WEST VALLEY DEMONSTRATION PROJECT ANNUAL SITE ENVIRONMENTAL REPORT CALENDAR YEAR 2015

Prepared by: CH2M HILL BWXT West Valley, LLC
Prepared for: U.S. Department of Energy, DOE-WVDP
Under: Contract DE-EM0001529

September 2016
10282 Rock Springs Road
West Valley, New York 14171-9799

Department of Energy
West Valley Demonstration Project
10282 Rock Springs Road
West Valley, NY 14171-9799

To the Reader:

This report, prepared by the United States (U.S.) Department of Energy (DOE) West Valley Demonstration Project (WVDP), summarizes the environmental protection program at the WVDP for calendar year 2015.

Monitoring and surveillance of the WVDP facilities are conducted to verify that public health and safety and the environment are protected. The quality assurance requirements applied to the environmental monitoring program by the DOE confirm the validity and accuracy of the monitoring data.

At the WVDP, radiological air emissions are controlled and permitted by the U.S. Environmental Protection Agency (EPA) under National Emission Standards for Hazardous Air Pollutants, Subpart H, regulations. Nonradiological liquid effluent discharges are controlled and permitted through the New York State Pollutant Discharge Elimination System. Generation, storage, and treatment of hazardous and mixed wastes are conducted in accordance with Resource Conservation and Recovery Act interim status regulations and New York State Environmental Conservation Law.

Air, surface water, groundwater, storm water, soil, sediment, and biological samples are collected and analyzed for radiological and nonradiological constituents. The resulting data are evaluated to assess effects of activities at the WVDP on the nearby public and the environment.

The calculated dose to the hypothetical critical receptor from airborne radiological emissions in 2015 was estimated to be <4.7% of the 10-millirem (mrem) EPA limit. The dose from combined airborne and water-borne radiological releases in 2015 to the same individual was estimated to be <0.49% of the 100-mrem DOE limit, verifying that dose received by off-site residents continues to be minimal.

Safety performance at the WVDP during 2015 continued to be outstanding. In 2015, the employees achieved 1.7 million consecutive safe work hours without a lost-time work injury or illness, while accomplishing complex decontamination, demolition, and waste management activities.

CH2M HILL BWXT West Valley, LLC (CHBWV) continued to perform Phase 1 Decommissioning and Facility Disposition activities for DOE during 2015. The term of the Phase 1 Decommissioning and Facility Disposition contract is from August 2011 to March 2020.

If you have any questions or comments about the information in this report, please contact WVDP Communications at (716) 942-4601 or by email at Lynette.Bennett@chbwv.com. You may also complete and return the enclosed survey.

Sincerely,

B. C. B

Bryan C. Bower, Director
West Valley Demonstration Project

WVDP Annual Site Environmental Report

Can We Make This Report More Useful to You?

We want to make the *WVDP Annual Site Environmental Report* useful to its readers. Please take a few minutes to let us know if the report meets your needs. You can e-mail or mail this survey, or call Lynette Bennett at:

phone: (716) 942-4601
email: Lynette.Bennett@chbwv.com
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10282 ROCK SPRINGS ROAD
WEST VALLEY, NY 14171

1. How do you use the *WVDP Annual Site Environmental Report?*

- ☐ To learn general information about the WVDP
- ☐ To learn about doses received for the current year
- ☐ To learn about site compliance information
- ☐ To gather effluent or environmental surveillance data
- ☐ Other: ______________________________

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- ☐ Graduate degree: ☐ Scientific ☐ Nonscientific
- ☐ Undergraduate degree: ☐ Scientific ☐ Nonscientific
- ☐ Experience with science outside college setting
- ☐ Little or no scientific background

West Valley Demonstration Project

Annual Site Environmental Report

for

Calendar Year 2015

Prepared for the U.S. Department of Energy

West Valley Demonstration Project Office

Under: Contract DE-EM0001529

September 2016

CH2M HILL BWXT West Valley, LLC

10282 Rock Springs Road

West Valley, New York 14171-9799

Disclaimer

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Preface

Environmental monitoring at the West Valley Demonstration Project (WVDP) was conducted by CH2M HILL BWXT West Valley, LLC (CHBWV)[1], under contract to the United States Department of Energy. The data collected provide a historical record of radionuclide and radiation levels, and chemical data from natural and man-made sources in the survey area. The data also document the chemical and radiological quality of the groundwater on and around the WVDP and of the air and water released by the WVDP. Meteorological data are also presented.

It is the policy of CHBWV to conduct the WVDP in a safe, compliant, and cost-effective manner that protects human health and the environment. We achieve this by integrating environmental requirements and pollution prevention into our work planning and execution, and taking actions to minimize the environmental impacts of our operations. We establish and communicate environmental responsibilities, provide environmental training to our workforce, and implement controls to mitigate environmental hazards. These activities are conducted in accordance with our Environmental Management System.

This report represents a single, comprehensive source of on-site and off-site environmental data collected during 2015. The environmental monitoring program and results are discussed in the body of this report. Additional monitoring information is presented in the appendices. Appendix A contains maps of on-site and off-site sampling locations and a summary of the site environmental monitoring schedule. Appendices B through G contain summaries of data obtained during 2015 and are intended for those readers interested in more detail than is provided in the main body of the report. Appendix H contains a copy of the WVDP Act. The entire Annual Site Environmental Report (ASER) is available on compact disk (CD) and on the DOE website (http://www.wv.doe.gov). Hardcopy versions of the ASER do not include printed data tables (Appendices B through G) and the WVDP Act (Appendix H) but do include the complete report on CD inside the back cover.

A reader opinion survey has been inserted in this report. Requests for digital copies of the 2015 ASER and questions regarding the report should be referred to WVDP Communications, 10282 Rock Springs Road, West Valley, New York 14171 (telephone: 716-942-4601). Additional Project information, including links to the current and previous WVDP ASERs, is available on the internet at http://www.wv.doe.gov.

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[1]In April 2015, CHBWV changed it's name from CH2MHILL • Babcock & Wilcox West Valley, LLC to CH2M HILL BWXT West Valley, LLC. The CHBWV acronym remained the same.

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EXECUTIVE SUMMARY

Purpose of This Report

The Annual Site Environmental Report for the West Valley Demonstration Project (WVDP or Project) is published to provide information about environmental conditions at the WVDP to members of the public, to the United States (U.S.) Department of Energy (DOE) Headquarters, and to other interested stakeholders. In accordance with DOE Order 231.1B, "Environment, Safety, and Health Reporting," this document summarizes calendar year 2015 environmental monitoring data, describes the performance of the WVDP's environmental management system (EMS), confirms compliance with environmental standards and regulations, and highlights important environmental monitoring programs. WVDP activities are conducted in cooperation with the New York State Energy Research and Development Authority (NYSERDA).

Project Status

The WVDP is located on the site of a former commercial nuclear fuel reprocessing plant, which shut down in 1976. In 1980, Public Law 96-368 (the WVDP Act) was passed, which authorized DOE to demonstrate a method for solidifying approximately 660,000 gallons (gal) (2.5 million liters [L]) of liquid high-level radioactive waste (HLW) that remained at the site. Solidification by vitrification (VIT) of the HLW began in 1996 and was completed in September 2002. Activities for decontaminating and dismantling the facilities and for managing and disposing of wastes were then initiated and continued through the end of 2015.

Record of Decision. In April 2010, DOE released a Record of Decision (ROD) for the Final Environmental Impact Statement (FEIS) for the WVDP and the Western New York Nuclear Service Center (WNYNSC) ("Final Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center," DOE/EIS-0226, issued on January 29, 2010). In the FEIS, DOE and NYSERDA evaluated four alternatives: Site-wide Removal, Site-wide Close-In-Place, Phased Decisionmaking, and No Action. Phased Decisionmaking was identified as the preferred alternative. Under this alternative, decommissioning will be conducted in two phases.

During Phase 1 Site Decommissioning, a number of highly contaminated facilities will be removed under a facilities disposition contract awarded in 2011 (discussed below). Soil remediation actions will be performed under a separate Phase 1 contract following the facilities disposition contract. Phase 1 also includes characterization work and focused studies that will facilitate future decisionmaking for the remaining facilities or areas on the property. The original estimated cost for all of the Phase 1 work was approximately 1.2 billion dollars (FEIS, 2010). The complete FEIS and the ROD can be viewed online at the DOE-WVDP website at www.wv.doe.gov.

Phase 2 will address the Waste Tank Farm (WTF), the waste disposal areas, and the non-source area of the groundwater plume. DOE intends to complete any remaining WVDP decisionmaking with its Phase 2 decision (to be made within 10 years of the ROD) in a Supplemental EIS and expects to select either removal or in-place closure, or a combination of those two for the portions of the site for which it has decommissioning responsibility. In September 2015, DOE awarded a contract for preparation of a probabilistic performance assessment to identify and reduce uncertainty in decommissioning decisions for the remaining facilities. In December 2015, DOE issued a request for information seeking feedback from contractors and interested parties regarding their capabilities and proposed innovative approaches for performance of the Phase 2 Supplemental EIS.

DOE/NYSERDA Consent Decree. DOE and NYSERDA reached an agreement on the cost sharing for cleanup of the WVDP and the WNYNSC by signing a Consent Decree on August 17, 2010 in the U.S. District Court, Western District of New York. While the Consent Decree defines the cost-sharing agreement, it does not affect in any way what the cleanup will be or the end state of the WVDP and the WNYNSC.

Facilities Disposition Contract. On June 30, 2011, DOE awarded the Phase 1 Decommissioning and Facility Disposition Contract to CH2M HILL • Babcock & Wilcox, West Valley, LLC (CHBWV), made up of CH2M HILL, Babcock & Wilcox Technical Services Group, Inc., and Environmental Chemical Corporation. In April 2015, CHBWV changed its name to CH2M HILL BWXT West Valley. The acronym CHBWV has not changed. CHBWV's small business protégé is American Demolition and Nuclear Decommissioning, Inc. The term of the contract is approximately nine years. The scope of the contract is divided into four primary milestones. The following provides the contract status at the end of calendar year (CY) 2015 for each of these milestones:

Milestone 1 - Complete relocation of the canisters of vitrified HLW at the WVDP:

The 2015 milestone 1 activities included procurement and operational testing of specialized equipment designed for remote-controlled decontamination, removal, and over packing the canisters into highly shielded Vertical Storage Casks (VSCs) inside the Main Plant Process Building (MPPB), and transportation of these 87.5 ton casks to the newly constructed outdoor interim storage pad on the WVDP south plateau. The successful and safe loading and relocation of four HLW storage casks, each containing five HLW canisters, to the on-site HLW Cask Storage Pad was completed in December 2015.

Removal of a HLW canister from the MPPB storage rack using remote-controlled equipment

Four casks were placed on the interim HLW Cask Storage Pad in 2015

Shipment of legacy waste

Milestone 2 - Processing, shipment and off-site disposal of all legacy waste (waste existing at the WVDP when the Phase 1 Decommissioning and Facility Disposition Contract was issued to CHBWV):

During 2015, specialized equipment was procured to obtain dose rates of the remaining containers of non-HLW that will be removed from the MPPB former Chemical Process Cell (CPC). Legacy low-level waste (LLW) shipment is 50% complete, legacy mixed LLW shipment is 100% complete, and legacy industrial and hazardous waste shipment is 100% complete. The Nuclear Regulatory Commission (NRC) issued a "Special Package Authorization (SPA)" for the Vitrification (VIT) melter transportation package in 2015. Plans were subsequently made to install the required impact limiter on the package, and to ship the melter package and two additional oversized LLW packages to an offsite disposal facility.

Removal of process vessels from the MPPB in preparation for demolition

Milestone 3 - **Demolition and removal of the MPPB and the VIT facility:**

Preparations continued for demolition of the MPPB and VIT facility, including characterization of high-hazard areas, and removal of tanks/vessels, piping, ceiling grids, lighting, and asbestos. Additional preparations for demolition involved isolation of utility lines, and decontamination of the VIT cell and MPPB cells including removal of equipment and debris. Installation of a Replacement Ventilation System (RVS) in the MPPB began in 2014. The new system began operation in August 2015.

Milestone 4 - **Completion of all work described in the Performance Work Statement including disposition of the Balance of Site Facilities:**

During 2015, maintenance and repair of infrastructure continued. Some of this work involved personnel relocation from the Administration Building in preparation for demolition of this structure. An iron treatment filter was added to the groundwater water supply system for potable water in 2015. The system was converted from a surface water supply to a groundwater water supply in 2014 to allow for future closure and demolition of the site utility room attached to the MPPB.

Repairs to the Lake 1 Spillway, completed during 2014, were damaged as a result of the significant amount of rain that fell over a short time period on July 14, 2015. Removal of debris downstream of the dams and short term repairs were made in 2015. During 2015, the discharge from storm water outfall S09 was rerouted to alleviate erosion of the lagoon embankment.

Rerouted S09 storm water outfall discharge

The CHBWV contract scope also includes continued safe operation of the site through:

- managing and maintaining site infrastructure;
- maintaining the lagoon system;
- conducting environmental monitoring and maintaining compliance with WVDP regulatory and permit requirements; and
- maintaining the WTF, the NRC licensed-disposal area (NDA), and the north plateau Permeable Treatment Wall (PTW).

Major Site Programs

Safety Success. The radiological and hazardous work environment at the WVDP warrants strict adherence to safety procedures. As of December 31, 2015, CHBWV and its subcontractors achieved approximately 1.7 million consecutive work hours without a lost-time work accident or illness, one of the best safety records in the DOE complex.

Waste Tank Farm (WTF) Tank and Vault Drying System (T&VDS). With an ultimate goal of preventing the underground steel tanks from corroding under ambient tank and vault conditions, the WVDP installed a T&VDS in the WTF in 2010. The T&VDS was designed to reduce the liquid volumes in the tanks, thereby reducing the harmful effects of corrosion on the underground waste tanks situated within concrete vaults originally installed in the 1960s. The system has operated effectively since startup with only temporary shutdowns for minor repairs. The system has achieved the following results as of the end of 2015:

- maintained dry conditions in tanks 8D-1 and 8D-2;
- maintained liquid levels below level indicators in tanks 8D-1 and 8D-2 vaults and pans;
- maintained the liquid level in tank 8D-3 below the level indicator and reduced liquid levels in tank 8D-4;
- maintained the dry condition of the tank 8D-3/8D-4 vault; and
- continued to achieve lower relative humidity in the tanks and vaults reducing the corrosion rate.

System operations continue to be monitored to reduce air infiltration, and individual air flows are adjusted to maintain a target of <30% relative humidity in the tanks and vaults.

NRC-Licensed Disposal Area (NDA). Water level data indicate the cap and slurry wall installed in 2008 are causing the weathered Lavery till to become dry in some areas as designed. Reduced water volume extracted from the interceptor trench since the cap and slurry wall were installed also continues to indicate groundwater flow through the NDA is effectively being reduced.

Permeable Treatment Wall (PTW) Performance. The full-scale PTW, installed in November 2010, has now been monitored for five years. Performance monitoring data collected to date continue to indicate:

- groundwater flow patterns in the PTW area are similar to those observed prior to PTW construction indicating that the PTW installation does not substantially alter groundwater flow conditions on the north plateau;
- groundwater treatment by ion exchange is occurring as evidenced by the fact that strontium-90 activity in groundwater inside the PTW is either not detected or substantially lower overall than strontium-90 activity levels upgradient of the PTW;
- geochemical differences observed in groundwater that has migrated into and through the zeolite also indicate that ion exchange (i.e., treatment) is occurring;
- the most elevated concentrations of strontium-90 observed inside the PTW occur within relatively narrow zones which are located where plume migration upgradient of the PTW follows preferential groundwater flow paths, such as preferential migration through the slack-water sequence;
- strontium-90 activity in groundwater immediately downgradient of the PTW has decreased overall; and
- strontium-90 activity that had already migrated past the PTW prior to its installation is continuing to migrate downgradient. However, strontium-90 concentrations are decreasing in some wells further downgradient of the PTW and are expected to decrease over time as groundwater treated by the PTW flows towards these areas.

Based on the 2015 sampling results, there were no detected strontium-90 concentrations greater than 1.0E-05 µCi/mL (10,000 pico-Curies per liter [pCi/L]) downgradient of the PTW and no detected strontium-90 concentrations above 1.0E-06 µCi/mL (1,000 pCi/L) in the downgradient eastern lobe of the strontium-90 plume.

These observations indicate the ongoing processes within the PTW continue to achieve the remedial action objectives of the PTW defined in the PTW Performance Monitoring Plan.

Environmental Management System (EMS)

The WVDP EMS satisfies the requirements of DOE Order 436.1, "Departmental Sustainability," and is a key part of the WVDP Integrated Safety Management System. In 2015, WVDP employees continued to demonstrate their commitment to an all-inclusive approach to safety, coordinating the EMS with other safety management and work planning processes through the integrated environmental, health, and safety management program. CHBWV received a certificate of registration for its EMS under International Organization for Standardization 14001:2004 on July 31, 2012 and was recertified in 2015.

Compliance. WVDP management continued to provide strong support for environmental compliance in 2015. Requirements and guidance from applicable state and federal statutes, executive orders, DOE orders, and standards are integrated into the Project's compliance program.

- There were no New York State Pollutant Discharge Elimination System (SPDES) permit limit noncompliance events in CY 2015.

- Over 103 tons of material was diverted from landfills through the WVDP recycling program in 2015. Additionally, the scrap metal recycling program was restarted in 2015.

- Inspections by the New York State Department of Environmental Conservation showed continued Project compliance with applicable environmental and health regulations in 2015.

- Requirements of the Emergency Planning and Community Right-to-Know Act were met in 2015 by collecting information about hazardous materials used at the Project and making this information available to the appropriate emergency response organizations.

- No exceedances to the Environmental Protection Agency's National Emission Standards for Hazardous Air Pollutants (NESHAP) dose standard occurred in 2015.

Environmental Monitoring - Performance Indicators. As part of the WVDP EMS, environmental monitoring continued on and near the site to detect and evaluate changes in the environment resulting from Project (or pre-Project) activities and to assess the effect of any such changes on the environment or human population. Within the environmental monitoring program, airborne and waterborne effluents were sampled and environmental surveillances of the site and nearby areas were conducted.

- Waterborne Radiological Releases

  Waterborne radiological releases from the site were from two primary sources, lagoon 3 and a drainage channel on the WVDP's north plateau that is contaminated with strontium-90 from pre-WVDP operations. During 2015, treated process water was released in three batches from lagoon 3, totaling approximately 5.2 million gallons (19.6 million L), and approximately 21.1 million gallons (79.9 million L) flowed from the site through the north plateau drainage channel.

There were no unplanned releases of waterborne radioactivity in 2015.

- Airborne Radiological Releases

  In 2015, the WVDP maintained seven NESHAP permits for point source release of radiological airborne emissions. The primary controlled air emission point at the WVDP is the MPPB ventilation stack. In August 2015, the RVS for the MPPB began operations, replacing the Head End Ventilation (HEV) system which ventilates a portion of the building. This new system will facilitate continued decommissioning of the MPPB.

