monitoring includes a monthly collection of samples for metals and anions (24-hour composite), volatile organics (grab) and three times (48- to 72-hour composites) weekly for radiological analyses. While radiological analyses over the last 2 years have shown significant decreases in concentration and nuclide detection, public perception issues drive the frequency of sample collection to a very high level.

Step 5: Develop the Decision Rules

Decision 1

Are all discharges in compliance with permit limits or ambient water quality standards (or both)? In other words, is no action required?

Analytical data collected from the STP effluent are continuously compared to SPDES permit limits or New York State ambient water quality standards.

If this comparison yields a violation of either a permit limit or water quality standard, **then** an evaluation is conducted under the Environmental Event Response Procedure to determine the source of the contaminant and additional samples are collected to better define the extent (i.e., duration and magnitude) of the violation.

If the comparison shows the data to be consistently below regulatory limits or standards, **then** the monitoring frequency may be reduced.

Decision 2

Are treatment systems effective at removing or immobilizing contaminants to prevent their release to the environment?

Influent and effluent samples are collected routinely from the STP and compared to historical values. The STP is effective at reducing the concentration of conventional pollutants (e.g., BOD, nitrates or nitrites), and inorganics**.**

If the concentration of either the influent or effluent exceeds typical ranges, **then** an investigation will be conducted to identify sources and additional samples will be collected to determine the magnitude of the excursion. STP operations will be evaluated as part of this investigation including clarifier efficiencies, dissolved oxygen levels, mixed liquor suspended solids, pH, etc.

Decision 3

Are radiological releases remaining ALARA and continuing to decline as institutional controls are implemented and enforced?

Radiological monitoring is conducted in real-time and samples are collected continuously under the environmental surveillance program to ensure the STP effluent is adequately characterized and effluents remain ALARA.

If either routine monitoring or analytical data show levels of radiological constituents approaching administrative limits (i.e., 25 percent of the drinking water standard), **then** the plant may be placed into a bypass mode and the wastewater collected for full evaluation under the Environmental Event Response Procedure.

Decision 4

Are pollution prevention initiatives effective, and is the quality of the STP effluent continually improving as a result of reduced pollutant loads?

The Laboratory has implemented many pollution prevention projects with the goal of reducing the volume of wastewater treated at the STP, reducing releases of chemical and radiological constituents to the STP, and ultimately the Peconic River. Routine monitoring data are compared with historical and permit levels to ensure concentrations decline or, at a minimum, remain below permit limits.

If comparison of data shows levels are increasing, **then** an evaluation is conducted to determine the source of the contaminant, effectiveness of P2 initiatives, and measures to mitigate the increase.

Step 6: Specify Acceptable Error Tolerances

There are several potential errors associated with monitoring of the STP. These include failure to collect a representative sample, failure of a sample collection device, and analytical errors. Because there are several samples collected from the STP monthly, loss of a single sample would not have a detrimental impact on BNL's ability to adequately characterize the effluent from the STP. Sample collection devices are monitored daily to ensure they are operating properly. After collection, the sample is inspected to determine whether its volume is appropriate for the collection period, and whether the sample looks representative (e.g., color, settleable solids, etc.). Deviations are noted on the Field Sampling Team sample logs. If a sample device fails during a sample collection period, or if the sample volume seems inappropriate, samples are either collected on a subsequent day or a grab sample is taken. The field log is appropriately annotated to document the failure of the sample collection device.

Once wastewater enters the plant, it commingles with approximately 500,000 gallons of water contained in the clarifiers. Consequently, if a slug of chemical contaminant were to enter the plant, it would take several days for it to completely discharge. A delay of a day would therefore not preclude detection. Because radiological samples are collected continuously, no impact is expected from a single day's failure of a sample collection device. Real-time monitoring of the influent and effluent also provides added protection against an unmonitored radiological or inorganic discharge.

Analytical errors could have a greater impact on monitoring. Because the sample is consumed in analysis, if an error is made during the analysis, complete loss of a sample is possible. If the error is not discovered soon enough, the loss could be unrecoverable. To prevent such an occurrence, additional sample volume is collected to allow for repeat analyses. However, in 2004 and 2005, there were several instances where methylene chloride was detected at elevated levels. Investigation by BNL revealed the source was likely within the analytical laboratory. Increased surveillance of the laboratories performing analyses, increased QA, and modified methods have been implemented to prevent these occurrences from recurring.

If any of the aforementioned errors or malfunctions were to occur, contingency measures would mitigate loss of samples and potential violations of permit conditions. Failure to implement these mitigative measures could result in SPDES permit violations, which would lead to loss in public and regulatory confidence in BNL operations.

