9 LIQUID EFFLUENTS

CHAPTER CONTENTS

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SURFACE WATER RECHARGE BASINS

DQO START DATE January 1, 2003

REVISION NUMBER/DATE Rev. 7, December 12, 2014

IMPLEMENTATION DATE January 1, 2016

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SUMMARY OF PROPOSED CHANGES

There are no proposed changes for calendar year (CY) 2016.

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 State Pollutant Discharge Elimination System (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 Collider Accelerator Department (CAD) complex.
- Outfall 002B receives cooling tower blowdown from Buildings 1002 and 1004 within the CAD complex (Relativistic Heavy Ion Collider [RHIC]).
- Outfall 003 (Recharge Basin HO) receives once-through cooling water discharges, cooling tower blowdown, and stormwater runoff from the CAD complex, stormwater runoff from areas north and east of the High Flux Beam Reactor (HFBR), and once-through cooling from the Energy, Environment and National Security building (Building 830). There are no SPDES monitoring requirements for this outfall.
- Outfall 004 (Recharge Basin HP) formerly received once through cooling water discharges from the Brookhaven Medical Research Reactor (BMRR), which was shut down in 2000. This basin no longer receives process discharges, but does receive treated groundwater discharges from Comprehensive Environmental Response, Compensation and Liability Act

(CERCLA) remediation activities. Monitoring and reporting is performed in accordance with SPDES equivalency permits, which are managed by BNL's Groundwater Protection Group (GPG)..

- Outfall 005 (Recharge Basin HS) receives predominately stormwater runoff and minimal cooling tower blowdown and once-through cooling water from the NSLS-II and the Chemistry Department. This basin also receives treated groundwater from the Freon-11 and Building 96 Treatment Systems, which are managed by the GPG and reporting performed in accordance with a SPDES equivalency permit.
- Outfall 006A (Recharge Basin HT-W) receives noncontact cooling water discharges, cooling tower blowdown, floor drain discharges (minor), and stormwater runoff from the Alternating Gradient Synchrotron (AGS) complex.
- Outfall 006B (Recharge Basin HT-E) receives noncontact cooling water discharges, cooling tower blowdown, floor drain discharges (minor), and stormwater runoff from the AGS complex.
- Outfall 007 (Recharge Basin HX) receives filter backwash water from the Water Treatment Facility.
- Outfall 008 (Recharge Basin HW) receives stormwater runoff from the NSLS-II 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 (Central Steam Facility [CSF] recharge basin) receives stormwater runoff from the CSF area.
- Outfall 011 (former Hazardous Waste Management Facility [HWMF]) formerly received stormwater runoff from the paved areas of the HWMF. The area has since been remediated, and all buildings and most roads have been 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 CAD complex. There are no SPDES monitoring requirements for this outfall.

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 Clean Water Act [CWA]) establishes a national permitting program that sets effluent standards for direct discharges to water's of the United States and pretreatment standards for indirect discharges of industrial wastes. Under the CWA, the Environmental Protection Agency (EPA) also develops quality-based water criteria. Wastewater discharges from Laboratory operations are subject to the CWA and are regulated through BNL's SPDES permit issued by NYSDEC, who is authorized to implement CWA provisions under Part 750 of Title 6 of the New York Codes, Rules, and Regulations (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 703.6. 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 436.1 (2011), *Departmental Sustainability*, requires sites to maintain and Environmental Management System (EMS). BNL's EMS specifies requirements for conducting general surveillance monitoring to evaluate the effects, if any, of site operations on the environment. Because NYSDEC does not regulate radioactive effluents, DOE Order 458.1 Admin Chg 3 (2013), *Radiation Protection of the Public and Environment*, is used as justification for radiological monitoring of recharge basins.

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. The Suffolk County Sanitary Code Standard Operating Procedure (SOP) No**.** 9-95, Pumpout and Soil Cleanup Criteria (January 2011), 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 pre-discharge 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 BNL's on-site recharge basins. NYSDEC's 6 NYCRR Part 375 (Environmental Remediation Programs, December 14, 2006) is also referenced and used, as appropriate, when evaluating on-site recharge basin sediment sampling results.