MPPB HEV Replacement Ventilation System (RVS)

CY 2015 was the third full year of monitoring with the 16 ambient air sampling stations. The WVDP obtained approval from the Environmental Protection Agency for retrospective use of ambient air monitoring data to demonstrate compliance with airborne radiological release limits beginning in CY 2014.

There were no unplanned radiological airborne releases at the WVDP during 2015.

- Estimated Dose

  The ambient air monitoring data were used to estimate the dose from airborne releases for NESHAP compliance for the second year in 2015. The estimated dose from airborne emissions from the WVDP in 2015 was <0.47 millirem (mrem) (0.0047 millisievert [mSv]) which is below the 10-mrem (0.1 mSv) limit established by EPA and mandated by DOE Order 458.1.

The estimated dose from waterborne sources in 2015 was 0.021 mrem (0.00021 mSv), with 0.005 mrem (0.000050 mSv) attributable to liquid effluent releases from lagoon 3 and 0.016 mrem (0.00016 mSv) attributable to the north plateau drainage.

Total estimated dose from both airborne and waterborne sources in 2015 was <0.49 mrem (<0.0049 mSv), less than 0.49% of the annual 100-mrem DOE standard. In comparison, the average dose to a member of the public from natural background sources is 310 mrem per year.

- Dose to Biota

A dose to biota evaluation for CY 2015 once again concluded that aquatic and terrestrial biota populations (both plants and animals) were not exposed to doses in excess of the existing DOE dose standard for aquatic animals and terrestrial plants (1 rad/day), nor the recommended thresholds for riparian and terrestrial animals (0.1 rad/day).

- Nonradiological Releases

Nonradiological releases from Project wastewater and storm water monitoring points were measured and documented under the site's SPDES permit. As noted previously, there were no SPDES permit noncompliance events in 2015.

Quality Assurance (QA). In 2015, the QA program continued for activities supporting the environmental and groundwater monitoring programs at the WVDP. As part of this ongoing effort, on-site and subcontract laboratories that analyze WVDP environmental samples participated in independent radiological and nonradiological constituent performance evaluation studies. In these studies, environmental test samples with concentrations only known by the testing agency were analyzed by the laboratories. Of 322 performance evaluation analyses conducted for the WVDP, 99.1% were within acceptance limits.

Numerous inspections, audits, assessments, and surveillances of components of the environmental monitoring program were conducted in 2015. Although actions were recommended to improve the program, nothing was found that would compromise the quality of data in this report or the environmental monitoring program in general.

Other Environmental Programs

Phase 1 Studies. To support Phase 2 decommissioning decisions, DOE and NYSERDA are conducting scientific studies to facilitate interagency consensus on specific technical issues and to identify and reduce uncertainty in decommissioning decisions for the remaining facilities. In September 2011, DOE and NYSERDA jointly awarded the Phase 1 Studies contract to Enviro Compliance Solutions, Inc., an independent, agency-neutral contractor that is jointly funded by the agencies. This contract was renewed in March 2013. Under this contract, the Erosion Working Group initiated field studies and the Exhumation Working Group began evaluating radionuclide inventories in the disposal areas and WTF during 2015.

Environmental Characterization Services (ECS) Contract. Phase 1 includes characterization work and focused studies that will facilitate future decisionmaking for the remaining facilities or areas on the property. In August 2015, DOE awarded a support service contract to North Wind Solutions, LLC to support the data collection activities described in the Phase 1 Characterization Sampling and Analysis Plan and Phase 1 Final Status Survey Plan. Other technical support and subject matter expertise will also be provided under this contract. No ECS sampling was performed for environmental characterization in 2015.

Aerial Survey. DOE in cooperation with NYSERDA commissioned an aerial survey to measure radiation at the WNYNSC and a portion of Cattaraugus Creek from the boundary of the WNYNSC to Lake Erie. The aerial survey was conducted by helicopter in September 2014 and data analysis was performed during 2015. The survey serves as a new baseline for both on-site and off-site radiation levels and provides comprehensive updated information for Phase 2 decisionmaking. Follow-up surface soil samples were collected by NYSERDA in 2015 to further evaluate the aerial survey results and radiological soil concentrations in select survey areas. The sampling results are expected to be available in 2016.

Conclusion

In addition to demonstrating compliance with environmental regulations and directives, evaluation of data collected in 2015 continued to indicate that WVDP activities pose no threat to public health or safety, or to the environment.

INTRODUCTION

Site Location

The West Valley Demonstration Project (WVDP or Project) is located in western New York State (NYS), about 30 miles (mi) (50 kilometers [km]) south of Buffalo, New York (Fig. INT-1). The WVDP facilities currently occupy a security-fenced area of about 152 acres (61 hectares [ha]) within the 3,338-acre (1,351 ha) Western New York Nuclear Service Center (WNYNSC or Center) located primarily in the town of Ashford in northern Cattaraugus County.

General Environmental Setting

Climate. Although extremes of 99°F (37°C) and -20°F (-29°C) have been recorded in western New York, the climate is moderate, with an average annual temperature of 47.7°F (8.7°C) (National Oceanic and Atmospheric Administration Climatic Data Center [Official Record] for 1895 to 2013, www.ncdc.noaa.gov/cag and www.weather.gov/buf/BUFRecords). Precipitation is markedly influenced by Lake Erie to the west and, to a lesser extent, by Lake Ontario to the north. Based on data collected at the on-site meteorological tower from 2005 to 2014, the recent 10 year average annual precipitation at the WVDP was 41.6 inches/year. Regional winds are generally from the west and south at about 9 miles per hour (4 meters/second).

Ecology. The WNYNSC lies within the northern deciduous forest biome, and the diversity of its vegetation is typical of the region. Equally divided between forest and open land, the site provides a habitat especially attractive to white-tailed deer and various indigenous and migratory birds, reptiles, and small mammals. No species on the federal endangered species list are known to reside on the WNYNSC.

Geology and Hydrology. The Project lies on NYS's Allegheny Plateau at an elevation of approximately 1,300 to 1,450 feet (ft) (400 to 440 meters [m]) above mean sea level. The underlying geology includes a sequence of glacial sediments above shale bedrock. The Project is drained by three small streams (Franks Creek, Quarry Creek, and Erdman Brook) and is divided by a stream valley (Erdman Brook) into two general areas: the north plateau and the south plateau.

Franks Creek, which receives drainage from Erdman Brook and Quarry Creek, flows into Buttermilk Creek, which enters Cattaraugus Creek and flows westward away from the WNYNSC. (See Figures A-1 and A-5.) Cattaraugus Creek ultimately drains into Lake Erie, to the northwest.

Relevant Demographics

Although several roads and a railway approach or pass through the WNYNSC, the public is prohibited from accessing the WNYNSC. A limited public deer hunting program managed by New York State Energy Research and Development Authority (NYSERDA) is conducted on a year-to-year basis in designated areas on the WNYNSC. No unescorted public access is allowed on the WVDP premises.

Land near the WNYNSC is used primarily for agriculture and arboriculture. Downgradient of the WNYNSC, Cattaraugus Creek is used locally for swimming, canoeing, and fishing. Although some water is taken from the creek to irrigate nearby golf course greens and tree farms, no public drinking water is drawn from the creek before it flows into Lake Erie. Water from Lake Erie is used as a public drinking water supply.

The communities of West Valley, Riceville, Ashford Hollow, and the village of Springville are located within approximately 5 mi (8 km) of the Project. Population around the site is sparse with the average population density of Cattaraugus County about 61 persons/mi^2 (24 persons/km^2). No major industries are located within this area.

Historic Timeline of the WNYNSC and the WVDP

The following summary, presented in Table INT-1, depicts a historic timeline for the WNYNSC and the WVDP beginning with the establishment of the WNYNSC as a commercial nuclear fuel reprocessing facility, to the creation of the WVDP, to the current Project mission. The summary includes significant legal directives, major activities, and accomplishments.

FIGURE INT-1
Location of the Western New York Nuclear Service Center

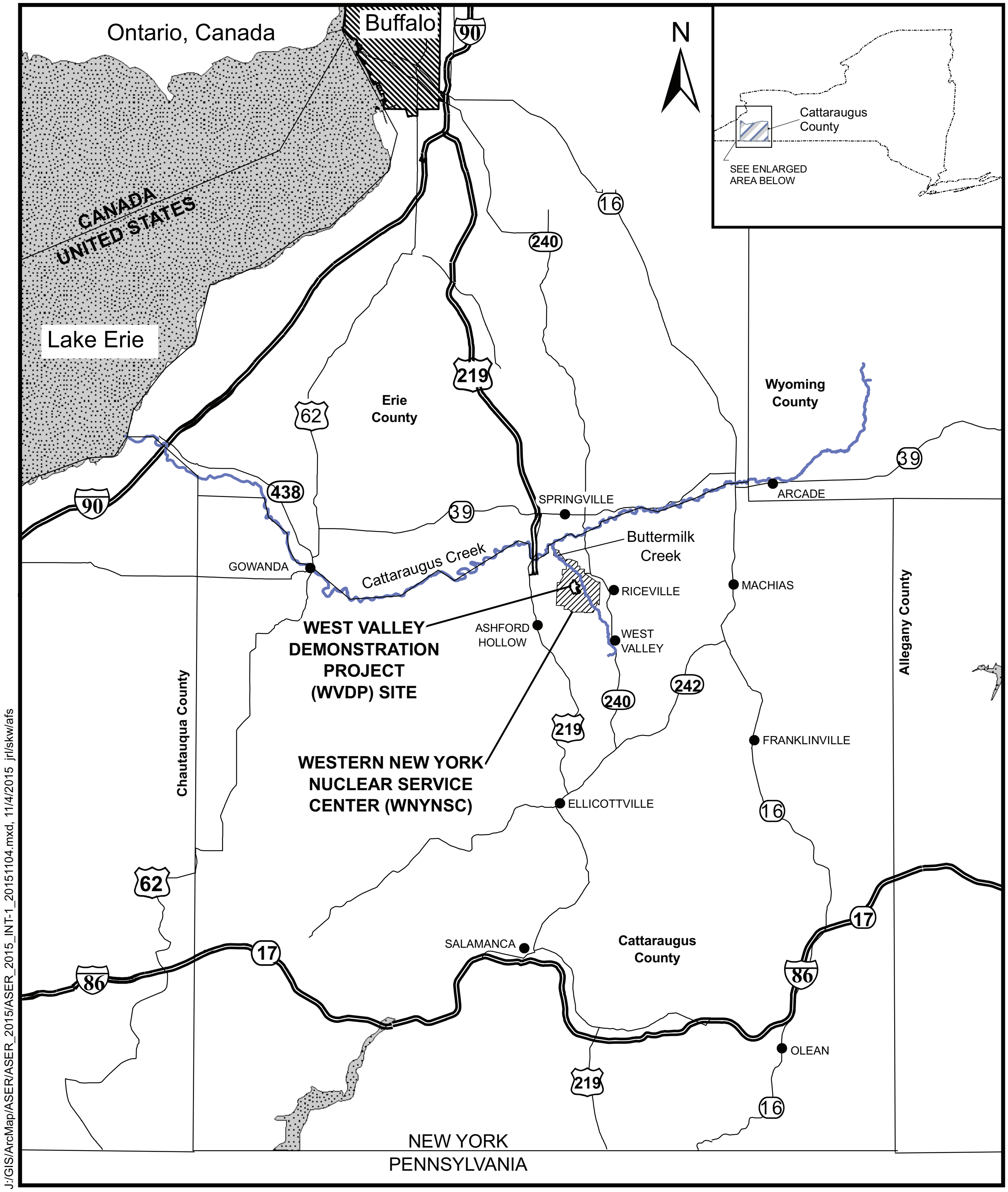

TABLE INT-1
Historic Timeline of the WNYNSC and the WVDP

Year	*Activity*
1954	The Federal Atomic Energy Act (AEA) promoted commercialization of reprocessing spent nuclear fuel.
1959	NYS established the Office of Atomic Development (OAD) to coordinate the atomic industry.
1961	The NYS OAD acquired 3,345 acres (1,354 ha) of land in Cattaraugus County, Town of Ashford (near West Valley), in western New York and established the WNYNSC.
1962	Davison Chemical Company established Nuclear Fuel Services, Inc. (NFS) as a nuclear fuel reprocessing company, and reached an agreement with NYS to lease the WNYNSC (also referred to as "the Center").
1966	NFS constructed and operated the commercial nuclear fuel reprocessing facility at the WNYNSC from 1966 to 1972. NFS processed 640 metric tons (mt) of spent reactor fuel at the facility, generating 660,000 gallons (gal) (2.5 million liters [L]) of highly radioactive liquid waste. A 5-acre landfill, the U.S. Nuclear Regulatory Commission (NRC)-licensed disposal area (NDA) was operated for disposal of waste generated from the reprocessing operations from 1966 until 1986. Also, a 15-acre commercial disposal area, the SDA regulated by NYS agencies, under delegation of authority from the NRC, accepted low-level radioactive waste (LLW) from operations at the WNYNSC and from off-site facilities from 1963 until 1975.
1972	In 1972, while the plant was closed for modifications, more rigorous regulatory requirements were imposed upon fuel reprocessing facilities. NFS determined the costs to meet regulatory requirements of spent nuclear fuel reprocessing were not economically feasible. NFS then notified the NYSERDA, the successor to NYS OAD, in 1976 that they would discontinue reprocessing and would not renew the lease that would expire at the end of 1980.
1975	Water infiltrated into the New York State-Licensed Disposal Area (SDA) trenches and waste burial operations ceased. Between 1975 and 1981, NFS pumped, treated, and released liquids to the adjacent stream. Redesigning the covers reduced, but did not eliminate, water accumulation in the trenches.
1980	The United States (U.S.) Congress passed Public Law 96-368, the West Valley Demonstration Project Act (WVDP Act), requiring the U.S. Department of Energy (DOE) to be responsible for solidifying the liquid high-level radioactive waste (HLW) stored in underground tanks, disposing of the waste that would be generated by solidification, and decontaminating and decommissioning the facilities used during the process. Per the WVDP Act, the DOE entered into a Cooperative Agreement with NYSERDA that established the framework for cooperative implementation of the WVDP Act. Under the agreement, DOE has exclusive use and possession of a portion of the Center (i.e., WNYNSC) known as the Project Premises (approximately 167 acres at that time). A supplement to the Cooperative Agreement (1981 amendment) between the two agencies set forth special provisions for the preparation of a joint Environmental Impact Statement (EIS).
1981	DOE and NRC entered into a Memorandum of Understanding (MOU) that established specific agency responsibilities and arrangements for informal review and consultation by NRC. Because NYSERDA holds the license and title to the WNYNSC, NRC put the technical specifications of the license (CSF-1) in abeyance to allow DOE to carry out the responsibilities of the WVDP Act.
1982	West Valley Nuclear Services (WVNS), a Westinghouse subsidiary, was chosen by DOE to be the management and operating contractor. WVNS commenced operations at the WVDP on February 28, 1982.
1983	Before discontinuing fuel reprocessing operations, NFS had accepted 750 spent fuel assemblies which remained in storage in the on-site fuel receiving and storage (FRS) area. Between 1983 and 1986, 625 of those assemblies were returned to the utilities that owned them. In 1983, NYSERDA assumed management responsibility for the SDA and focused efforts on minimizing infiltration of water into the trenches. In the 1990s, installation of a geomembrane cover over the entire SDA and an underground barrier wall were successful in eliminating increases in trench water levels. The DOE selected the vitrification (VIT) process as the preferred method for solidifying the HLW into glass.
1984	Non-radioactive testing of a full-scale VIT system was conducted from 1984–1989. NFS entered into an agreement with DOE in which DOE assumed ownership of the remaining 125 fuel assemblies in the FRS pool and the responsibility for their removal.

TABLE INT-1 *(continued)*
Historic Timeline of the WNYNSC and the WVDP

Year	*Activity*
1986	A large volume of radioactive, non-HLW would result from WVDP activities. On-site disposal of most of this waste was evaluated in an Environmental Assessment (EA [DOE/EA-0295, April 1986]), and a finding of no significant impact (FONSI) was issued. The Coalition on West Valley Nuclear Waste (The Coalition) and the Radioactive Waste Campaign filed suit contending an EIS should have been prepared. The NYS Department of Environmental Conservation (NYSDEC) was authorized by the U.S. Environmental Protection Agency (EPA) to administer the Resource Conservation and Recovery Act (RCRA) hazardous waste program.
1987	A decision to potentially dispose of LLW at the Project led to a legal disagreement between DOE, The Coalition, and the Radioactive Waste Campaign. The lawsuit was resolved by a Stipulation of Compromise which states that LLW disposal at the site and the potential effects of erosion at the site must be included in a comprehensive EIS.
1988	In December 1988, the DOE and NYSERDA issued a Notice of Intent (NOI) in the Federal Register (FR) to prepare an EIS in accordance with Section 102(2)(C) of the National Environmental Policy Act (NEPA) and Section 8-0109 of the New York State Environmental Quality Review (SEQR) Act. To prepare for VIT, the integrated radiological waste treatment system was constructed to process liquid supernatant from the underground waste tanks by removing most of the radioactivity in the supernatant, concentrating the liquid, and blending it with cement. The HLW sludge layer was then washed to remove soluble salts. The water containing the salts was also stabilized into cement. About 20,000 drums of cement-stabilized LLW were stored in the aboveground drum cell. The process was completed in 1995.
1990	Organic solvent was observed in a groundwater monitoring well immediately downgradient of the NDA in 1983. Following characterization of the area, an interceptor trench bordering the northeast and northwest boundaries of the NDA and a liquid pretreatment system (LPS) were built in 1990–1991. The trench was designed to collect liquid that might migrate from the NDA and the LPS was designed to recover free organic product (if present) from the recovered liquid. To date, no organic product has been detected in the interceptor trench water; therefore, the water has been pumped and treated through the LLW treatment system. In 1990, NYS was granted the authority to regulate the hazardous waste constituents of radioactive mixed waste. Subsequently, a Title 6 New York State Official Compilation of Codes, Rules, and Regulations (NYCRR) RCRA Part 373-3 (Part A) Permit Application for the WVDP was filed with NYSDEC for storage and treatment of hazardous and mixed wastes.
1992	In 1992, DOE and NYSERDA entered into a RCRA §3008(h) Administrative Order on Consent (Consent Order) with NYSDEC and the EPA. The Consent Order pertained to management of hazardous waste and/or hazardous constituents from solid waste management units (SWMUs) at the WVDP. It also required DOE and NYSERDA to perform a RCRA Facility Investigation (RFI) at the WNYNSC to determine if there had been or if there was potential for a release of RCRA hazardous constituents. Final RFI reports were submitted in 1997, completing the Consent Order investigative activities.
1993	In 1993, gross beta activity in excess of 1.0E-06 microcuries per milliliter (µCi/mL) (the DOE Derived Concentration Guide [DCG] for strontium-90, the applicable guidance at that time) was detected in surface water on the north plateau, in the vicinity of sampling location WNSWAMP. The gross beta radioactivity was determined to be strontium-90.
1994	Extensive subsurface investigations delineated the extent of the strontium-90 plume and determined that the plume originated beneath the southwest corner of the main plant process building (MPPB) during NFS operations and migrated toward the northeast quadrant of the north plateau. A second lobe of contamination was attributed to the area of former lagoon 1, which was backfilled in 1984.
1995	In 1995, a groundwater recovery system consisting of three wells was installed on the north plateau to extract and treat the strontium-90-contaminated groundwater. In 1999, a pilot-scale permeable treatment wall (PTW) was constructed to test this passive in-situ remediation technology. The VIT building shielding was installed in 1991, the slurry-fed ceramic melter was assembled in 1993, and the remaining major components were installed and tested by the end of 1994. In 1995, the VIT facility was completed, fully tested, and "cold operations" began.