Step 7: Optimize the Design

Monitoring the STP includes routine sampling of both the influent and effluent. Sampling frequency ranges from daily to monthly, depending on the contaminant in question. Samples are tested for radioactivity (daily), conventional pollutants such as Biochemical Oxygen Demand, nitrogen, suspended solids, (several times monthly), volatile organics and inorganics (several times monthly), semivolatile organics (yearly), PCBs (several times quarterly), and pesticides (yearly). Data collected over the past several years show that inorganics are the contaminants most frequently detected at or above permit limits. Organics (both volatile and semivolatile compounds), PCBs, and pesticides are rarely detected above the MDL. Although radioactive elements are detected, they are seldom detected at concentrations approaching limits established by EPA for drinking water, which is the comparative standard adopted by BNL. Additionally, the SPDES permit requires that Whole Effluent Toxicity (WET) testing be conducted quarterly. This sampling evaluates the toxicity of the STP effluent using live organisms. During this testing, organisms are exposed to various concentrations of the STP effluent and their rate of survival and growth (or reproduction) are monitored and compared with controls. This test is conducted for a period of seven days, during which three water samples are collected and used as make-up water for the test organisms. The requirement for WET testing was reimplemented in 2005 with the issuance of the new SPDES permit. Due to questionable performance in 2005, WET testing was continued in 2006 and will again be performed in 2007.

The compliance monitoring program is dictated by SPDES permit conditions. A full list of parameters and the frequency of sample collection appear in Appendix B.

Radiological monitoring is not a condition of the SPDES permit. However, samples are collected from the STP influent and effluent continuously and analyzed three times weekly under the surveillance program. The radiological monitoring frequency was reduced in 2002 from five times weekly to three times weekly. This reduction was justified after a review of radiological data collected over the previous two years showed little detection of tritium and other BNL-generated nuclides in both the STP influent and effluent. In addition, the sewage collection system is monitored in real-time using beta and gamma detection systems to ensure that no unplanned releases occur that could jeopardize the quality of the STP effluent. Surveillance monitoring of the STP includes monthly sampling and analysis for volatile organics, inorganics, and anions. Field data including pH, dissolved oxygen, and conductivity are also recorded. Surveillance monitoring is conducted due to the variability in the quality of the STP influent and is compared with regulatory compliance data. The surveillance monitoring program may be further reduced if the trend of radiological detection continues to decline and if reviews of analytical results show uniform consistency in STP influent and effluent quality.

TOTAL SAMPLING AND ANALYSIS COSTS

Annual Cost Impact Due to Proposed Change: None. However, there is a significant increase in analytical costs associated with SPDES compliance samples collected at the STP.

Total Cost for Monitoring Program for This Media:

2008 SEWAGE TREATMENT PLANT MONITORING PROGRAM COSTS			
Compliance Program			
Sewage Treatment Plant	Frequency/year	Unit Cost	Total Cost
TAL Metals	80 analyses	$168	$13,440
Volatile Organics	64 analyses	$113.75	$7,280
Semi-Volatiles	5 analyses	$240.50	$1,202.50
Wet Chemistry (Nitrogen series, Phosphorus, Cyanide, Fecal Coliform)	112 analyses	$161.25	$18,060
PCBs/Pesticides	12 analyses	$97.50	$1,170
Whole Effluent Toxicity Testing	4 analyses	$2500	$10,000
TSS	80 analyses	$11.25	$900
BOD	92 analyses	$40	$3,680
Herbicides	5 analyses	$104	$520
QA/QC Samples		10%*	$5,625
STP Compliance Monitoring Costs			$61,878
Process Monitoring	Frequency/year	Unit Cost	Total Cost
UCON Oil	4 analyses	$220	$880
TAL Metals	8 analyses	$168	$1,344
Semi-Volatile Organics	8 analyses	$240.50	$1,924
QA/QC Samples		10%	$407
Process Compliance Monitoring Costs			$4,555
Total Compliance Monitoring Costs			$66,433

2008 SEWAGE TREATMENT PLANT MONITORING PROGRAM COSTS *(continued)*			
Environmental Surveillance			
Sewage Treatment Plant	Frequency/year	Unit Cost	Total Cost
TAL Metals	24 analyses	$110	$2,640
Anions	24 analyses	$30	$720
Volatile Organics	12 analyses	$80	$960
Gross alpha and gross beta	324 analyses	$40	$12,960
Tritium	364 analyses	$30	$10,920
Gamma	36 analyses	$70	$2,520
Strontium 90	24 analyses	$100	$2,400
QA/QC Samples		20%	$6,624
		Surveillance Monitoring Costs	$39,744
		Total Analytical Program Costs	$106,097
Sewage Treatment Plant Sampling Program Costs			
Compliance Sampling	Frequency/year	Unit Cost	Total Cost
STP Effluent	28 samples	$40.50	$1,134
STP Influent	28 samples	$40.50	$1,134
Sub-Outfalls	12 samples	$40.50	$486
		Compliance Sampling	$2,754
Surveillance Sampling	Frequency/year	Unit Cost	Total Cost
EA	156 samples	$40.50	$6,318
DA	156 samples	$40.50	$6,318
MH-232	52 samples	$40.50	$2,025
Radiological Monitor Checks (two locations)	500 checks	$40.50	$20,250
		Surveillance Sampling	$34,911
		Total Sampling Program Costs	$37,665
		Total Monitoring Costs for Sewage Treatment Plant	$143,762

See Appendix B for the monitoring program for this DQO.