BNL's Natural Resource Management Plan was updated in 2011 (BNL 2011) and continues 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 incorporates 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 and/or 6 NYCRR Part 375 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 and/or 6 NYCRR Part 375 Action Levels for soil cleanup, as applicable
- 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 BNL's SPDES permit
- Collection of samples representative of routine discharges at appropriate monitoring locations
- Review of analytical results by project managers in accordance with Environmental Protection Division (EPD) data review procedures to ensure data are of acceptable quality
- Field Sampling Team instrumentation calibration and maintenance records
- Field Sampling Team field logs and records
- Environmental Monitoring SOPs
- Documentation of the sampling and analysis program
- Historic sediment sampling analytical results

Step 4: Define the Study Boundaries

The study boundaries incorporate all watersheds that drain into the recharge basins. BNL'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 direct discharges to groundwater at the recharge basins and stormwater outfalls on site. Monitoring in support of the BNL'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 quality of

stormwater and process discharges observed over the past several years, surveillance monitoring will be conducted semi-annually 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.

As outlined in BNL's 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 healthy environment for the tiger salamander and promotes breeding. Degradation in the water quality on site may lead to health problems with the tiger salamander population. 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.

Discharges of contaminants in wastewater will eventually result in accumulation in the recharge basin sediments. The accumulation of contaminants is, however, slow and the sampling frequency is therefore longer than for wastewater. Historically, sediment sampling was performed periodically rather than on a routine basis. Beginning in 2003, a five-year cycle sediment sampling program was instituted to assess accumulation of any contaminants in the discharged wastewater to the recharge basins. Results to date have shown that there is little impact on sediment quality. In some cases, the concentrations of contaminants are above the Suffolk County Article 12 Cleanup Objectives, but below the Action Levels; consequently, no remediation has been required. The most recent sampling event occurred in CY 2012. Review of analytical results from the recharge basins shows that all parameters are less than Suffolk County Action Levels or NYSDEC Part 375 Cleanup Objectives with the exception of a few semi-volatile organic compounds (SVOC) found in Basin HT-W. Additional sediment sampling of the HT-W Basin was completed in CY 2013 to confirm original SVOC results and determine if remediation is required. The scope of this sampling effort included the collection of five additional surface samples downstream of the outfall for SVOC analysis. Review of these data showed that, with the exception of one sample location, SVOC results were all below SCDHS action levels. One sample collected furthest downstream of the outfall contained three Polycyclic Aromatic Hydrocarbons (PAHs) that were just above SCDHS action levels. BNL will be coordinating a characterization effort with SCDHS to determine if any further action is necessary at this location.

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 at its approved frequency.

If the comparison yields an exceedance of either a permit limit or water quality standard, **then** an evaluation will be conducted in accordance with BNL's Events/Issues Management Subject Area, as appropriate, 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 help determine whether

corrective actions are required. For SPDES permit excursions that are reported through a Discharge Monitoring Report (DMR), standard reporting methods (i.e., letter and preparation of nonconformance report) will be completed and submitted along with the DMR.

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 as defined. **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 investigation conducted to determine the source of the contaminant**.**

If the contaminant source is determined to be associated with 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 will be pursued to decrease or eliminate 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 and/or 6 NYCRR Part 375 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 and/or 6 NYCRR Part 375, as appropriate.

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 in accordance with the Event/Issues Management Subject Area, as appropriate, 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 recharge basin surveillance monitoring will be compared against action levels developed by BNL's 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 at its approved frequency.

If the comparison reveals that the action levels have been exceeded, **then** an evaluation will be conducted in accordance with the Events/Issues Management Subject Area, as appropriate, to determine the source of the water quality degradation and the necessary corrective actions.

Step 6: Specify Acceptable Error Tolerances

The Laboratory retains a large amount of historical data generated from the recharge basin compliance and surveillance monitoring programs. Metals are the most commonly detected analyte with concentrations that are usually below regulatory limits and groundwater effluent standards. There have been periodic detections of water treatment byproducts and oil and grease at or above regulatory limits. BNL'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 environment is relatively low for the contaminants detected in the effluents. The sampling frequency outlined in Step 7 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 BNL'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.

Permit excursions and contaminated sediments due to historic operations could result in loss of public and regulatory confidence in Laboratory operations. Past permit excursions have been attributable to sampling errors, analytical laboratory errors, and contributions from road runoff, which are difficult to control/predict. These sampling and analytical errors have been addressed through SOPs and prompt spill response helps control road runoff. 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. Monitoring results are used to verify 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 the SPDES program, and to comply with DOE Order 436.1 Admin Chg (2013), the Laboratory has established a surveillance monitoring program at each of the recharge basins. Starting in CY 2013, this program changed from quarterly surveillance monitoring to semi-annual based on historical data. 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 BNL's SPDES permit monitoring requirements since the last revision. The SPDES 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
Bromodichloromethane	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

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 stormwater 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 – 8.5 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, Dissolved	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.