TABLE INT-1 *(continued)*
Historic Timeline of the WNYNSC and the WVDP

Year	*Activity*
1996	The DOE and NYSERDA issued a draft EIS (DEIS) for completion of the WVDP and closure or long-term management of the WNYNSC. Following evaluation of the public comments on the DEIS, the Citizen Task Force was convened to enhance stakeholder understanding and input regarding the WVDP/WNYNSC closure process. VIT operations began in 1996 and continued into 2002, producing 275 ten-foot-tall stainless-steel canisters of hardened radioactive glass containing 16.1 million curies of radioactive material, primarily cesium and strontium, with the radioactivity from daughter products included (decay corrected to January 1, 2014, WVNS-CAL-396). The VIT melter was shut down in September 2002. NYSDEC and DOE entered into an Order on Consent negotiated under the Federal Facilities Compliance Act (FFCA) for handling, storage, and treatment of mixed wastes at the WVDP. The Seneca Nation of Indians Cooperative Agreement was signed in 1996 to foster government-to-government relationships between the Seneca Nation and the U.S. government, as represented by DOE.
1999	VIT expended materials processing was initiated to begin processing unserviceable equipment from the VIT facility. This success helped in developing a remote-handled waste facility (RHWF) to process large-scale, highly contaminated equipment excessed during decontamination and decommissioning (D&D) activities.
2000	Restructuring of the work force and construction of the RHWF began.
2001	The 125 spent fuel assemblies that remained in storage at the WVDP since 1975 were prepared for transport to the Idaho National Engineering and Environmental Laboratory (INEEL). Initial decontamination efforts began in two significantly contaminated areas in the MPPB, the process mechanical cell and the general purpose cell, to place the cells in a safer configuration for future facility decommissioning. DOE published formal notice in 66 FR 16447 to split the EIS process into (1) the WVDP Waste Management EIS, and (2) the Decommissioning and/or Long-Term Stewardship EIS at the WVDP and the WNYNSC.
2002	NRC issued "Decommissioning Criteria for the West Valley Demonstration Project (M-32) at the West Valley Site; Final Policy Statement" (67 FR 5003).
2003	The remaining 125 spent fuel assemblies were shipped to INEEL, allowing for decontamination of the FRS to begin.
2004	The RHWF became operational. Major decontamination efforts continued and site footprint reduction began as 20 office trailers were removed. In December, the 6 NYCRR Part 373-2 Permit Application (i.e., Part B) was submitted to NYSDEC.
2005	In June, the DOE published its final decision on the "WVDP Waste Management Environmental Impact Statement (68 FR 26587)." The DOE implemented the preferred alternative for the management of LLW and mixed LLW. The decision on transuranic (TRU) waste was deferred, and the canisters of vitrified HLW will remain in on-site storage until they can be shipped to a repository. In November, the WVDP was downgraded to a Category 3 nuclear facility, marking the first time in the site's history that it has been designated the least of the three DOE nuclear facility designations. The categorization is based on amounts, types, and configuration of the nuclear materials stored and their potential risks.
2006	An EA (DOE/EA-1552) evaluating the proposed decontamination, demolition, and removal of 36 facilities was issued. By the end of 2006, 11 of the 36 structures were removed. The DOE-WVDP office initiated a collaborative, consensus-based team process, referred to as the "Core Team," that involved DOE, NYSERDA, EPA, the New York State Department of Health (NYSDOH), NRC, NYSDEC, and later West Valley Environmental Services, LLC (WVES). This team brought individuals with decisionmaking authority together to resolve challenging issues surrounding the WVDP EIS process and to make recommendations to move the Project toward an "Interim End-State" prior to issuance of the "Final EIS for the Decommissioning and/or Long-Term Stewardship at the WVDP and the WNYNSC." Shipment of the cement-filled LLW drums was initiated.
2007	Demolition and removal of four more structures identified under DOE/EA-1552 was completed. On June 29, 2007, DOE awarded WVES a four-year contract (Contract DE-AC30-07CC30000) to conduct the next phase of cleanup operations at the WVDP. The remaining drums of cemented LLW in the drum cell were packaged and shipped to the Nevada Test Site for disposal. In the fall of 2007, an Interim Measure (IM) to minimize water infiltration into the NDA was initiated with site surveys and soil borings.

TABLE INT-1 *(continued)*
Historic Timeline of the WNYNSC and the WVDP

Year	*Activity*
2008	During 2008, a trench was excavated along two sides of the NDA, on the south plateau. The trench was backfilled with bentonite and soil to form a slurry wall, a low-permeability subsurface barrier to infiltration. A geomembrane cover was placed over the entire landfill. On the north plateau, additional subsurface soil and groundwater samples were collected in the summer and fall of 2008 to further characterize chemical and radiological constituents within the contaminated groundwater plume beneath and downgradient of the MPPB. The revised DEIS for Decommissioning and/or Long-Term Stewardship at the WVDP and WNYNSC was issued in December for public review, which continued through September 8, 2009. Concurrently, the Proposed Phase 1 Decommissioning Plan (DP) for the WVDP was prepared and submitted to NRC.
2009	Extensive characterization was completed on the north plateau in 2009 to delineate the leading edge of the subsurface strontium-90 groundwater plume and to find a suitable material to capture and retain the contamination.
2010	In January, DOE and NYSERDA issued the final EIS (FEIS) for the WVDP and the WNYNSC (DOE/EIS-0226). The phased decisionmaking alternative was selected as the preferred alternative. The phase 2 decision was deferred for no more than 10 years. In February, NRC issued a Technical Evaluation Report (TER) for the DP, concluding that the DP was consistent with the preferred alternative in the EIS. A SEQR notice of completion for the EIS and its acceptance by NYSERDA was issued on January 27, 2010. On April 14, 2010, DOE issued the Record of Decision (ROD) for the EIS, and on May 12, NYSERDA issued a SEQR Findings Statement, selecting the phased decisionmaking alternative. On August 17, 2010, DOE and NYSERDA reached an agreement and signed a Consent Decree that formally defined the cost sharing for cleanup of the WVDP and the WNYNSC. In September 2010, a revised RCRA Part 373-2 Permit Application was submitted to NYSDEC. An 860-foot-long full-scale PTW near the leading edge of the strontium-90 plume was installed and completed. The Tank and Vault Drying System (T&VDS) was installed to reduce the harmful effects of corrosion on the underground waste tanks. MPPB cell decontamination and deactivation activities continued.
2011	DOE awarded the Phase 1 Decommissioning and Facility Disposition contract to CH2M HILL • B&W West Valley, LLC (CHBWV) on June 29, 2011. The "continuity of contract" period extended to August 29, 2011 during which time work activities were transitioned, environmental monitoring continued, and licenses and permits were transferred to CHBWV. A separate contract was awarded to Safety and Ecology Corporation to implement work associated with the Phase 1 characterization support services, which are requirements of the Phase 1 DP. In September 2011, DOE and NYSERDA jointly awarded a Phase 1 Studies contract to Enviro Compliance Solutions to identify and implement the Phase 1 Studies. The objective of the studies is to use technical experts to conduct scientific studies that will facilitate interagency consensus for decisionmaking in the Phase 2 decommissioning process.
2012	CHBWV continued work on the Phase 1 Decommissioning Facilities Disposition Contract, including design of the HLW Canister Interim Storage System, continued legacy waste shipment, preparation for demolition of the MPPB and VIT facility, and demolition of nonradiological Balance of Site Facilities (BOSF). Demolition of the nonradiologically contaminated portions of the 01-14 building began in 2012. DOE issued a final Waste Incidental to Reprocessing (WIR) evaluation for the VIT melter in February 2012, determining that this vessel is LLW incidental to reprocessing and therefore may be managed under DOE's authority in accordance with the requirements of LLW. Phase 1 Studies teams of Subject Matter Experts (SMEs) continued development of recommendations for the identified areas of study. Environmental characterization of surface soils and soil excavations performed in 2012 included characterization of two reference areas, the HLW Canister Interim Storage System area, and two building footprints following demolition.

TABLE INT-1 *(concluded)*
Historic Timeline of the WNYNSC and the WVDP

Year	*Activity*
2013	CHBWV completed demolition of seven buildings in 2013, including demolition of the radiologically contaminated portions of the 01-14 building. The HLW Cask Storage Pad was constructed and eight Vertical Storage Casks (VSCs) were fabricated. The site's existing inventory of legacy LLW and mixed low-level waste (MLLW) was reduced by 50% from the start of the CHBWV contract as a result of off-site shipments. Preparations continued for canister relocation and demolition of the MPPB and VIT facility. A request for EPA approval was prepared for a new MPPB ventilation system. The off-site ambient air monitoring network was in service for a full year in 2013. DOE issued a WIR for the Concentrator Feed Makeup Tank (CFMT) and Melter Feed Hold Tank (MFHT) in February 2013 and began planning for off-site shipment of these vessels and the VIT melter. Phase 1 Studies to support the Phase 2 decision continued in 2013. Environmental characterization activities continued in 2013 and included collection of soil samples and radiological ground surface surveys.
2014	The WVDP was identified as one of DOE's safest sites in 2014 and CHBWV earned the DOE-Voluntary Protection Program (VPP) STAR of Excellence for safe work practices. CHBWV continued preparation for HLW canister relocation, with fabrication of eight additional VSCs, development of a canister decontamination process, procurement of custom designed heavy equipment to move the canister-loaded casks from the MPPB to the HLW Cask Storage Pad, and modifications to the rooms in the MPPB that will be used during the transfer. The Con-Ed and T-FS-04 buildings were demolished. Deactivation and hazard reduction continued inside the MPPB. Debris removal and gross decontamination of the VIT facility was completed in preparation for demolition. The potable water supply system was changed over from a surface water source to a groundwater source. EPA conditionally approved construction of a new MPPB ventilation system in April 2014 (with final approval in March 2015). EPA approved use of the ambient air data to demonstrate compliance with air emissions standards for 2014. A transportation safety analysis report for off-site shipment of the VIT melter was submitted to NRC. Extensive repairs to the lakes and dams were made followed by site restoration.
2015	CHBWV safely removed the first 20 canisters of HLW from the MPPB, placed them in VSCs, and relocated the first four VSCs to the HLW Cask Storage Pad on the south plateau in 2015. Prior to the HLW cask relocation, the final custom designed relocation equipment was received and operation readiness testing was completed. A dose rate cave was procured to obtain dose rates on the non-HLW drums stored in the Chemical Process Cell in order to remove and store the drums safely in preparation for MPPB demolition. A Replacement Ventilation System (RVS) for a portion of the MPPB was constructed, tested and put into operation in August 2015. An erosion control engineering project was completed to reroute the S09 storm water outfall discharge from the lagoon 3 embankment to the bottom of the hill at Franks Creek. The radiologically contaminated High Efficiency Particulate Air (HEPA) filters from the MPPB were shipped off site in 2015, achieving 100% reduction in the legacy MLLW. Deactivation and hazard reduction continued inside the MPPB and VIT facility. The NRC issued a "Special Package Authorization (SPA)" for the VIT melter transportation package in 2015. Personnel were relocated from the Administration Building in order to prepare the building for demolition. Work began on a probabilistic performance assessment to support Phase 2 of the Phased Decisionmaking alternative for the WVDP and WNYNSC.

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ENVIRONMENTAL COMPLIANCE SUMMARY

Compliance Program

Activities at the WVDP are regulated by various federal and state, public, worker, and environmental protection laws. These laws are administered primarily by the EPA, DOE, the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers (USACE), NYSDEC, and NYSDOH through programs and regulatory requirements for permitting, reporting, inspecting, self-monitoring, and auditing.

Table ECS-1 describes the WVDP's compliance status with applicable environmental statutes, DOE directives, executive orders (EOs), and state laws and regulations applicable to the Project activities.

Table ECS-2 presents a summary of the significant NEPA document history. An update of NEPA activities is provided later in this chapter.

EPA, NYSDEC, and DOE have established standards for effluents that are intended to protect human health, safety, and the environment. DOE applies to EPA for permits to release limited amounts of radiological constituents to the air and applies to NYSDEC for permits to release limited amounts of nonradiological constituents to the air and water, in concentrations determined to be safe for human health and the environment. In general, the permits describe release points, specify management and reporting requirements, list discharge limits on those pollutants likely to be present, and define the sampling and analysis regimen. Releases of radiological constituents in water are subject to the requirements in DOE Orders 458.1 (Radiation Protection of the Public and the Environment, Change 3) and DOE-STD-1196-2011 (Derived Concentration Standards [DCSs]). A summary of the WVDP environmental permits is found in Table ECS-3. (See the compliance tables at the end of this chapter.)

2015 Accomplishments and Highlights at the WVDP

CHBWV began performing the Phase 1 Decommissioning and Facility Disposition activities for DOE in August 2011. The term of the Phase 1 Decommissioning and Facility Disposition contract is from August 2011 to March 2020 and includes the following scope:

- packaging and relocating canisters of vitrified HLW from the MPPB to a new interim dry storage area;
- processing and shipping legacy waste;
- dismantling and removing the VIT facility and the MPPB;
- removing ancillary facilities; and
- continuing safe operations of the site, including:
  - managing and maintaining site infrastructure;
  - conducting environmental monitoring;
  - maintaining the waste tank farm (WTF), the NDA, and the north plateau PTW; and
  - maintaining the lagoon system.

2015 Major Accomplishments. Major accomplishments towards achieving Phase 1 Decommissioning and Facility Disposition included the following:

- completed procurement and operational testing of specialized equipment (e.g. the Vertical Cask Transporter (VCT) and Low Profile Rail Cart (LPRC)) designed for relocating the HLW casks at the WVDP;

- safely removed the first 20 canisters of HLW from the MPPB, placed them into four casks (each containing five canisters) and relocated them to the HLW Cask Storage Pad on the south plateau;

Vertical Cask Transporter (VCT)

- procured special equipment designed for the WVDP to obtain dose rates on the remaining 144 containers of non-HLW that will be removed from the former MPPB Chemical Process Cell (CPC) prior to demolition;

- shipped the last containers of mixed low-level waste (MLLW) in the WVDP's Site Treatment Plan (STP) off site for disposal, achieving a 100% reduction in legacy MLLW inventory and a 50% reduction in the site legacy LLW in existence at the beginning of the CHBWV contract;

- NRC issued a "Special Package Authorization (SPA)" for the melter transportation package;

- performed hazard reduction activities to prepare the MPPB and VIT facility for demolition including:

  - piping, miscellaneous equipment, and debris removal;
  - liquid removal and flushing of eight of the nine tanks in the Liquid Waste Cell (LWC);
  - size reduction and removal of several other tanks and process vessels within the MPPB, and
  - continued asbestos abatement;

Main Plant Process Building

- operated the off-site ambient air monitoring network for a third full year, and used this data to estimate potential dose to the public from the airborne pathway;

- completed installation of a Replacement Ventilation System (RVS) for a portion of the MPPB (final approval received in March 2015) and began operation of the new system in August 2015; and

- constructed engineering controls to channel the S09 storm water outfall discharge water into Franks Creek to alleviate erosion of the lagoon embankment, as approved by NYSDEC in the 2015 SPDES permit modification.

Rerouted S09 storm water outfall discharge

State Pollutant Discharge Elimination System (SPDES) Permit Noncompliance Events. During calendar year (CY) 2015, all SPDES discharges were within applicable SPDES permit limits.

Mercury Minimization Program. In June 2015, the WVDP submitted the annual Mercury Minimization Program Report to NYSDEC per the SPDES permit. The report identified actions that have reduced mercury discharges at effluent discharge points, and stated that the WVDP continues to perform enhanced sampling to monitor mercury concentrations in its wastewaters. The report concluded that the WVDP continued to meet the goal of achieving and maintaining effluent water quality discharges below the required level and diligence to minimize mercury at the source will also continue.

Permeable Treatment Wall (PTW) Performance. The full-scale PTW, installed in November 2010, has now been monitored for five years. Performance monitoring data to date continue to indicate:

- groundwater flow patterns in the PTW area are similar to those observed prior to PTW construction, indicating that the PTW installation does not substantially alter general groundwater flow conditions on the north plateau;

- groundwater treatment by ion exchange is occurring as evidenced by the fact that strontium-90 activity in groundwater inside the PTW is either not detected or substantially lower overall than strontium-90 activity levels upgradient of the PTW;

- geochemical differences observed in groundwater that has migrated into and through the PTW zeolite also indicate that ion exchange (i.e., treatment) is occurring;
- the most elevated concentrations of strontium-90 observed inside the PTW occur within relatively narrow zones which are located where plume migration upgradient of the PTW follows preferential groundwater flow paths, such as preferential migration through the slack-water sequence (SWS);
- strontium-90 activity in groundwater immediately downgradient of the PTW has decreased overall; and
- strontium-90 activity that had already migrated past the PTW prior to its installation is continuing to migrate downgradient. However, strontium-90 concentrations are decreasing in some wells further downgradient of the PTW and are expected to continue to decrease over time as groundwater treated by the PTW flows towards these areas.

During 2015, there were no detected strontium-90 concentrations greater than 1.0E-5 µCi/mL (10,000 picoCuries per liter [pCi/L]) downgradient of the PTW and no detected strontium-90 concentrations above 1.0E-6 µCi/mL (1,000 pCi/L) in the downgradient eastern lobe of the strontium-90 plume.

These observations indicate the ongoing processes within the PTW continue to achieve the remedial action objectives and the functional requirements of the PTW defined in the PTW Performance Monitoring Plan.

Waste Tank Farm (WTF) and the Tank and Vault Drying System (T&VDS). With an ultimate goal of preventing the underground steel tanks from corroding under ambient tank and vault conditions, the WVDP installed a T&VDS in the WTF in 2010. The T&VDS was designed to reduce the liquid volumes in the tanks, and thereby the harmful effects of corrosion on the underground waste tanks situated within concrete vaults originally installed in the 1960s. The system has operated effectively since startup, with only temporary shutdowns for maintenance and minor repairs. The system has achieved the following results as of the end of 2015:

- maintained dry conditions in tanks 8D-1 and 8D-2;
- maintained liquid levels below level indicators in tanks 8D-1 and 8D-2 vaults and pans;
- maintained the liquid level in tank 8D-3 below the level indicator and reduced the liquid level in tank 8D-4 by 60 gal (227 L) during 2015 resulting in a residual 4,620 gal (17,489 L) in tank 8D-4;
- maintained the dry condition of the 8D-3/8D-4 vault; and
- continued to achieve lower relative humidity in the tanks and vaults, reducing the corrosion rate.

System operations continue to be monitored to reduce air infiltration, and individual air flows are adjusted to maintain a target relative humidity of <30% in the tanks and vaults.

Packaging and Transportation of Radioactive Material. Preparations for LLW disposal continued in 2015 for the VIT melter and two additional oversized LLW packages, each containing a large tank from the vitrification system. A SPA for the melter package was received from the NRC. The transportation safety analysis report for the melter submitted to NRC in 2014 demonstrated compliance with NRC transportation requirements in 10 Code of Federal Regulations (CFR) Part 71. Plans were made to install an impact limiter on the melter package and to ship it and the two additional oversized LLW packages to an offsite disposal facility.

National Environmental Policy Act (NEPA)

NEPA requires DOE to consider the overall environmental effects of its proposed actions. Draft documents are prepared that describe potential environmental effects associated with proposed Project activities. The level of evaluation and documentation depends upon whether the action constitutes a major federal action significantly affecting the quality of the human environment within the meaning of NEPA.

The categories of documentation include categorical exclusion (CX), environmental assessment (EA), and environmental impact statement (EIS). Categorical Exclusions (CXs) describe actions that will not have a significant effect on the environment. EAs are used to evaluate the extent to which a proposed action, not categorically excluded, will affect the environment. Based on the analyses presented in an EA and considering regulatory agency, stakeholder, and public comments, DOE may determine that a proposed action is not a major federal action significantly affecting the quality of the human environment within the meaning of NEPA. Consequently, DOE may issue a notice indicating the finding of no significant impact (FONSI) and therefore would not require the preparation of an EIS.

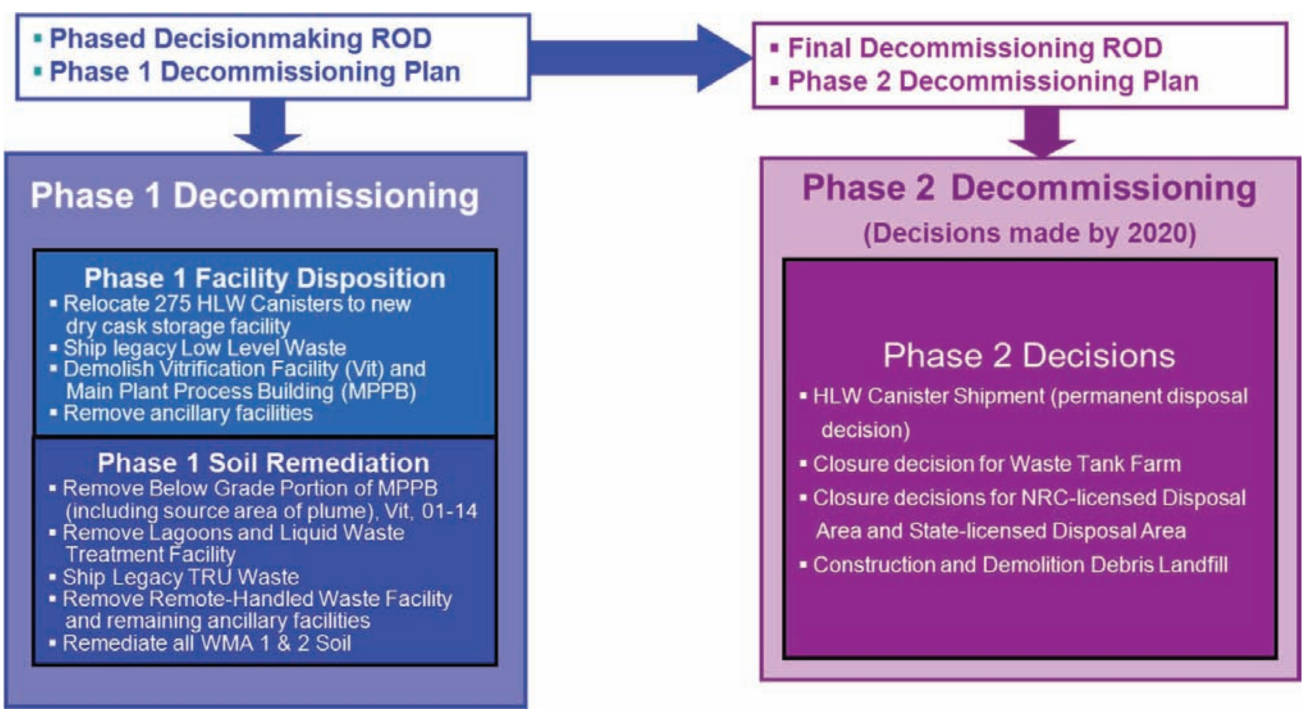
If a proposed action has potential for significant environmental effects, an EIS would be prepared that describes proposed alternatives to an action and explains the effects of each. Based on the analyses presented, and considering regulatory agency and public input, DOE will determine the preferred alternative and issue a ROD regarding the action.

Since the Project began, a number of proposed site activities have warranted environmental impact evaluations. A summary of the significant NEPA document history is presented in Table ECS-2. WVDP CXs, EAs, and EISs can be found on the DOE-WVDP website under the documents index (www.wv.doe.gov/index.html).

Environmental Impact Statement (EIS) Issued. On April 14, 2010, DOE issued the ROD for the EIS, "Decommissioning and/or Long-Term Stewardship at the WVDP and the WNYNSC" (DOE/EIS-0226), selecting the phased decision-making alternative. In Phase 1, DOE will decommission the MPPB, the VIT facility, RHWF, the wastewater treatment lagoons, and a number of other facilities (see Figure ECS-1). No decommissioning actions will be taken on the WTF or the NDA, and the canisters of vitrified HLW will be safely stored on site. NYSERDA will manage the SDA. Phase 1 was originally estimated to take up to 10 years, during which time DOE will manage the site's remaining facilities in a safe manner.

The Phase 2 decision, which involves determining the decommissioning approach for the remaining facilities (e.g., the two inactive radioactive waste disposal facilities on the south plateau and the underground waste storage tanks), will be made within 10 years of the EIS ROD. DOE and NYSERDA are currently conducting additional scientific studies (i.e., Phase 1 Studies) to facilitate interagency consensus on decommissioning decisions for the remaining facilities.

FIGURE ECS-1
Summary of Activities Under Phase 1 and Phase 2



Supplemental Environmental Impact Statement (EIS). In February 2014, DOE and NYSERDA announced that a Supplemental EIS will be prepared to support the Phase 2 decision. In December 2015, DOE issued a request for information seeking feedback from contractors and other interested parties regarding their capabilities and proposed innovative approaches for performance of the Supplemental EIS. This market research will assist DOE with identifying interested and capable companies to perform the Supplemental EIS for Phase 2 decisions for the disposal areas and the underground storage tanks.

Probabilistic Peformance Assessment. Prior to preparation of the Supplemental EIS, a probabilistic performance assessment will be prepared to support the Phase 2 decision. DOE and NYSERDA awarded the contract to Neptune and Company, Inc. in September 2015 to perform this assessment for Phase 2 of the Phased Decisionmaking Alternative for the WVDP and WNYNSC. The work to be performed under the contract includes the following four elements:

- perform sensitivity analyses to provide near-term direction to site data collection activities,
- transition existing components of a deterministic performance assessment to a probabilistic modeling platform to identify changes necessary in the model structure, input parameter distribution, the need for additional data, or the need for different modeling approaches,
- prepare the long term probabilistic performance assessment to support decision making and meet requirements of NEPA and SEQR, and
- prepare chapters and appendices for the Supplemental EIS as required by the Supplemental EIS contractor. (The Supplemental EIS contract has not yet been awarded.)

Phase 1 Studies. In September 2011, DOE and NYSERDA jointly awarded the Phase 1 Studies contract to Enviro Compliance Solutions, Inc., an independent, agency-neutral contractor that is jointly funded by DOE and NYSERDA to administer contracts for all Phase 1 Study activities, including contracting with a facilitator, subject matter experts (SMEs), the Independent Scientific Panel (ISP), and contractors performing the study activities. This contract was renewed in March 2013. The purpose of the Phase 1 studies is to enable the agencies to make informed decisions for Phase 2 decommissioning and/or long-term stewardship of the landfills and buried tanks at the WVDP. Future erosion processes and buried waste inventories need to be estimated with sufficient confidence and with sufficient understanding of the uncertainties involved in order to make these decisions.

At the August 2015 Quarterly Public Meeting, the Exhumation Working Group and the Erosion Working Group of SMEs provided a detailed outline of their study plans. Field studies were initiated by the Erosion Working Group and the Exhumation Working Group began evaluating radionuclide inventories in the NDA, SDA and WTF in 2015.

Phase 1 Decommissioning Plan (DP) for the WVDP. On December 5, 2008, the DOE issued the "Phase 1 Decommissioning Plan for the West Valley Demonstration Project, West Valley, NY" (73 Federal Register 74162) and transmitted it for NRC review. The DP addressed Phase 1 of the proposed two-phased approach for WVDP decommissioning, consistent with the preferred alternative selected in the ROD and the Findings Statement for the WVDP and the WNYNSC. On December 18, 2009, DOE submitted revision 2 of the Phase 1 DP after incorporating responses to NRC's comments.

On February 25, 2010, NRC transmitted to DOE-WVDP the Technical Evaluation Report for the Phase 1 DP, concluding that the Phase 1 DP was consistent with the preferred alternative in the EIS. NRC also determined that there is reasonable assurance that the proposed Phase 1 actions will meet the decommissioning criteria.

Phase 1 Characterization Sampling and Analysis Plan (CSAP) and the Phase 1 Final Status Survey Plan (FSSP) for the WVDP. The Phase 1 DP required the preparation of two supplemental documents, the CSAP and the FSSP. These two documents provide the specific details of sampling activities to support Phase 1 decommissioning of the WVDP. The CSAP describes the radiological environmental data collection activities (surface and subsurface soils, sediments, and groundwater) that will specifically support the implementation of the Phase 1 decommissioning actions within the WVDP premises as described in the Phase 1 DP.

The FSSP provides the technical basis and sampling protocols to demonstrate that specific portions of the WVDP premises meet the Phase 1 radiological cleanup goals for surface and subsurface soils identified in the Phase 1 DP. The FSSP is consistent with the Multi-Agency Radiation Survey and Site Investigation Manual.

Environmental Characterization Services. In August 2015, DOE awarded a support service contract to North Wind Solutions, LLC to support the data collection activities, including environmental characterization services, described in the CSAP and the FSSP. Other technical support and subject matter expertise will also be provided under this contract. No CSAP or FSSP sampling was performed for environmental characterization in 2015.

Resource Conservation and Recovery Act (RCRA)

RCRA and its implementing regulations govern the life cycle of hazardous waste from "cradle-to-grave" and mandate that generators take responsibility for ensuring the proper treatment, storage, and ultimate disposal of their wastes. A hazardous waste permit is required for facilities that store large quantities of hazardous waste for more than 90 days or treat and/or dispose of hazardous waste at the facility.

EPA is responsible for issuing guidelines and regulations for the proper management of solid and hazardous waste (including mixed [radioactive and hazardous] waste). In New York, EPA has delegated the authority to issue permits and enforce these regulations to NYSDEC. In addition, the U.S. Department of Transportation is responsible for issuing guidelines and regulations for labeling, packaging, and spill reporting for hazardous and mixed wastes while in transit.

Hazardous Waste Permitting - RCRA Interim Status Permit Application. In 1984, DOE notified EPA of hazardous waste activities at the WVDP and identified DOE as a hazardous waste generator. In 1990, to comply with 6 NYCRR Part 373-3, a RCRA Part A (i.e., Interim Status or Part A) Permit Application for the WVDP was filed with NYSDEC for storage and treatment of hazardous waste. The WVDP has operated under interim status ever since. RCRA facility operations are limited to those described in the RCRA Part A Permit Application and must comply with the interim status regulations; therefore, the RCRA Part A Permit Application must be revised prior to changes to the Project's RCRA waste management operations. The latest revisions to the RCRA Part A Permit Application were submitted to NYSDEC on April 27, 2011 and were conditionally approved by NYSDEC on June 9, 2011.

In accordance with the Part A requirements, DOE prepared closure plans for the hazardous waste management units at the WVDP. The closure plans were transmitted to NYSDEC in anticipation of closure activities, and are revised as appropriate to address NYSDEC comments or changes in activities. To complete closure of a RCRA unit, waste is removed, and impacted areas and facilities are decontaminated and/or removed. When specified in the closure plan, confirmatory sampling and analysis are performed, and data are evaluated and presented to NYSDEC in a closure certification report to document completion of closure activities.

The 01-14 building, which contained the Cement Solidification System (CSS) was demolished in 2013. Piping and vessels associated with the CSS were removed during demolition. Building demolition did not include removal of the concrete floor which will be performed during subsequent Phase 1 decommissioning activities along with the below grade portions of the MPPB and VIT. A proposed path forward for RCRA closure of the CSS was submitted to NYSDEC on February 6, 2014. The proposed path forward would provide for completion of closure of the CSS unit after the concrete floor is removed. In the interim, the concrete floor is maintained in an environmentally safe and stable condition.

RCRA closure plans for all of the Interim Status RCRA Treatment and Storage Units are in the process of being revised to be consistent with current demolition plans for the MPPB and VIT facility, and Facilities Disposition contract end state.

RCRA Final Status Permit Application. In 2003, NYSDEC officially requested the submittal of a 6 NYCRR Part 373-2 Permit Application (i.e., Part B) for the WVDP. The completed permit application was transmitted to NYSDEC in December 2004.

On April 16, 2009, NYSDEC officially requested the submittal of a revised Part B Permit Application for the WVDP. The revised permit application was submitted to NYSDEC on September 30, 2010. Due to the scope and breadth of the permit application, DOE and NYSERDA agreed to NYSDEC's request for an indefinite suspension of NYSDEC's completeness review in January 2011.

On March 22, 2012, NYSDEC notified NYSERDA and DOE that they would suspend further action relative to a Part B Permit. The site will continue to operate according to the 6 NYCRR Part 373-3, Part A (Interim Status) Permit Application and the RCRA 3008(h) Administrative Order on Consent.

RCRA §3008(h) Administrative Order on Consent. Section §3008(h) of RCRA authorizes EPA to issue an order requiring corrective action to protect human health and a release of hazardous waste or hazardous constituents to the environment from a Solid Waste Management Unit (SWMU). DOE and NYSERDA entered into the Consent Order with NYSDEC and EPA in March 1992. Consent Order activities performed to date are summarized below.

- RCRA Facility Investigation (RFI)

  The Consent Order required NYSERDA and DOE's WVDP office to conduct RFIs (unit-specific environmental investigations) at SWMUs to determine if a release occurred or if there was a potential for release of RCRA-regulated hazardous constituents from a SWMU. As many SWMUs are contiguous or close together, most were grouped into larger units, called super SWMUs (SSWMUs), terminology unique to the WVDP. SSWMU descriptions and the individual constituent SWMUs are presented in Table ECS-4. Figures A-9 and A-10 in Appendix A show the WVDP SSWMU locations. Final RFI reports were submitted in 1997, completing the Consent Order investigative activities. No corrective actions were required at that time.

  Groundwater monitoring, as recommended in the RFI reports and approved by EPA and NYSDEC, continued during 2015 per the Consent Order requirements. The groundwater program and monitoring results at the WVDP are discussed in Chapter 4, "Groundwater Protection Program."

- Current Conditions Report

  Per a NYSDEC request, a report entitled "WVDP Solid Waste Management Unit Assessment and Current Conditions Report" was submitted in November 2004, which summarized the historic activities at each SWMU through the RFI activities and provided environmental monitoring data and information on SWMU activities performed since the RFI reports were submitted.

  This document was revised and submitted to NYSDEC and EPA on September 29, 2010, incorporating operational status changes of each SWMU and providing updated environmental monitoring data.

- Corrective Measures Studies (CMSs)

  In 2004, NYSDEC requested CMSs to be performed on six specific SWMUs at the WVDP. The six SWMUs were:
  - NDA Burial Area (SWMU #2);
  - NDA Interceptor Trench (SWMU #23);
  - Demineralizer Sludge Ponds (SWMU #5);
  - Lagoon 1 (SWMU #3);
  - Construction and Demolition Debris Landfill (CDDL) (SWMU #1); and
  - The Low-Level Waste Treatment Facility (LLWTF) (SWMUs #17, #17a, and #17b).

  The CMS Work Plan was conditionally approved by NYSDEC in October 2006. Draft CMS reports were revised in 2010 to be consistent with the EIS and ROD and provide corrective measures evaluations. The revised documents were submitted to NYSDEC and EPA on September 29, 2010.

- Interim Measures (IMs)

  The NDA (SSWMU #9) is regulated under the Consent Order. In 1990, an IM was implemented that involved construction of a trench system through the weathered Lavery till along the northeast and northwest sides of the NDA to intercept and collect groundwater potentially contaminated with a mixture of n-dodecane and tributyl phosphate (TBP). Monitoring results in 2015 detected no TBP or organic constituents in groundwater from the NDA interceptor trench.

  In 2008 DOE implemented a second IM for the NDA designed to minimize the potential release of impacted groundwater from the NDA, and minimize water infiltration into the NDA until the final disposition of the NDA is determined and can be implemented. An approximately 850 foot long low permeability slurry wall was constructed along the south and western sides of the NDA to limit lateral groundwater migration. In order to meet the IM requirements to ensure a minimum four foot thick earthen cap, the project also involved resurfacing the entire five acre (2 ha) landfill with additional soils, and re-grading, compacting, and applying an impermeable geomembrane cover. As a result of this IM, the volume of water pumped from the NDA interceptor trench has decreased significantly, to 63,035 gal (238,613 L) in CY 2015, compared with pre-IM volumes of several hundred thousand gallons per year. Refer to Chapter 4, "Groundwater Protection Program."

  In August 2015, the entire NDA cap was inspected, including storm water basins, walkways, ballast tubes, field seams, pipe penetrations, and the anchor trench. The need for several minor repairs, such as sealing minor holes, was observed; however, the overall cap condition was good, with no general deterioration of the geomembrane noted. The minor repairs identified were completed in 2015.

- Quarterly Reporting to EPA and NYSDEC

  Per the Consent Order, DOE transmits a quarterly progress report to EPA and NYSDEC, summarizing all Consent Order activities at the WVDP for the previous quarter. The report includes progress and accomplishments, contacts with local community interest groups and regulatory agencies pertaining to Consent Order activities at the WVDP, changes to personnel, projected future work activities, and an inventory of mixed waste generated from decontamination activities during the reporting period. The other report submitted quarterly to EPA and NYSDEC under the Consent Order is the groundwater exception report, a summary of RCRA groundwater monitoring results that exceed established trigger levels. The trigger levels are statistically derived from historical results, are based on regulatory criteria, or are based on analytical detection limits. This report includes NDA water level data that demonstrate the performance of the interceptor trench, cap, and slurry wall.

Hazardous Waste Management. Under RCRA, hazardous wastes at the WVDP are managed in accordance with 6 NYCRR Parts 370-374 and 376. Hazardous and mixed waste activities are reported to NYSDEC in the WVDP's Annual Hazardous Waste Report, which specifies the quantities of waste generated, treated, and/or disposed of, and identifies the treatment, storage, and disposal facilities used. The Annual Hazardous Waste Report for 2015 was submitted to NYSDEC in February 2016.