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 formerly received stormwater runoff from the paved areas of the HWMF. The area has since been remediated, and all buildings and most roads have been demolished. This discharge currently redirects accumulated rainwater from one area to another. The Laboratory's SPDES permit does not require effluent monitoring for this outfall.

Outfall 012 (HZ): Outfall 012 receives noncontact cooling water discharges from Building 902 in the CAD complex, as well as stormwater discharges from the surrounding area. Although monitoring is not required under BNL's SPDES permit, this outfall is sampled under the Laboratory's environmental surveillance program.

A general discussion of historical surveillance monitoring results for VOCs, anions, metals, and radiological parameters and associated sampling frequency is provided on the following page:

Surveillance monitoring results show that VOCs are usually not present in the BNL's discharges above the minimum detection limit (MDL). Due to the discharge of chlorinated tap water, trihalomethanes are detected occasionally. Acetone and methylene chloride are also sporadically detected in samples, but at very low levels. Due to the ubiquitous nature of these two contaminants in the contract analytical laboratory, detections are usually 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 potential source, sampling for these analytes will continue under the surveillance monitoring program on a semi-annual basis. Monitoring also supports BNL's Natural Resource Management Program efforts to protect tiger salamander breeding areas.

An 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 during winter months may be high due to runoff of salt used in road maintenance. Due to the potential impact of these contaminants on wildlife and groundwater, semi-annual water quality sampling and analysis will continue.

Metals analyses have 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. Radiological analyses of the discharge to on-site recharge basins includes gross alpha, gross beta, tritium, and gamma analyses. While gross alpha and beta analyses show detectable levels of radioactivity, gamma analysis shows all nuclides to be naturally occurring; potassium-40 is typically the only radionuclide identified. No radionuclides attributable to BNL operations are detected in any of the recharge basins. Tritium concen-

trations at the recharge basins over the past several years are typically below laboratory method detection limits. However, if detected, the source is most likely from the interaction of high-energy protons and secondary radiation (due to beam/target interactions) with the cooling water within the CAD beam complex. The collection of radiological samples will continue at the re-charge basins on a semi-annual basis due to the possibility of releases in cooling water dis-charges.

See Appendix B for the monitoring program for this DQO.

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SEWAGE TREATMENT PLANT

DQO START DATE January 1, 2003

REVISION NUMBER/DATE Rev. 4, December 12, 2014

IMPLEMENTATION DATE January 1, 2016

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SUMMARY OF PROPOSED CHANGES

There are no proposed changes for calendar year (CY) 2016.

DESCRIPTION AND TECHNICAL BASIS

BNL's Sewage Treatment Plant (STP) receives the majority of the wastewater generated by site operations and treats these wastes prior to discharging them to groundwater via recharge basins. Approximately 300,000 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 through a disc filtration system, and discharged to one of four recharge beds. Wastewater streams received at the STP include sanitary wastes (kitchen and bathroom wastes); process wastes (industrial cleaning operations, 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. Past analysis of this sludge has shown it to contain mercury and other inorganics, cesium-137 (Cs-137), and other manmade and natural radionuclides; however, continued pollution prevention initiatives, engineering controls and clean-up activities have allowed BNL to continue shipping new sludge directly to the County-operated Bergen Point facility. Representative samples of the sludge will continue to be collected prior to shipment to Bergen Point to ensure waste acceptance criteria continue to be met. Since 2008, all waste characterization samples of sludge have been acceptable and subsequently released to the county sewage works for disposal.