Additional reports are submitted each year to document hazardous waste reduction efforts. Pursuant to Article 27, Section 0908 of New York State Environmental Conservation Law, an update of the WVDP's Hazardous Waste Reduction Plan must be submitted to NYSDEC biennially. An annual status report (an abbreviated version of the biennial update) must be submitted in the interim years. The plan is updated to reflect changes in the types and amounts of hazardous wastes generated at the WVDP. The annual status report for the Hazardous Waste Reduction Plan for CY 2014 was submitted to NYSDEC on June 22, 2015. The biennial update for CY 2015 was submitted to NYSDEC in June 2016.

Mixed Waste Management. Mixed wastes that cannot be treated or disposed of within one year are managed according to the STP, prepared by the DOE under requirements of the Federal Facilities Compliance Act (FFCA) (an amendment to RCRA), in accordance with a Consent Order agreement. The annually updated plan describes the development of treatment capabilities and technologies for treating mixed waste and updates the mixed waste inventory. The fiscal year (FY) 2015 plan identified two proposed milestones for waste streams managed under the WVDP STP, one that was completed in FY 2015 with the successful off-site shipment of the large MPPB HEPA filters packaged in the 1980s, the last legacy containers of MLLW in the WVDP STP. The second STP milestone involves the management of MLLW from draining several tanks in the MPPB, scheduled to be completed by FY 2017. During 2015, 67,931 pounds (33.97 tons) of hazardous and mixed waste were shipped off site for disposal. (See Table ECS-5.)

Nonhazardous, Regulated Waste Management. Nonradioactive, nonhazardous material was also shipped off site to solid waste management facilities in 2015. Certain components of this waste (lead-acid batteries and spent lamps [i.e., universal wastes]) were reclaimed or recycled at off-site, authorized reclamation and recycling facilities. (See Table ECS-5.) Discharge of treated industrial wastewater to Erdman Brook was discontinued in November 2014. With the transfer from surface water to groundwater for a water supply in late September 2014, the generation of several nonradiological wastewater streams was eliminated and routine discharges ceased. Sanitary waste waters are shipped to the Buffalo Sewer Authority, to the Gowanda Sewage Treatment Plant, or to the Arcade Sewage Treatment Plant for treatment and disposal. (See Table ECS-5.)

Waste Minimization and Pollution Prevention. The annual pollution prevention progress report was submitted to DOE summarizing information for the pollution prevention tracking and reporting system. Reports are submitted to DOE and NYSDEC to document waste reduction efforts.

Construction and Demolition Debris Landfill (CDDL) Activities. The CDDL was closed in 1986 under a NYSDEC-approved closure plan for a nonradioactive solid waste disposal facility. The overall condition of the CDDL grounds were inspected in 2015, with no concerns noted. Over time, the north plateau strontium-90 plume has migrated from the MPPB into the CDDL area and beyond. In 2010, a full-scale PTW was installed south of the CDDL. Construction of the PTW did not impact the CDDL. See "Strontium-90 Plume Remediation Activities" in Chapter 4.

National Emission Standards for Hazardous Air Pollutants (NESHAP) Compliance.

NESHAP regulations in Title 40 CFR Part 61, Subpart H allow for use of two alternate methods of demonstrating compliance, either (1) the "measure and model" approach which involves measuring radiological emissions in air released from point sources (such as stack effluents) and using EPA-approved computer models to estimate dose to the maximally exposed off-site individual (MEOSI), or (2) the "environmental measurement" approach which involves measuring environmental concentrations (ambient monitoring) of airborne radionuclides at ambient air monitoring locations. Historically, NESHAP compliance at the WVDP was demonstrated using the "measure and model" approach. Resulting dose estimates for the WVDP using this method have always been far below the 10-millirem (mrem)/year compliance standard. As WVDP facilities continue to be decommissioned or demolished, the alternative approach of using environmental air sampling data to demonstrate compliance has become the more appropriate method.

In the fall of 2012, an ambient air monitoring network was installed surrounding the WVDP consisting of 16 low-volume sampling stations (one for each of the 16 compass sectors) and one high-volume sampler (which can measure lower concentrations) in the sector most often identified as having the maximum estimated dose. Baseline monitoring was performed in October 2012. Routine ambient air network monitoring began in 2013 and continued through 2015. These sampling results are discussed in Chapter 2, "Environmental Monitoring" and are tabulated in Appendix C.

With EPA approval (received July 2015), the method of demonstrating NESHAP compliance was changed to the "environmental measurement" approach for the 2014 annual NESHAP report. The EPA approval was founded on the results of a one-year period of using both the "measure and model" and the "environmental measurement" approach to demonstrate equivalency and confirm compliance in 2013, demonstrating that either method could reliably be used to confirm compliance with air emissions regulations. The ambient air monitoring network data was used to demonstrate compliance in the CY 2014 and CY 2015 NESHAP reports. (See additional discussion in Chapter 3, "Dose Assessment.")

On January 25, 2016, in preparation for upcoming WVDP demolition activities, DOE submitted a request for approval to EPA for an alternative source term calculation for facility demolition by various methods. Following review and approval by EPA, the alternative calculation methodology will be used to estimate potential emissions from the future planned demolition activities as allowed for by 40 CFR Part 61.96(b).

Environmental Issues

Unplanned Releases. There were no unplanned waterborne or airborne releases of radiological or nonradiological constituents from the WVDP in 2015 (as noted in Tables ECS-6 and ECS-9).

Safety Inspections of the WNYNSC Dams. The two dams located on the WNYNSC property are maintained to provide backup fire-suppression water and SPDES discharge flow augmentation water for the WVDP. The WVDP rail spur and an access roadway are located parallel to the lakes and run along the crest of both dams. A severe rain event in August 2009 caused flood damage to areas of the lakes, dams, and spillway. Since this event, the standard operating procedure for maintenance, inspection, and operation of the dams and spillway was enhanced. Repairs to the Lake 1 spillway and repairs to the Lake 2 dam were completed during CY 2014. However, several severe storms in July 2015 caused new damage to the spillway. Short term repairs to the toe of the spillway were made in 2015 and debris was removed from Buttermilk Creek downstream of the dams.

Project Assessment Activities in 2015

Throughout CY 2015, assessments were conducted through the Integrated Assessment Program (IAP) at the WVDP. This program effectively complies with applicable DOE directives, regulations, standards, Integrated Safety Management System (ISMS) and Environmental Management System (EMS) requirements. The IAP applies to all disciplines including, but not limited to safety and health, operations, maintenance, environmental protection, quality, decontamination and decommissioning (D&D), HLW activities, emergency management, business processes, and management. Inspections, reviews, and oversight activities are routinely conducted to evaluate performance, reduce risk, and identify improvement opportunities.

DOE-WVDP and other agencies with responsibilities for the WVDP also independently reviewed various aspects of the environmental and waste management programs. In November 2015, the DOE-WVDP conducted an audit of the CHBWV Environmental Protection Programs. This performance-based audit evaluated compliance with applicable regulatory requirements of the DOE, EPA and NYS relative to surface water and drinking water quality, and groundwater monitoring. The audit identified two findings related to off-site transportation of sanitary waste which have since been remedied. The auditors also included five noteworthy comments commending the site surface water, drinking water and groundwater programs and seven comments with potential program improvements.

Overall assessment results reflected continuing, well-managed environmental programs at the WVDP.

TABLE ECS-1
Compliance Status Summary for the WVDP in 2015

Citation	*Environmental Statute, DOE Directive, EO, Agreement*	*WVDP Compliance Status*
42 United States Code (USC) §2011 et seq.	The **AEA** of 1954 was enacted to assure the proper management of source, special nuclear, and by-product materials. The AEA and the statutes that amended it delegate the control of nuclear energy primarily to DOE, NRC, and EPA.	See discussions of the WVDP Act, DOE Orders 435.1, and 458.1
Public Law 96-368	The **WVDP Act** of 1980 authorized DOE to carry out a HLW demonstration project at the WNYNSC (the Center) in West Valley, New York.	DOE is focusing on goals that will lead to completion of responsibilities listed in the WVDP Act.
Cooperative Agreement between DOE and NYSERDA	The **Cooperative Agreement** between DOE and NYSERDA established a cooperative framework for implementing the WVDP Act, effective October 1980, as amended in September 1981. In 1990, the first supplemental agreement was signed by DOE and NYSERDA which set forth specific provisions for preparing a joint EIS. A second supplemental agreement to the Cooperative Agreement was drafted in January 2010 and issued by DOE and NYSERDA in March 2011.	Except as delineated in specific sections of the agreement, DOE was given sole responsibility to carry out the requirements of the WVDP Act. The DOE ROD was issued in April 2010 for the WVDP and the WNYNSC. There are no current activities being conducted under the 1990 Supplemental Agreement. In accordance with the second supplemental agreement, Phase 1 studies continued in 2015, including the initiation of field studies by the Erosion Working Group and NDA radionuclide inventory evalutions by the Exhumation Working Group.
WVDP MOU between DOE and NRC	The 1981 **MOU,** mandated by the WVDP Act, established procedures for review and consultation by NRC with respect to activities conducted at the WNYNSC by DOE. The agreement encompassed development, design, construction, operation, and D&D activities associated with the Project as described in the WVDP Act. Under the WVDP Act, and to satisfy commitments made to NRC, DOE was required to prepare a DP for the Project and submit it to NRC for review.	In 2002, NRC issued "Decommissioning Criteria for the WVDP (M-32) at the West Valley Site; Final Policy Statement" (67 FR 5003). The "Phase 1 DP for the West Valley Demonstration Project" was prepared by DOE and submitted to NRC in December 2008, and March and December, 2009. In February 2010, NRC issued a TER on DOE's Phase 1 DP. NRC conducted monitoring visits at the WVDP in late June and early November 2015.
DOE Order 231.1B	DOE Order 231.1B, **Environment, Safety, and Health Reporting (updated and approved on June 27, 2011 with Change 1 issued on November 28, 2012),** was issued to ensure that DOE and National Nuclear Security Administration receives timely and accurate information about events that could adversely affect the health, safety, and security of the public or workers, the environment, the operations of DOE facilities, or the credibility of the Department. *(continued on next page)*	This WVDP Annual Site Environmental Report (ASER) is prepared and submitted annually to DOE Headquarters (HQ), regulatory agencies, and interested stakeholders in compliance with DOE Order 231.1B.

TABLE ECS-1 *(continued)*
Compliance Status Summary for the WVDP in 2015

Citation	***Environmental Statute, DOE Directive, EO, Agreement***	***WVDP Compliance Status***
DOE Order 231.1B *(continued)*	This is accomplished through timely collection, reporting, analysis, and dissemination of data pertaining to environment, safety, and health issues as required by law or regulations, or in support of U.S. political commitments to the International Atomic Energy Agency (IAEA).	
DOE Order 458.1	DOE Order 458.1, **Radiation Protection of the Public and the Environment** (including Change 3, January 15, 2013), replaced DOE Order 5400.5 and established requirements to protect the public and environment against undue risk from radiation associated with radiological activities conducted under control of DOE pursuant to the AEA, by ensuring that: (1) operations are conducted to limit radiation exposure to members of the public pursuant to limits established in the Order, (2) radiological clearance of DOE real and personal property is controlled, (3) potential radiation exposures to members of the public are as low as reasonably achievable (ALARA), (4) routine and nonroutine releases are monitored and dose to the public is assessed, and (5) the environment is protected from the effects of radiation and radioactive material.	This ASER summarizes radiological estimates of dose to the public and the environment, and compares these values with release and dose standards established by this Order. In 2015, estimated doses from airborne and waterborne releases to the MEOSI were <0.49% of the 100-millirem (mrem) standard.
DOE Order 435.1	DOE Order 435.1, **Radioactive Waste Management**, originally issued in 1999, with Change 1 issued in 2001, ensures that all DOE radioactive waste is managed in a manner that is protective of worker and public health and safety and the environment, and complies with applicable state, federal, and local laws and regulations. Under the Order, sites that manage radioactive waste are required to develop, document, implement, and maintain a site-wide radioactive waste management program which includes actions to minimize radioactive waste generation.	The WVDP maintains program documentation separately for each waste type. Management of HLW was conducted in accordance with the "WVDP Waste Acceptance Manual;" TRU waste was managed in accordance with the "TRU Waste Management Program Plan;" LLW was managed as summarized in the "LLW Management Program Plan;" and the radioactive component of mixed LLW was managed as summarized in the "Site Treatment Plan (STP) FY 2015 Update."

TABLE ECS-1 *(continued)*
Compliance Status Summary for the WVDP in 2015

Citation	***Environmental Statute, DOE Directive, EO, Agreement***	***WVDP Compliance Status***
DOE Order 436.1, and EOs 13423 and 13514	DOE Order 436.1, **Departmental Sustainability**, May 2, 2011 replaced DOE Orders 450.1A and 430.2B. The Order also incorporates the initiatives of EOs 13423 and 13514, which provide requirements and responsibilities for managing sustainability within DOE to (1) ensure the DOE carries out its missions in a sustainable manner that addresses national energy security and global environmental challenges, and advances sustainable, efficient and reliable energy for the future, (2) institute cultural change to factor sustainability and greenhouse gas (GHG) reductions into all DOE decisions, (3) ensure DOE achieves the sustainability goals established in its **Strategic Sustainability Performance Plan (SSPP)** pursuant to applicable laws, regulations, and EOs.	The WVDP supports the objectives of DOE Order 436.1, and has an established culture of environmental stewardship through its EMS. Pollution prevention, waste minimization, and energy efficiency have been incorporated into the culture through standard practices, procedures, training, and encouraging new ideas. In December 2015, DOE-WVDP submitted the "WVDP FY 2016 Site Sustainability Plan" to DOE-HQ, which outlined performance status and planned goals to support DOE's sustainability mission. Refer to Chapter 1, "Environmental Management System." CHBWV, the WVDP Phase 1 decommissioning and facilities disposition contractor, received a Certificate of Registration for the International Organization for Standardization (ISO) 14001:2004 certification of its EMS on July 31, 2012. The CHBWV EMS was audited in 2015 and approved for re-certification on July 7, 2015.
Title 10 Code of Federal Regulations (10 CFR) Part 830, Subpart A	10 CFR Part 830, **Nuclear Safety Management**, Subpart A, **Quality Assurance Requirements,** and **DOE Order 414.1D, Quality Assurance**, provide the quality assurance (QA) program policies and requirements applicable to WVDP activities.	A QA program that provides a consistent system for collecting, assessing, and documenting data pertaining to radionuclides in the environment continued to be implemented at the WVDP. In 2015 the WVDP conducted their annual review of the Safeguards and Security programs in addition to the annual EMS assessment.
42 USC §4321 et seq., and 10 CFR Part 1021	The **NEPA** of 1969 and as amended in 1970, established a national policy to ensure that protection of the environment is included in federal planning and decisionmaking. The President's Council on Environmental Quality established a screening system of analyses and documentation that requires each proposed action to be categorized according to the extent of its potential environmental impact.	NEPA documents are prepared at the WVDP to describe potential environmental effects associated with proposed activities. The level of documentation depends upon whether the action constitutes a major federal action significantly affecting the quality of the human environment within the meaning of NEPA. During 2015, NEPA environmental checklists were prepared for installation of new temporary office space, construction of a new storm water discharge location (S09), routine WVDP maintenance, waste management, and other site activities. It was concluded that none of these activities have a significant impact on the human environment.

TABLE ECS-1 *(continued)*
Compliance Status Summary for the WVDP in 2015

Citation	***Environmental Statute, DOE Directive, EO, Agreement***	***WVDP Compliance Status***
Environmental Conservation Law (ECL), 6 NYCRR Part 617 NYS	The NY **SEQR Act** of January 1, 1996, enacted in September 1976 and as amended on June 26, 2000, requires adequate environmental review and assessment of whether a proposed action has the potential to have a significant environmental impact, prior to a decision regarding the action. Where a project involves both NYS and federal approvals, it is preferred to coordinate the SEQR and NEPA processes.	The SEQR process is an action-forcing statute that requires state agencies to incorporate environmental considerations directly into their decisionmaking, and where necessary, to modify that action to mitigate adverse environmental effects. Coordinated efforts were made at the WVDP to effectively utilize information from the federal EIS process to make the required SEQR Findings Statement for the WVDP and WNYNSC, which was issued in May 2010.
42 USC §6901 et seq., and NYS ECL, 6 NYCRR Chapter 4, subchapter B	The **RCRA** of 1976 and the **NYS Solid Waste Disposal Act** (NYS ECL Article 27 [Title 9]) govern the generation, storage, handling, and disposal of hazardous wastes and closure of systems that handle these wastes. RCRA was enacted to ensure that hazardous wastes are managed in a way that protects human health, safety, and the environment.	Generation, storage, handling, treatment, and disposal of hazardous waste, and closure of systems that handle hazardous waste at the WVDP, are conducted in accordance with the RCRA interim status regulations. CHBWV performed a RCRA self-assessment in March 2015 and no RCRA issues or concerns were identified. In May 2015, DOE performed a RCRA surveillance of tank 8D-4 management. The surveillance identified two findings which have since been addressed. DOE conducted a surveillance of RCRA operating records in August 2015. There were two comments on the operating records. No findings or concerns were identified.
Amendment to 42 USC §6961, NYS ECL, and NYSDEC Administrative Order on Consent with DOE	The **FFCA** of 1992 (an amendment to RCRA) requires DOE facilities to prepare an STP for treating mixed waste inventories to meet land disposal restrictions and to annually update the plan to account for changes in mixed waste inventories, capacities, and treatment technologies. DOE entered into a Consent Order with NYSDEC for the WVDP in 1996.	The FFCA and the FFCA Consent Order requires completing milestones identified in the STP volume. The WVDP STP for FY 2015 update was submitted to NYSDEC in February 2016. Refer to "Mixed Waste Management," earlier in this chapter.
Docket No. II RCRA 3008(h) 92-0202, and NYS ECL	DOE and NYSERDA entered into the **RCRA §3008(h) Administrative Order on Consent** with EPA (lead agency) and NYSDEC in March 1992. The state and federal RCRA regulations authorize the agencies to issue orders requiring RCRA corrective actions associated with the potential releases of hazardous waste and/or hazardous constituents from SWMUs at the WNYNSC.	Written procedures and site activities are compliant with the Consent Order. In accordance with the Consent Order, DOE submits quarterly reports to EPA and NYSDEC that summarize all RCRA §3008(h) activities and progress conducted at WVDP SWMUs for the representative quarter. A discussion of CY 2015 activities is presented earlier in this chapter.

TABLE ECS-1 *(continued)*
Compliance Status Summary for the WVDP in 2015

Citation	*Environmental Statute, DOE Directive, EO, Agreement*	*WVDP Compliance Status*
RCRA 3016 Statute	The **RCRA 3016 Statute** applies to all federal hazardous waste facilities currently owned or operated by the government. It requires that facility hazardous waste information be submitted to EPA and authorized states every two years.	WVDP facility hazardous waste activities are reported biennially to EPA and NYSDEC. The RCRA 3016 Hazardous Waste Plan Biennial Update for CY 2015 was submitted in June 2016.
42 USC §7401 et seq.; 40 CFR 61, Subpart H; and 6 NYCRR Chapter 3, Air Resources	The **Clean Air Act** of 1970 and the **NYS ECL** regulate the release of air pollutants through permits and air quality limits. Emissions of radionuclides are regulated by EPA via the NESHAP regulations. On April 5, 1995, DOE and EPA entered into an MOU concerning the Clean Air Act Emission Standards for Radionuclides 40 CFR Part 61 including Subparts H, I, Q, and T. Nonradiological emissions are permitted under 6 NYCRR Part 201-4 (Minor Facility Registrations).	DOE maintained seven NESHAP permits for radiological emissions and one Air Facility Registration Certificate for nonradiological emissions at the WVDP. The CY 2015 annual NESHAP Report summarizing radiological emissions and estimated dose was submitted to the EPA in June 2016. Estimated dose to the critical receptor from radiological air emissions during 2015 was <0.47 mrem, far below the 10-mrem Subpart H standard. Refer to Chapter 3, "Dose Assessment," for discussion.
33 USC §1251 et seq. and NYS ECL and 6 NYCRR Chapter 10	The **Federal Water Pollution Control Act** of 1977 (**Clean Water Act [CWA]**) and **NYS ECL** (Article 17 [Title 8]) seek to improve surface water quality by establishing standards and a system of permits. Wastewater and storm water discharges are regulated by NYSDEC through the SPDES permit. Discharges of fill material are regulated through permits issued by the USACE and water quality certifications issued by NYSDEC.	The current SPDES permit was modified in July 2015 to include the relocation of storm water outfall S09. NYSDEC granted an extension to continue operating under this permit after the 2016 expiration date while they conduct a technical review of the current permit. Monthly SPDES Discharge Monitoring Reports (DMRs) are submitted to NYSDEC. Industrial wastewater was monitored for chemical constituents during lagoon discharges (outfall 001). Treated industrial wastewaters are no longer discharged through outfall 007. SPDES-permitted storm water monitoring was completed during 2015 by sampling the eight drainage basins during storm events. During 2015, all results were within the effluent discharge limits specified in the SPDES permit.
NYS ECL Article 17, Titles 7 and 8, and ECL Article 70	**NYS ECL Article 17 (Titles 7 and 8), and** ECL **Article 70** regulate storm water discharges related to construction activity.	No new Storm Water Pollution Prevention Plans (SWPPPs) for storm water discharges associated with construction activities were required in CY 2015.

Table ECS-1 *(continued)*
Compliance Status Summary for the WVDP in 2015

Citation	***Environmental Statute, DOE Directive, EO, Agreement***	***WVDP Compliance Status***
NYS Navigation Law and NYS ECL	**NYS ECL** Article 17 (Titles 10 and 17), 6 NYCRR 612–614 and Parts 595–599, and 6 NYCRR Subpart 360-14 regulate design, operation, inspection, maintenance, and closure of aboveground and underground petroleum bulk storage (PBS) and chemical bulk storage (CBS) tanks. These laws also regulate spill reporting and cleanup. Under terms of a 1996 agreement, amended in 2005, DOE is not required to report a spill of petroleum product onto an impervious surface if the spill is less than five gal and is cleaned up within two hours of discovery.	The last CBS tank at the WVDP was closed under these regulations in 2006. There remain nine registered PBS tanks (eight aboveground storage tanks [ASTs] and one underground storage tank [UST]) that are periodically inspected and maintained. Spills are reported and cleaned up in accordance with WVDP policies and procedures. There were no immediately reportable spills during 2015. There were 8 small petroleum spills (less than five gal [18.9 L] each) during CY 2015, which did not require immediate notification to NYSDEC, but were reported in quarterly reports.
EO 11990	EO 11990, **Protection of Wetlands**, directed federal agencies to avoid, where possible, impacts (e.g., destruction, modification, or new construction) that would adversely effect wetlands wherever there is a practical alternative. Activities in wetlands are regulated by the USACE and NYSDEC permits. The wetlands on the WVDP are subject to regulation under Section 404 of the CWA and NYS ECL Articles 24 and 36.	Wetlands are periodically identified and delineated on the WVDP. In March 2006, the USACE approved the 2003 site-wide WVDP wetlands survey. Additional wetlands were delineated in the vicinity of the firing range in October 2006 and in the vicinity of the HLW Cask Storage Pad and north slope of the NDA in May 2013. During 2015, no new wetlands were delineated and no wetlands were impacted by construction activities.
42 USC §9601 et seq.	The **Comprehensive Environmental Response, Compensation, and Liability Act** of 1980 **(CERCLA**, including the **Superfund Amendments and Reauthorization Act** of 1986 **[SARA]**) provided the regulatory framework for remediation of releases of hazardous substances and remediation of inactive hazardous waste disposal sites.	Based on the results of a Preliminary Assessment Report prepared for DOE, it was determined that the WVDP did not qualify for listing on the national priorities list. Therefore, no further investigation pursuant to CERCLA was warranted. However, if a hazardous substance spill exceeds a reportable quantity, CERCLA reporting requirements would be triggered.
42 USC §11001 et seq.	The **Emergency Planning and Community Right-to-Know Act (EPCRA)** of 1986 (also known as SARA Title III) was designed to create a working partnership between industry, business, state, and local government, and emergency response representatives to help local communities protect public health, safety, and the environment from chemical hazards.	Chemical inventories for the WVDP are reported quarterly under EPCRA, as appropriate. Refer to Tables ECS-7 and ECS-8.

TABLE ECS-1 *(continued)*
Compliance Status Summary for the WVDP in 2015

Citation	*Environmental Statute, DOE Directive, EO, Agreement*	*WVDP Compliance Status*
42 USC §300f et seq.	The **Safe Drinking Water Act** of 1974 requires that each federal agency operating or maintaining a public water system must comply with all federal, state, and local requirements regarding safe drinking water. Compliance in NYS is verified by oversight of the NYSDOH, through NYS Public Health Law, and the Cattaraugus County Health Department (CCHD).	The WVDP operates a nontransient, noncommunity public drinking water system serving a population of less than 500. All CY 2015 results from analyses of drinking water were reported within limits to the CCHD. The CCHD routinely performs inspections of the treatment and distribution system. Potable water has been supplied by two groundwater wells since the fall of 2014. In 2015, a nurse's station and new men's and ladies' restrooms were constructed in temporary trailers in the site parking lot, requiring installation of new water supply distribution lines.
10 CFR Part 851	10 CFR 851 **Worker Safety and Health Program** of 2006 requires DOE contractors to provide workers with a safe and healthful workplace. To accomplish this objective, the rule established program requirements specific to management responsibilities, worker rights, hazard identification and prevention, safety health standards, required training, recordkeeping, and reporting.	Procedures and programs are revised to maintain requirements that comply with 10 CFR 851. Any proposed modification that may invalidate a portion of the worker health and safety program at the WVDP must be approved by DOE-WVDP. The plan was reviewed in July 2015, and it was determined that no changes to the current plan were necessary.
10 CFR Part 835	10 CFR Part 835, **Occupational Radiation Protection**, amended May 2011, established radiation protection standards, limits, and program requirements for protecting individuals from ionizing radiation resulting from the conduct of DOE activities.	The document "CH2MHILL·B&W West Valley, LLC Documented Radiation Protection Program and Implementation for 10 CFR Part 835, as amended May 2011" (WVDP-477) was last revised in February 2012.
15 USC §2601 et seq., and 12 NYCRR Part 56	The **Toxic Substances Control Act** of 1976 regulates the manufacture, processing, and distribution of chemicals, including asbestos-containing material (ACM) and polychlorinated biphenyls (PCBs). Effective September 2006, the NYS Department of Labor (NYSDOL) significantly revised the asbestos regulations, cited in 12 NYCRR Part 56. As a result, operating procedures were revised, special training for asbestos workers was conducted, and the WVDP applied for and was granted site-specific variances.	ACM activities were managed in accordance with the site "Asbestos Management Plan" and activities were completed by personnel certified by NYSDOL. Refer to Table ECS-5 for a summary of asbestos waste management activities. PCBs are managed in accordance with the WVDP document "PCB and PCB-Contaminated Material Management Plan." The WVDP operators maintain an annual document log that details PCB use and changes in storage or disposal status.

TABLE ECS-1 *(continued)*
Compliance Status Summary for the WVDP in 2015

Citation	***Environmental Statute, DOE Directive, EO, Agreement***	***WVDP Compliance Status***
7 USC §136 et seq.	The **Federal Insecticide, Fungicide, and Rodenticide Act** of 1996 and **NYS ECL** provide for EPA and NYSDEC control of pesticide distribution, sale, and use.	Chemical pesticides are applied at the WVDP only after alternative methods are evaluated by trained and NYSDEC-certified professionals and determined to be unfeasible. Herbicides were used at the WVDP during July, August, and October 2015. No paraquat dichloride, the active ingredient in the herbicide used at the WVDP, was detected in the storm water outfall samples collected in 2015 following these applications.
NYS ECL, Article 15, Title 5, et seq.	**NYS ECL**, Article 15, Title 5, **Protection of Water** regulates the safety of dams and other surface water impounding structures, including construction, inspection, operation, maintenance, and modification of these structures. Revised dam safety regulations became effective on August 19, 2009. The dams maintained by the WVDP, on the WNYNSC property, are classified as Class A - low-hazard dams.	Two surface water impounding dam structures are located on the WNYNSC: NYS Atomic Development Dam #1 (DEC Dam ID #019-3149) and NYS Atomic Development Dam #2 (DEC Dam ID #019-3150). Severe storms in July 2015 caused damage to the 2014 repairs to the Lake 1 spillway. In 2015, short term repairs were made to the toe of the spillway and debris was removed downstream from Buttermilk Creek. Routine maintenance and inspections continued to be performed in 2015.
NYS ECL Article 15, Title 33, Part 675	**NYS ECL,** Article 15, Title 33 **Water Withdrawal Reporting** requires that any person who withdraws or is operating any system or method of withdrawal that has a capacity to withdraw more than 100,000 gal (378,541 L) of groundwater or surface water per day shall file an annual report with NYSDEC. The legislation was enacted to gain more complete information for managing the state's water resources.	A nontransient, noncommunity public water supply system for drinking water and operational purposes is maintained and operated at the WVDP. In compliance with the legislation, the water withdrawal reporting forms for 2015 were submitted to NYSDEC in March 2016. The WVDP withdrew an average of 58,311 gal/day (220,731 L/day).
49 CFR Part 172, and 6 NYCRR Part 364.9	**6 NYCRR Part 364.9** regulates handling and storage of potentially infectious regulated **medical waste**. 49 CFR Part 172, Subpart H regulates transportation safety and disposal of regulated medical waste at a licensed facility.	The on-site health services office is registered with NYS as a "Small Quantity Generator" of regulated medical waste. Medical services generate potentially infectious medical wastes that are securely stored in approved biohazard containers and are handled and controlled by authorized personnel.

TABLE ECS-1 ***(concluded)***
Compliance Status Summary for the WVDP in 2015

Citation	***Environmental Statute, DOE Directive, EO, Agreement***	***WVDP Compliance Status***
16 USC §703 et seq. and EO 13186	The **Migratory Bird Treaty Act** of 1918 implemented various treaties and conventions between the U.S. and foreign countries for the protection of migratory birds. Under the Act, taking, killing, or possessing migratory birds is unlawful.	DOE maintains a U.S. Fish and Wildlife Bird Depredation Permit for the WVDP. Migratory bird nest depredation activities for the current year are summarized in Table ECS-10.
16 USC §1531 et seq., and 6 NYCRR Part 182	The **Endangered Species Act** of 1973 provided for the conservation of endangered and threatened species of fish, wildlife, and plants. (See also 6 NYCRR Part 182, **Endangered and Threatened Species of Fish and Wildlife; Species of Special Concern**.)	Several ecological surveys of the WNYNSC premises have been conducted. Except for "occasional transient individuals," no plant or animal species protected under the Endangered Species Act are known to reside at the Center.
16 USC §470	The **National Historic Preservation Act** of 1966 established a program for the preservation of historic properties throughout the nation.	Surveys of the WNYNSC have been conducted for historic and archaeological sites. Surveys revealed American Indian and historic homestead artifacts, consistent with the area.
EO 11988	EO 11988, **Floodplain Management**, was issued to avoid adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative.	No activities were performed during 2015 at the WVDP that would develop new floodplains or be adversely impacted by the existing 100-year floodplain within the premises.
Stipulation Pursuant to NYS ECL Section 17-0303, and Section 176 of the Navigation Law	In accordance with **Stipulation No. R9-4756-99-03**, dated March 1999, DOE agreed to install a soil bioventing system to remediate petroleum contaminated soils in the warehouse UST site (NYSDEC Spill number 9708617). The remediation plan was to construct a bioventing system, operate it for two years, assess performance, and report to NYSDEC.	The system stimulated in-situ biodegradation of petroleum hydrocarbons in the soil by providing abundant oxygen to existing microorganisms. After reviewing soil and water sampling data and evaluations, NYSDEC determined that no further remediation was required. The system was removed in 2014. A determination regarding the potential need for additional future actions will be made consistent with Phase 2 decisionmaking under the NEPA process.
6 NYCRR Part 360	**NYS ECL Solid Waste Management Facility Regulations** define requirements for closure of nonradioactive solid waste disposal facilities in a manner that protects the environment.	Per a 1986 NYSDEC approved engineering closure plan, the CDDL was closed. As required by the plan, the CDDL cover was inspected in 2015 and all areas were found to be in good condition.

TABLE ECS-2
NEPA Documents Affecting DOE Activities at the WVDP

Year	*Action*	*Outcome*
1982	The FEIS, "Final Environmental Impact Statement: Long-Term Management of Liquid High-Level Radioactive Wastes Stored at the WNYNSC, West Valley (DOE/EIS-0081)" and associated ROD were issued outlining the actions DOE proposed for solidification of the liquid HLW contained in the underground tanks.	The initial period of WVDP Act work activities, completed in September 2002, removed the HLW from the tanks and immobilized it into borosilicate glass through VIT. The canisters of vitrified HLW remain on site in storage. During 2015, four casks, each containing five HLW canisters, were relocated from the MPPB to the on-site HLW Cask Storage Pad.
1988	DOE and NYSERDA published a NOI to prepare the EIS for "Completion of the WVDP and Closure or Long-Term Management of the Facilities at the WNYNSC (the Center)."	The DEIS was issued in 1996.
1996	DOE and NYSERDA issued the “Draft EIS for the Completion of the WVDP and Closure or Long-Term Management of the Facilities at the WNYNSC” (DOE/EIS-0226-D).	The DEIS was issued without a preferred alternative for a six-month review and comment period. After issuing the DEIS, and despite long negotiations, DOE and NYSERDA were unable to reach an agreement on the future course of action for closure at the Center (see Government Accounting Office, 2001).
1997	Following issuance of the 1996 DEIS, NYSERDA and DOE formed a stakeholder advisory group (the West Valley Citizen Task Force) to provide additional input to the public comment process required by the NEPA.	The Citizen Task Force's mission is to provide stakeholder input to decisionmaking for development of a closure option for the WVDP and the WNYNSC.
1997	DOE-HQ issued the “Final Waste Management Programmatic EIS,” (WM PEIS [DOE/EIS-0200F]) to evaluate nationwide management and siting alternatives for treatment, storage, and disposal of five types of radioactive and hazardous waste.	The WM PEIS (DOE/EIS-0200F) was issued with the intent to issue a separate ROD for each type of waste generated, stored, or buried over the next 20 years at 54 sites in the DOE complex.
1999	DOE issued a ROD for nationwide management of HLW, Vol. 64, FR, p. 46661 (64 FR 46661).	The ROD specified that WVDP-vitrified HLW will remain in storage on site until it is accepted at a geologic repository
2000	DOE issued a ROD for nationwide management of LLW and mixed LLW (65 FR 10061).	The Hanford site in Washington State and the Nevada National Security Site (previously the Nevada Test Site) were designated as national DOE disposal sites for LLW and mixed LLW.
2001	DOE published an NOI (66 FR 16447) formally announcing its rescoping plan for preparing the waste management EIS for the WVDP. DOE published an Advance NOI (66 FR 56090), announcing in advance, its intention to prepare an EIS for Decommissioning and/or Long-Term Stewardship at the WVDP and the WNYNSC.	The rescoping plan split the scope of the 1996 WVDP DEIS into two phases: (1) near-term waste management decisionmaking and (2) final decommissioning and/or long-term stewardship decisionmaking. The advanced NOI informed interested parties of a pending EIS and provided opportunity for public comments early in the process.

TABLE ECS-2 *(continued)*
NEPA Documents Affecting DOE Activities at the WVDP

Year	*Action*	*Outcome*
2003	DOE issued a notice of availability of the "WVDP Draft Waste Management EIS" (68 FR 26587). DOE, in cooperation with NYSERDA, issued an NOI (68 FR 12044) to issue an EIS for "Decommissioning and/or Long-Term Stewardship at the WVDP and the WNYNSC."	The DEIS presented alternatives for near-term management of WVDP LLW, mixed LLW, TRU waste, and HLW. Based on comments during the scoping process and the complexity of issues relating to long-term agency responsibility, this EIS was delayed (DOE-EIS-0226-R).
2005	DOE issued a ROD, based on alternative A, for the "WVDP Waste Management EIS (WVDP WM EIS-0337)" (70 FR 35073).	The canisters of vitrified HLW will remain in storage on site until transfer to a geologic repository, the decision on TRU waste would be deferred until certification is obtained from the Waste Isolation Pilot Plant in Carlsbad, New Mexico, and LLW and mixed LLW would be shipped off site for disposal at commercial or DOE sites.
2005	On August 26, 2005, The Coalition filed a complaint in the U.S. District Court, Western District of New York, against DOE regarding the NEPA process at the WVDP. The Coalition contended that DOE's rescoping plan to split the 1996 WVDP DEIS violated NEPA and the Stipulation of Compromise. The Coalition also sought a declaration that DOE is not empowered to reclassify waste at the WVDP using the "waste incidental to reprocessing" determination.	On September, 28, 2007, the U.S. District Court, Western District of New York ruled to dismiss the complaint in its entirety. Refer to Case 1:05-cv-00614-JTC, Document 41, filed September 28, 2007 for the ruling.
2006	An EA (DOE/EA-1552) evaluated the proposed decontamination, demolition, and removal of select site facilities. A FONSI was issued.	The EA, with the FONSI, cleared the way for removal of 36 facilities that were (or in the next four years would be) no longer required to support WVDP activities.
2007	DOE issued an NOI to prepare an EIS for the disposal of Greater-Than-Class-C (GTCC) LLW (72 FR 40135). In March 2011, DOE issued the DEIS for the disposal of GTCC LLW and GTCC-like waste.	Nine scoping meetings for the EIS were held throughout 2007. On February 25, 2011, a notice of availability for the GTCC draft EIS was issued with the 120-day public comment period ending on June 27, 2011. The final EIS for disposal of GTCC and GTCC-like waste was issued on March 4, 2016 with a review period ending April 4, 2016.
2008	DOE issued a notice of availability for the revised "Draft Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the WVDP and WNYNSC (DOE/EIS-0226-D [Revised])" (73 FR 74160).	The DEIS evaluated the range of reasonable alternatives for decommissioning and/or long-term stewardship of the facilities at the Center. This DEIS is a revision of the 1996 Cleanup and Closure DEIS. This DEIS was distributed December 5, 2008, for a six-month public review period, which was extended through September 8, 2009.