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 STP are monitored at the source to ensure that the discharge does not compromise the quality of the STP effluent (e.g., metal cleaning facility). 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 BNL's State Pollutant Discharge Elimination System (SPDES) permit requirements and compliance with DOE Orders. Two monitoring programs have been established to meet these requirements. Compliance monitoring specifically addresses SPDES compliance, whereas surveillance monitoring is conducted to meet DOE requirements for radiological releases, improves knowledge of influent and effluent variability, and determines 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 Clean Water Act (CWA)) 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 CWA. The Laboratory maintains a SPDES permit issued by NYSDEC, which has been authorized to implement the CWA provisions under Part 750 of Title 6 of the New York Codes, Rules, and Regulations (NYCRR) (6 NYCRR Part 750). BNL’s SPDES permit authorizes releases to the environment through 13 designated outfalls and specifies the frequency of monitoring and specification of analytical requirements. Effluent limitations specified for each analytical parameter will be based on discharges to a source of drinking water (Class GA) 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 436.1 (2011), *Departmental Sustainability*, requires DOE sites to maintain and Environmental Management System (EMS). BNL's EMS specifies requirements for conducting general surveillance monitoring to evaluate the effects, if any, of site operations on the environment. Because NYSDEC does not regulate radioactive effluents, DOE Order 458.1 Admin Chg. 3 (2013), *Radiation Protection of the Public and Environment*, 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. BNL has implemented procedures and guidelines to maintain releases of radioactivity to Outfall 001 (STP) 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
- Analytical results are reviewed by project managers in accordance with Environmental Protection Division (EPD) data review procedures to ensure data is of good quality and is representative of discharges to the environment
- 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 "As Low as Reasonably Achievable" (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

- Review of analytical results by project manager in accordance with EPD data review procedures to ensure data is of acceptable quality
- STP Operators' logs and records
- STP Operators' instrumentation calibration and maintenance records
- Field Sampling Team instrumentation calibration and maintenance records
- Field Sampling personnel field logs and records
- Environmental Monitoring Standard Operating Procedures (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), and research activities (including bench-top and pilot scale).

Data Quality Objectives (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.

Effluent samples will continue to be collected twice monthly in accordance with SPDES permit requirements to ensure effluent limits are being met. Review of the past 5 years of analytical data shows the quality of the STP effluent to be very consistent, with most volatile and semivolatile organic compounds (VOCs/SVOCs) being non-detectable. In accordance with permit conditions, VOCs are analyzed twice monthly. Annual analysis for SVOCs is adequate to verify characterization. Metallic elements are the only routinely detected contaminants, some of which have been found to occasionally exceed established effluent limits.

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 of influent water for inorganics, biological oxygen demand, and total suspended solids is conducted in conjunction with effluent monitoring so that plant performance can be evaluated.

Based on review of analytical data over the past 5 years, collection of samples for metals, anions, and VOCs analysis will no longer be performed as part of the surveillance monitoring program. The STP influent and effluent are sampled and analyzed for these parameters at least twice per month as part of the compliance program. Except for an occasional low-level detection of tritium, radionuclides at the STP have not been detected for several years. Therefore, sample collection frequency for gross alpha/beta, tritium, gamma, and strontium-90 will be reduced from three days per week composite samples to weekly composite samples.

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 in accordance with BNL's Events/Issues Management Subject Area, as appropriate, 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. For SPDES permit excursions that are reported through a Discharge Monitoring Report (DMR), standard reporting methods (i.e., letter and preparation of non-conformance report) will be completed and submitted along with the DMR.

If the comparison shows the data to be consistently below regulatory limits or standards, **then** the monitoring will continue as required by the SPDES permit and, for the surveillance monitoring program, 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., Biological Oxygen Demand [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 real-time 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 conducted in accordance with BNL's Events/Issues Management Subject Area, as appropriate.

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 is continuously evaluating and implementing pollution prevention projects with the goal of reducing the volume of wastewater treated at the STP and reducing releases of chemical and radiological constituents to the STP. 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 pollution prevention (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 300,000 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 most of the sample volume 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. In addition, increased surveillance of the laboratories performing analyses, increased quality assurance, and modified methods have been implemented, as necessary, to prevent analytical errors from occurring.

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 could 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 BOD, nitrogen, suspended solids, total dissolved solids (twice monthly), VOCs and inorganics (twice monthly), and SVOCs (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) 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 the Laboratory. The compliance monitoring program is dictated by the SPDES permit. A full list of parameters and the frequency of sample collection appear in Appendix B of this report.

Radiological monitoring is not a condition of the SPDES permit. However, samples are collected from the STP influent and effluent continuously and are analyzed weekly under the surveillance program. The radiological monitoring frequency was reduced in 2013 from three times weekly to weekly. This reduction was justified after a review of radiological data collected over the previous 5 years showed only an occasional low-level detection of tritium and no detection of any 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 detect unplanned releases, which could jeopardize the quality of the STP effluent. Surveillance monitoring of the STP for VOCs, inorganics, and anions will no longer be performed. These parameters are monitored as part of the Compliance Program. Field data including pH, dissolved oxygen, and conductivity are also recorded. 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.

See Appendix B for the monitoring program for this DQO.

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