TABLE ECS-2 *(concluded)*
NEPA Documents Affecting DOE Activities at the WVDP

Year	*Action*	*Outcome*
2010	In January 2010, DOE issued the "Final EIS (FEIS) for Decommissioning and/or Long-Term Stewardship at the WVDP and WNYNSC (DOE/EIS-0226 [Revised])". On April 14, 2010, DOE issued the ROD for the FEIS, selecting the phased decisionmaking alternative as the preferred alternative. On May 12, 2010, NYSERDA issued a SEQR Findings Statement selecting the phased decisionmaking alternative as the preferred alternative.	In Phase 1 of the phased decisionmaking preferred alternative, DOE will decommission the MPPB, the VIT facility, RHWF, the wastewater treatment lagoons, and a number of other facilities. The Phase 2 decision will be made within 10 years of the EIS ROD.
2014	In early 2014, DOE and NYSERDA announced that a joint Supplemental EIS would be prepared for the Phase 2 decisions. The integrated approach developed by DOE and NYSERDA for making the Phase 2 decision will incorporate probabilistic performance assessment to support the Phase 2 Decisionmaking Alternative for the WVDP and WNYNSC.	In September 2015, DOE awarded the contract for preparing the probabilistic performance assessment to Neptune and Company, Inc.
2015	In December 2015, DOE issued a request for information seeking feedback from contractors and other interested parties regarding their capabilities and proposed innovative approaches for performance of the Supplemental EIS.	This market research will assist DOE with identifying interested and capable companies to perform the EIS to support Phase 2 decisions for the disposal areas and the underground storage tanks.

TABLE ECS-3
WVDP Environmental Permits

Permit Name and Number	*Agency / Permit Type*	*Description*	*Updates*	*Status*
WVDP RCRA Part A Permit Application (EPA ID #NYD980779540)	NYSDEC Hazardous Waste	Provides interim status under RCRA for treatment and storage of hazardous waste.	DOE is currently operating under the April 2011 RCRA Part A Permit Application. Revisions were submitted to NYSDEC in April 2011, and conditionally approved on June 9, 2011.	On August 29, 2011, the permit was transferred to CHBWV.
6 NYCRR Part 373-2 (i.e., Part B) Permit Application (Rev. 1)	NYSDEC Hazardous Waste	Provides final status under RCRA for treatment and storage of hazardous waste.	Submitted a revised application to NYSDEC on September 30, 2010. In January 2011, NYSDEC review was suspended indefinitely.	On March 22, 2012, NYSDEC suspended action relative to the Part B until completion of Phase 1 work.
Air Facility Registration Certificate (9-0422-00005/00099)	NYSDEC / Air Emissions	Certificate caps nitrogen oxide (NO_x) and sulfur oxide (SO_x) emissions from two boilers.	None. Boilers have been taken out of service.	No expiration date.
MPPB Ventilation (WVDP-687-01)	EPA / NESHAP	MPPB ventilation radionuclide emissions (originally permitted to ventilate the Liquid Waste Treatment System [LWTS]).	MPPB stack ventilation is still operating under the original permit. Discharge through the MPPB stack continues from the Ventilation Exhaust Cell (VEC). The original Head End Ventilation (HEV) portion of the MPPB ventilation has been shut down and now exhausts through a new Replacement Ventilation Unit (RVU) emission point that became operable in August 2015. (See RVS permit below.)	Original approval on December 22, 1987. Modified on May 25, 1989 to include the laboratories. Modified February 18, 1997 to include the slurry-fed ceramic melter. No expiration date.
Replacement Ventilation System (RVS) (WVDP-RVS-MPPB-New-001)	EPA / NESHAP	Permit to construct a new ventilation and emission system to replace the HEV portion of the MPPB ventilation system.	The RVS is composed of two RVUs discharging through one emission point. The RVS became operational in August 2015.	Application was approved by EPA on March 25, 2015. No expiration date.
VIT Facility Heating, Ventilation, and Air-Conditioning (HVAC) System (no permit number)	EPA / NESHAP	VIT Facility HVAC system for radionuclide emissions.	Facility being used for remote processing of waste .	Approved on February 18, 1997. No expiration date.

TABLE ECS-3 *(continued)*
WVDP Environmental Permits

Permit Name and Number	*Agency / Permit Type*	*Description*	*Updates*	*Status*
Contact Size-Reduction Facility (CSRF) (WVDP-287-01)	EPA / NESHAP	Contact size-reduction and decontamination facility radionuclide emissions	Stack ventilation not in service. Portable Ventilation Unit (PVU) installed in 2015 for use during pre-demolition cleanout activities in 2016. There was no activity requiring ventilation in the CSRF during 2015.	Approved on October 5, 1987. No expiration date. This system is inactive and being prepared for demolition.
Supernatant Treatment System (STS) /PVU (WVDP-387-01)	EPA / NESHAP	STS ventilation for radionuclide emissions	System receives air ventilated from T&VDS.	Original approval on October 5, 1987. Modified on May 4, 1998 for full-time ventilation of WTF. No expiration date.
RHWF (WVDP-RHWF Mod-001)	EPA / NESHAP	RHWF ventilation for radionuclide emissions	Permit issued to allow use of plasma arc cutting techniques in the RHWF.	Approved on April 18, 2012. No expiration date.
Outdoor Ventilated Enclosures/ PVUs (WVDP-587-01)	EPA / NESHAP	Fifteen PVUs for removal of radionuclides.	Since 2007, EPA approval to expand usage of PVUs from 10 to 15. DOE tracks usage on the basis of annual cumulative estimated dose.	Original approved on December 22, 1987. Modified on December 10, 2007 for 15 units. No expiration date.
SPDES (NY0000973)	NYSDEC / Effluent water	Monitors discharges to surface waters from various on-site sources.	An amended SPDES permit was issued by NYSDEC, effective July 1, 2011. The SPDES permit was modified in July 2015 for the relocation of the S09 storm water outfall.	The permit expires on June 30, 2016. Per NYSDEC request, the WVDP submitted a "SPDES Notice/Renewal Application and Questionnaire" to NYSDEC on November 5, 2015 and received a letter from NYSDEC allowing discharges to continue under the existing permit while NYSDEC conducts their technical review of the current permit.
Zuech's Environmental Services, Inc. (Waste Transporter Permit #9A-707)	Sanitary sewage sludge hauler permit	Permit to haul sewage from the Wastewater Treatment Facility (WWTF), portable toilet units, and parking lot waste water collection tank (installed in January 2016).	Annual renewal by March 1st.	Permit renewed annually. Most recent renewal February 29, 2016.

Note: Permit and license expiration dates are current as of September 2016.

TABLE ECS-3 *(concluded)*
WVDP Environmental Permits

Permit Name and Number	*Agency / Permit Type*	*Description*	*Updates*	*Status*
Public Water System ID #NY0417557	CCHD	The WVDP is a nontransient noncommunity public drinking water system.	System was changed from a surface water source to a groundwater source in 2014.	No expiration date.
PBS (#9-008885)	NYSDEC / PBS tank registration	Registration of bulk storage tanks used for petroleum.	Diesel fuel tank FO-D-11 was permanently closed and removed from the license.	License expires September 2, 2016.
Asbestos-Handling License CHBWV #61646	NYSDOL / asbestos-handling and sampling activities	Asbestos contractors license with specific variances for handling and monitoring.	Renewed for CY 2016 in September 2015.	The license was renewed in 2015 and expires on September 30, 2016; each variance has a unique expiration date.
NYS Atomic Development Dam #1 (Reg. ID #019-3149) NYS Atomic Development Dam #2 (Reg. ID #019-3150) USACE Emergency Regional Permit (#99-000-1)	NYSDEC Division of Water, Bureau of Flood Protection and Dam Safety	Two Class A Low-Hazard dams on the WNYNSC property, that supply water for operational purposes, are maintained at the WVDP.	Repair of the 2009 flood damage was completed in 2014. However, new damage to the spillway occurred on July 14, 2015 when a significant amount of rain fell over a short time period.	In 2015, additional short term repairs of the 2015 storm damage were made to the toe of the spillway. Debris in Buttermilk Creek was also removed downstream of the dams. This work was performed under the USACE Emergency Regional Permit.
Underground Injection Control Program Regulation (UICID: 11NY00906001)	EPA Groundwater Compliance Section	EPA regulates injection of tracer solutions into groundwater wells.	Several wells in the north plateau PTW were used to inject sodium bromide tracer solution to estimate groundwater flow velocities.	On November 18, 2010, EPA authorized operation of injection wells.
Bird Depredation Permit (MB747595-0)	U.S. Fish and Wildlife Service	Federal permit for the limited taking of migratory birds and active bird nests.	Permit was renewed on October 1, 2015.	Permit expires September 30, 2016. Renewed annually in August.

Note: Permit and license expiration dates are current as of September 2016.

TABLE ECS-4
WVDP RCRA SSWMUs and Constituent SWMUs
Identified in the RFI under the RCRA 3008(h) Order on Consent

SSWMU	SWMU #	Constituent SWMUs
SSWMU #1 – LLWTF	3, 4, 17, 17a, and 17b	Former lagoon 1; LLWTF; lagoons 2, 3, 4, and 5; neutralization pit; and interceptors
SSWMU #2 – Miscellaneous Small Units	5, 6, 7, and 10	Demineralizer sludge ponds and solvent dike; effluent mixing basin; and waste paper incinerator
SSWMU #3 – LWTS	18, 18a, 22, and Sealed Rooms	LWTS; cement solidification system; and specific sealed rooms in the MPPB (per the RFI Workplan and Current Conditions Report)
SSWMU #4 – HLW Storage and Processing Area	12/12a, 13, 19, and 20	WTF; VIT test facility waste storage tanks; STS; and VIT facility
SSWMU #5 – Maintenance Shop Leach Field	8	Maintenance shop leach field
SSWMU #6 – Low-Level Waste Storage Area	9/9a, 15, 16/16a, and 38	Lag storage additions (LSAs) #1 and #2 hardstands; old and new hardstand storage areas; Lag storage building; Lag storage extension; LSAs #3 and #4; and the drum supercompactor
SSWMU #7 – Chemical Process Cell-Waste Storage Area	14	Chemical Process Cell-Waste Storage Area
SSWMU #8 – CDDL	1	CDDL
SSWMU #9 – NDA	2, 11/11a, 23, 31, and 39	NDA and NDA trench soil container area; kerosene tanks; NDA container storage area; and interceptor trench project and staging area for NDA
SSWMU #10 – Integrated Radwaste Treatment System	21	Integrated radwaste treatment system drum cell
SSWMU #11 – SDA	NA	The SDA is a closed radioactive waste landfill that is contiguous with the Project premises and is owned and managed by NYSERDA. For more information, see their website at www.nyserda.ny.gov.
SSWMU #12 – Hazardous Waste Storage Lockers (HWSLs)	24	HWSLs 1 to 4

Note: The WVDP RCRA SWMUs and SSWMUs are discussed under the section titled "RCRA §3008(h) Administrative Order on Consent." See Figures A-9 and A-10 for location of the SSWMUs.

TABLE ECS-4 *(concluded)*
WVDP RCRA SSWMUs and Constituent SWMUs
Identified in the RFI under the RCRA 3008(h) Order on Consent

WVDP RCRA SWMUs Not Associated with a SSWMU		
Individual SWMUs	25	Inactive scrap metal landfill adjacent to bulk storage warehouse (NYSERDA SWMU)
	26	Subcontractor maintenance area
	27	Fire brigade training area
	28	VIT hardstand
	29	Industrial waste storage area
	30	Cold hardstand area near the CDDL
	32	Old sewage treatment facility
	33	Existing sewage treatment facility
	34	Temporary storage locations for well purge water
	35	Construction and demolition area
	36	Old school house septic system
	37	CSRF
	40	Satellite accumulation areas and 90-day storage areas
	41	Designated roadways
	42	Product storage area
	43	Warehouse extension staging area
	44	Fuel receiving and storage area; high-integrity container and SUREPAK™ staging area
	45	Breach in laundry wastewater line
	46	VIT vault and empty container hardstand
	47	RHWF

Note: The WVDP RCRA SWMUs and SSWMUs are discussed under the section titled "RCRA §3008(h) Administrative Order on Consent." See Figures A-9 and A-10 for location of the SSWMUs.

TABLE ECS-5
Summary of Waste Management Activities at the WVDP During 2015

Waste Description/ Facility	*Type of Project Generating Waste*	*Quantity in 2015*	*Discussion*
LLW	Includes all sources of generation	27,759 cubic feet (ft^3) (786 cubic meters [m^3])	LLW shipped in 2015.
TRU waste	TRU waste processing	1,602 cubic Feet (ft^3) (45.4 cubic meters [m^3])	TRU waste generated in 2015.
Hazardous and Mixed LLW	Primary source of generation was decomissioning activites and legacy waste shipments	Generated: 2,013.9 lbs (1.01) tons Shipped: 67,931.2 lbs (33.97) tons	Waste generated and shipped during 2015. Shipped quantity includes cemented boxes containing MPPB HEPA filters.
Radiological wastewater from the LLWTF (Low Level Waste Treatment Building, LLW2 [WNSP001])	NYSDEC regulates point-source liquid effluent discharges of treated process wastewater through the SPDES permit for the WVDP.	Approximately 5,186,150 gallons (19,631,713 L)	During 2015, three batches of wastewater were processed through the LLW2. This included groundwater pumped from the NDA interceptor trench.
Industrial wastewaters (WNSP007)	All sources of industrial wastewater were terminted prior to 2015.	No industral wastewaters were discharged through outfall 007 during 2015.	Discharges through outfall 007 were discontinued in November 2014.
Sanitary wastewaters	Waste shipping and disposal	Approximately 1,248,809 gallons (5,677,201 L)	Sanitary wastewaters were authorized for shipment to the Buffalo Sewer Authority, the Gowanda Sewage Treatment Plant, or the Arcade Sewage Treatment Plant for treatment and disposal during 2015.
NDA interceptor trench	Interceptor trench (WNNDATR) and groundwater pre-treatment	Approximately 63,035 gallons (238,613 L)	Groundwater was pumped and transferred to the LLW2. No organics or TBP were encountered in 2015. No pre-treatment was necessary.
Asbestos	Asbestos management and abatement	1,500 square feet (ft^2) (139.4 square meters [m^2]) of friable asbestos	Friable asbestos was removed from the Off-Gas Cell as a pre-demolition activitiy during 2015.
Universal waste	Spent bulbs/spent batteries	Bulbs - 287 lbs (0.14 ton) Batteries - 3,710 lbs (1.86 ton)	Waste disposed of as universal waste.

TABLE ECS-6
WVDP 2015 Air Quality Noncompliance Episodes

Permit Type	*Facility*	*Parameter*	*Date(s) Exceeded*	*Description/ Solutions*
EPA, NESHAP	All	All	None	None
NYSDEC Air Permit	All	All	None	None

TABLE ECS-7
Status of EPCRA (SARA Title III) Reporting at the WVDP for 2015

EPCRA Section	*Description of Reporting*	*Submission Required*
EPCRA 302–303	Planning Notification	No
EPCRA 304	Extremely Hazardous Substance Release Notification	No
EPCRA 311	Material Safety Data Sheet	No
EPCRA 312	Hazardous Chemical Inventory	Yes
EPCRA 313	Toxic Chemical Release Inventory Reporting	No

TABLE ECS-8
Reportable Chemicals Above EPCRA 312 (SARA Title III) Threshold Planning Quantities
Stored at the WVDP in 2015

Chemicals Stored at the WVDP Above the Threshold Planning Quantities
Diesel fuel/No. 2 Fuel Oil
Unleaded Gasoline
Oils - various grades
Lead-acid batteries
Sulfuric acid
Hydrogen Peroxide

TABLE ECS-9
WVDP SPDES[a] Permit Limit Exceedances in 2015

Permit Type	*Outfall(s)*	*Parameter*	*No. of Permit Exceptions*	*No. of Samples Taken*	*No. of Compliant Samples*	*Percent Compliant Samples*
SPDES	All	All	0	742	742	100%

[a] Radionuclides are not regulated under the site's SPDES permit. However, special requirements in the permit specify that the concentration of radionuclides in the discharge is subject to requirements of DOE Order 5400.5, (see letter CHBWV to NYSDEC, January 8, 2013).

Note: The WVDP notified NYSDEC that DOE Order 5400.5 was replaced by DOE Order 458.1. The WVDP is currently executing the requirements of DOE Order 458.1, including its referenced DCSs.

TABLE ECS-10
WVDP Migratory Bird Nest Depredation Activities in 2015

Permit/License Type	Parameter	Permit Limit	2015 Total
U.S. Fish and Wildlife - Bird Depredation Permit	Removal of Active Barn Swallow Nests	20	0
U.S. Fish and Wildlife - Bird Depredation Permit	Removal of Active American Robin Nests	15	0
U.S. Fish and Wildlife - Bird Depredation Permit	Removal of Active Eastern Phoebe Nests	5	0
U.S. Fish and Wildlife - Bird Depredation Permit	Removal of Active Common Grackle Nests	15	0
U.S. Fish and Wildlife - Bird Depredation Permit	Removal of Inactive Migratory Bird Nests	Not limited	0
U.S. Fish and Wildlife - Registration	Oiling of Canada Goose Eggs	NA	1

NA - Not applicable

CHAPTER 1
ENVIRONMENTAL MANAGEMENT SYSTEM

Environmental Management System (EMS)

The DOE is committed to implementing sound stewardship practices to protect the air, water, land, and other natural and cultural resources that may be affected by activities at the WVDP. The EMS is a program the WVDP utilizes to effectively manage the impacts its operations have on the environment, and to systematically improve its environmental stewardship practices. The WVDP EMS was designed to meet ISO 14001 (the Environmental Management Standard) as required by DOE Order 436.1, "Departmental Sustainability," which describes the requirements and responsibilities for implementing the EMS program. CHBWV, the prime contractor at the WVDP, received a Certificate of Registration for the WVDP EMS under ISO 14001:2004 on July 31, 2012. A third party ISO 14001 surveillance audit of the EMS was conducted in June 2015. The auditors reported that all core EMS elements were observed to be fully implemented, meeting the ISO 14001 requirements. The CHBWV EMS was approved for re-certification on July 7, 2015.

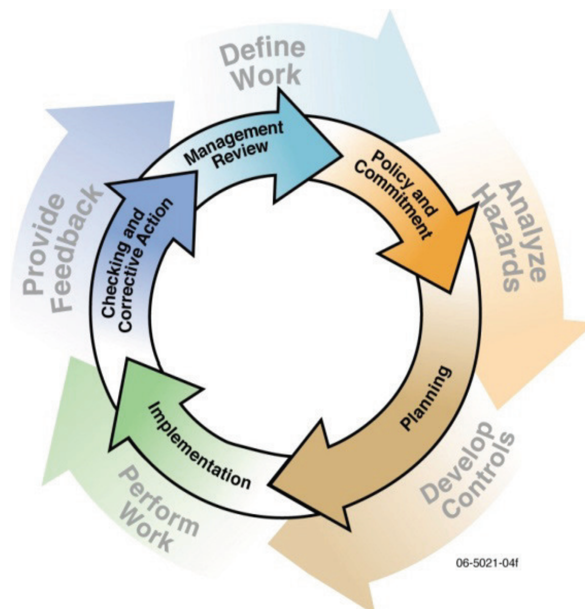
The WVDP EMS is also designed to ensure that DOE-WVDP carries out its mission in a sustainable manner. DOE Order 436.1 requires development and implementation of an annual Site Sustainability Plan (SSP) that identifies the site's contributions toward meeting DOE sustainability goals for national energy security, global environmental challenges, pollution prevention, waste minimization, energy reduction, and water conservation. Sustainability is an essential element of the facility disposition mission at the WVDP. CHBWV incorporates the DOE sustainability goals into its EMS in all work planning and execution via hazard screens, standard operating procedures, work instruction packages, walk downs, pre-job briefs and ongoing evaluations during job execution.

The EMS is a key component of the Integrated Safety Management System (ISMS). The objective of the ISMS is to perform work in a safe and environmentally sound manner. Together the EMS and ISMS provide a management framework for integrating safety, environmental, and regulatory requirements into all work practices so that work is accomplished while protecting the health and safety of the public, the site workers, and the environment at all levels.

The ISO 14001 EMS model employs a cycle of:

- policy development,
- planning,
- implementation,
- checking and corrective action, and
- management review

to improve resource efficiency, to prevent pollution, and to reduce waste.



ISMS/EMS Integration

The core functions of the EMS shown on the inner circle of the ISMS/EMS integration figure are aligned with the core functions of the ISMS shown in the outer circle: to define work, analyze hazards, develop controls, perform work, and provide feedback. The ultimate goal is to improve performance as the cycle repeats.

Safety is a core value for the work performed at the WVDP. CHBWV, was presented the Voluntary Protection Program (VPP) Star of Excellence Award in 2014, the highest level awarded by DOE for safety and health programs.

The WVDP first earned DOE VPP Star certification site in 1999. Safety performance during 2015 continued to be outstanding, with CHBWV and its subcontractors achieving over 1.7 million consecutive work hours without a job related lost time work injury or illness. Focus on safety not only protects workers but also promotes protection of the environment by reducing the occurrence of accidents. Safe behaviors at the WVDP are continuously reinforced through safety exercises and frequent safety training initiatives.

Policy and Commitment

The CHBWV Environmental Policy for the WVDP integrates environmental requirements and pollution prevention into project planning and execution and directs that sound stewardship practices are implemented. The CHBWV policy requires that site personnel will:

- comply with all environmental laws and regulations,
- minimize waste generation,
- protect and conserve natural resources, and
- quantify and track their environmental objectives with input from all stakeholders, employees and subcontractors.

The official site Environmental Policy is posted in many meeting areas across the site, and it is available on the CHBWV website (http://www.chbwv.com/graphics/CHBWV_Environmental_Policy.pdf). Managers are expected to take prompt action to address environmental concerns and to have zero tolerance for noncompliance with the policy.

Program Planning

Incorporating the EMS into planned work activities contributes to successful project outcomes. The EMS directs that the first step in planning work must involve identifying activities with specific regulatory requirements, activities with the potential for significant environmental impacts, and activities that can be performed in a manner that would contribute to DOE sustainability goals.

Regulatory Compliance. Involvement of regulatory support personnel in work planning enables assessment of the applicability of environmental laws and regulations prior to initiation of work to ensure appropriate permits and operating practices are in place. Compliance is also maintained by routine environmental monitoring of air, surface water, drinking water, groundwater, and ambient radiation dose. Required regulatory reports that analyze these data are generated on a regular basis.

Potential Environmental Impacts. Activities that have regulatory implications or those that have the potential for significant environmental impacts are identified as "significant aspects" through a quantitative ranking process, per the ISO 14001 standard. An "environmental aspect" is any element of an organization's activities, products, or services that can impact the environment.

The potential significant environmental aspects of site activities planned for 2015 at the WVDP were systematically graded with respect to their likelihood of occurring, the potential magnitude of the impact, the potential regulatory requirements or ramifications, and the anticipated level of community concern. The purpose of grading significant environmental aspects was to identify the most important potential environmental impacts of the planned work scope for the year. The most significant environmental aspects from the 2015 ranking are summarized in Table 1-1.

Facility Demolition Planning. The MPPB, the most prominent facility requiring demolition at the WVDP, is a 40,000 square feet, five-story, steel-reinforced, concrete

TABLE 1-1

WVDP Significant Environmental Aspects for 2015[a]

Environmental Aspect:
· Radiological and/or Asbestos Air Emissions
· Discharge of Metals, Organics, or Radiological Constituents to Surface Water
· Generation of Low-level Waste
· Savings in Energy Use
· Potential Accidental Radiological Release (i.e. HEPA filter failure)

[a] Each year all planned work activities are evaluated using a ranking system developed for the EMS that is based on potential environmental and regulatory impacts, community concerns, and likelihood of occurrence. Under this ranking system, aspects with an overall significance of 14 or greater are identified as "significant aspects."

structure that housed the mechanical and chemical process equipment used to separate uranium and plutonium from spent nuclear fuel. The MPPB facility is comprised of 55 rooms, many with residual high radiological dose rates. Since ventilation in the MPPB must be maintained while the building will be demolished in sections, preparation for MPPB demolition requires evaluation of the existing ventilation systems. The EMS was employed in the design, procurement, construction, and operation of a Replacement Ventilation System (RVS) for a portion of the MPPB in 2015. EMS practices are also currently involved in the development of detailed demolition planning documents for the VIT facility and MPPB structure.

Preparation for demolition requires removal of thousands of feet of piping, several radiologically contaminated tanks, many areas containing asbestos containing material, and a variety of specialized equipment that was used for chemical reprocessing of spent nuclear fuel.

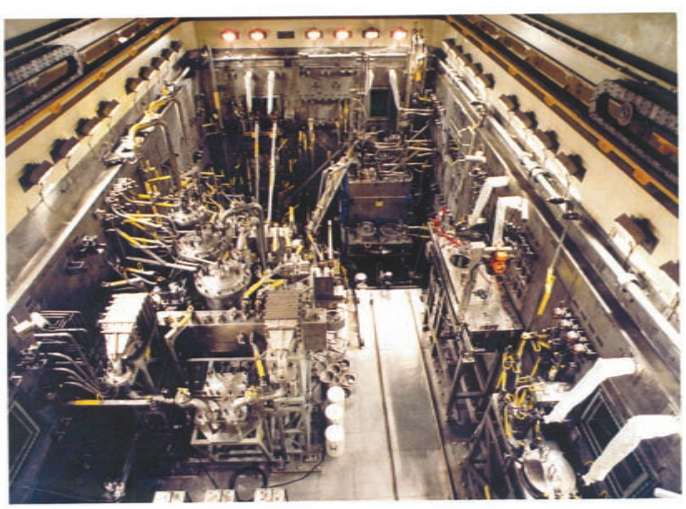
For each facility or structure that is considered for demolition, the base environmental aspects are identified and addressed during work planning with the assistance of hazard control specialists. Planning the demolition of each of the 55 rooms in the MPPB and areas within the VIT facility involves completion of a "Demolition Readiness Checklist" that captures the relevant environmental aspects that may be encountered during demolition. Demolition planning also involves quantitatively evaluating the methods by which the demolition will be performed with respect to their associated potential environmental emissions to air and water. Examples of demolition methods being considered include removal using a hydraulic hammer, diamond wire saw, or mechanical shearing. The EMS ensures that these evaluations are performed systematically, involve effective internal and external communication, abide by all appropriate regulatory guidance, and include required regulatory notifications and approvals.

Planning for building demolition includes sustainability as one of many aspects of the work scope. The key steps in the deactivation and demolition processes that address sustainability goals are shown in Table 1-2.

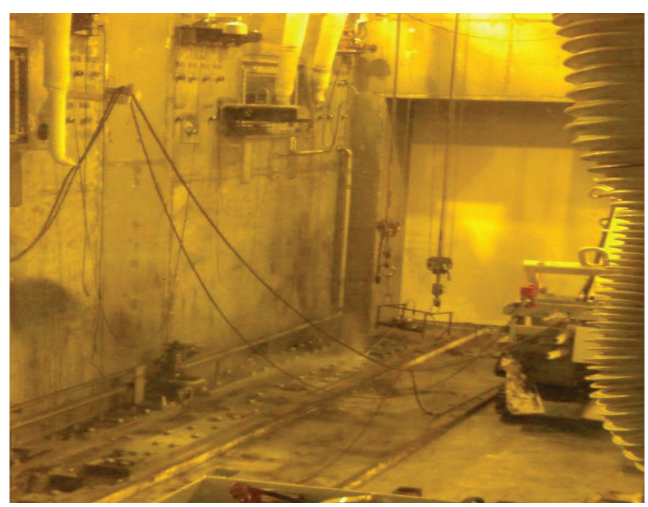
Activities which could have potential accidental releases to air and water are continuously evaluated under the EMS. The EMS is used to ensure appropriate operational procedures and environmental monitoring programs are in place to minimize or eliminate any potential impacts to the environment from this project.

HLW Canister Relocation Planning. The EMS planning process contributed to the safe removal of the first 20 HLW canisters from the MPPB and successful transfer of the first four Vertical Storage Casks (VSCs) containing these canisters from the MPPB to the HLW Cask Storage Pad on the south plateau in 2015. The EMS program ensured that this major planning process involved required steps to minimize the potential for environmental consequences. This included NESHAP evaluations and air monitoring for potential air releases from the welding

VIT facility while in operation



VIT facility after partial cell cleanup



The photograph on the left above of the inside of the VIT facility reveals the complexity of the system while it was in operation. The photograph on the right above shows the majority of the components taken out, demonstrating the significant removal and decontamination effort required prior to demolition.

TABLE 1-2
Sustainability Goals Incorporated in the Processes of Deactivation and Demolition

Sustainability Goal	*Deactivation/Demolition Activities*
Greenhouse Gas (GHG) Reductions	Isolate utilities.
Waste Reduction	Remove radiologically clean materials and equipment for reuse or for recycling.
Pollution Prevention	Remove and dispose radioactive and hazardous materials.
Waste Management	Identify demolition boundaries to separate clean debris from contaminated debris. Remove clean materials first.
Reduce Utility Water Use	Control spray volume and collect water during dust suppression.

process, evaluation of potential accidental transport failures, and waste minimization. Extensive dry-runs of the decontamination and relocation process were performed to test processes, infrastructure and operator readiness.

During vitrification, 275 stainless steel canisters were filled with vitrified HLW and an additional three canisters were partially filled with vitrified end-of-process materials. Each canister is 2 feet in diameter and 10 feet high. These canisters have been stored in a shielded room of the MPPB since vitrification was completed in 2002. These canisters will be loaded into 55 VSCs containing five canisters each and one cask containing three end of process canisters and two transport inserts.

Vertical Storage Cask (VSC) and Overpack

As shown in the diagram above, each VSC is made of a steel-reinforced concrete cylinder with a carbon steel liner. An inner stainless steel overpack holds the five canisters in place inside the cask. The cask walls are 2 feet thick, 4 inches of which is carbon steel and 20 inches is concrete. The casks are 10 feet in diameter and 13 feet high. The cask lids are 14 inches thick, with 4 inches of carbon steel and 10 inches of concrete. There is a 2 inch carbon steel shield plate in the cask base. The casks will be stored on the HLW Cask Storage Pad that was constructed of 3 foot thick steel-reinforced concrete. The casks weigh 87.5 tons when fully loaded. NAC International, the consultant that designed and fabricated the WVDP VSCs and overpacks, received a Certificate of Compliance from NRC approving the WVDP HLW overpack, containing up to five HLW canisters, to be used for future shipment of the canisters.

The canister relocation process required the procurement of specialty transportation equipment including the Vertical Cask Transporter (VCT), the Low Profile Rail Cart (LPRC), the in-plant cask transporter (TL220HD) and two air pallets. A Tow Tractor (GT-50), typically used to move commercial planes, was also procured to pull the loaded VCT.

Vertical Cask Transporter (VCT) and Tow Tractor

The safely executed relocation of the first four VSCs, (containing five HLW inert glass canisters per cask), paved the way for removal of the remaining canisters. This activity included successful decontamination of 20 canisters stored inside the MPPB, remotely loading the canisters into casks in high-risk radioactive areas using remotely controlled cranes and machinery, safely welding the over-pack lids and bolting the steel and concrete cask covers to complete the shielding of the canisters, and transporting the first four casks to the HLW Cask Storage Pad on the south plateau using custom designed and engineered equipment. The VSC package provides safe, shielded, passive storage of the HLW canisters.

Before the canisters of HLW were relocated, a comprehensive readiness assessment was performed. Environmental regulatory personnel were integrated with the HLW relocation project readiness assessment team. A line management assessment was performed for 12 environmental management Lines of Inquiry (LOI) in the Criteria Review Approach Documents. These LOI documented that all environmental and regulatory criteria were achieved for the preparation, construction, and pre-startup testing for relocation of the HLW.

Throughout the procurement of this equipment and the implementation of the relocation, EMS objectives to protect the air, water, land, and other natural resources were considered. The WVDP canister relocation process required unique cask and equipment designs. A video of this ground-breaking canister relocation in progress is available to the public at:

https://youtu.be/NdQdXlkdQjA or
http://www.chbwv.com/video1.htm.

EMS Implementation

Objectives. EMS objectives and targets are established in order to quantitatively evaluate progress towards pollution prevention, reduction of environmental hazards, reduction of waste disposal costs, improvements in environmentally safe operations, and overall protection of the public and environment. Objectives and targets are re-aligned annually to support upcoming operations and work activities. The WVDP objectives and targets take into consideration the site mission to demolish buildings and infrastructure. The 2015 EMS objectives and targets included the following:

- reduction in energy use,
- control of radiological emissions from the MPPB through evaluation and replacement of a portion of the MPPB ventilation system,
- re-establishment of the scrap metal recycling program, and
- reduction in the amount of waste generated during decommissioning activities.

Progress towards all of these targets was made in 2015. Reduction in required gas heating systems continues as buildings are demolished or prepared for demolition. A replacement ventilation system for a portion of the MPPB exhaust was installed and became operable in 2015. Scrap metal from nonradiological areas was recycled during the last quarter of 2015, and waste minimization objectives were included in the work instructions for decommissioning projects.

DOE Sustainability Goals. Each year, the WVDP updates their sustainability goals to correlate with the planned work scope and to contribute towards nationwide DOE sustainability goals. Achievements in 2015 towards these goals are discussed in the EMS Results section of this chapter.

Training. The "WVDP Worker Safety and Health Plan" describes required safety training and explains how the WVDP complies with 10 CFR 851, the Federal "Worker Safety and Health Program" which has been in effect since 2007. The safety plan is reviewed annually and updated as site conditions change. Based on individual work requirements, employees receive specialized safety training. For example employees who enter highly contaminate areas must first successfully complete RadWorker II training, and those who may work in a confined space take confined space training. Regulatory compliance personnel involved in waste management are required to take Hazardous Waste Operations and Emergency Response training. All employees participate in human performance/behavior-based safety training to help reduce errors and prevent accidents. Self-assessment activities are also stressed as a mechanism for evaluating, improving, and maintaining worker safety. A lessons-learned program that promotes communication and tracks learning opportunities for safety improvements is managed by the Performance Assurance group.

Any person working at the WVDP who has a personal photo badge allowing unescorted access to administrative areas of the site must successfully complete general employee training that covers health and safety, emergency response, environmental compliance and other essential topics.

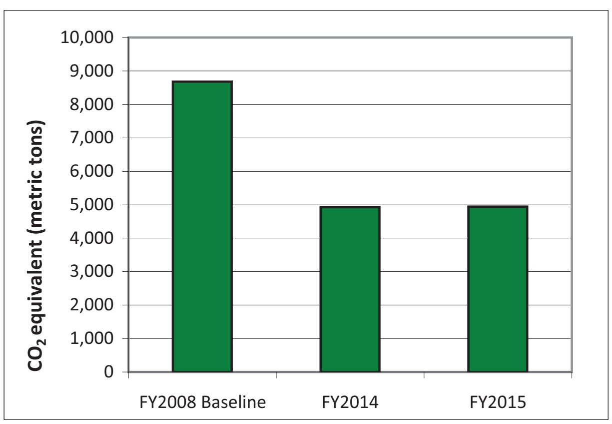
EMS Progress Tracking. Overall success towards reaching the objectives of the EMS program is fundamentally realized by the excellent safety record achieved at the WVDP in 2015 and by sustained compliance with all environmental laws and regulations. RCRA compliance, SPDES, drinking water, surface water, groundwater, and air monitoring reports (e.g., the radiological NESHAP report) are routinely submitted to DOE, NYSDEC and the EPA monthly, quarterly, or annually.

EMS Results

EMS Performance Metrics for 2015 EMS Scorecard. The EMS Annual Report, submitted to the Federal Facilities Environmental Stewardship and Compliance Assistance Center (www.fedcenter.gov), establishes EMS performance metrics in several categories on which each site is scored. Based on the current status of the site's EMS, the WVDP scored "green" on the scorecard for FY 2015 indicating the site has a compliant and robust environmental management system. Site-specific information for the EMS is provided in the following sections.

Greenhouse Gas (GHG) Emission and Energy Use. Overall GHG emissions and energy use did not change significantly from FY 2014 to FY 2015 at the WVDP as shown by Figures 1-1 and 1-2 respectively.

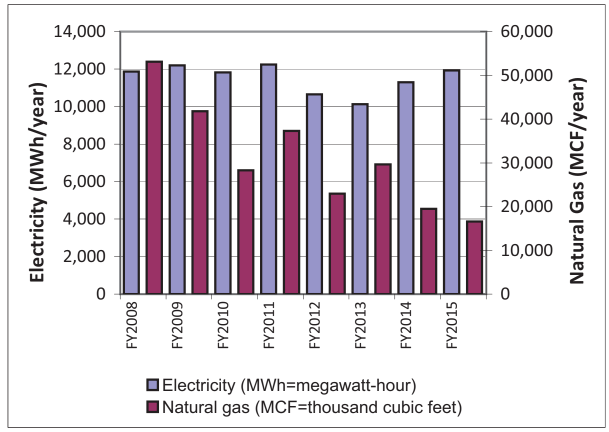
FIGURE 1-1
GHG Emissions



Reduction of the environmental footprint of the project by decontamination and demolition of site facilities results in decreasing energy use and subsequent GHG emissions as shown by the reduction in CO_2-equivalent metric tons since the 2008 baseline.

When the natural gas fueled boilers in the MPPB utility room were shutdown in 2014 there was a significant reduction in gas use, however this decrease was offset by an increase in the use of electricity. Energy conservation actions undertaken since the steam heating system was deactivated include insulation of the 450,000 gallon water storage tank, and the use of small, energy-efficient, natural gas water heaters to prevent the tank from freezing.

FIGURE 1-2
Energy Use

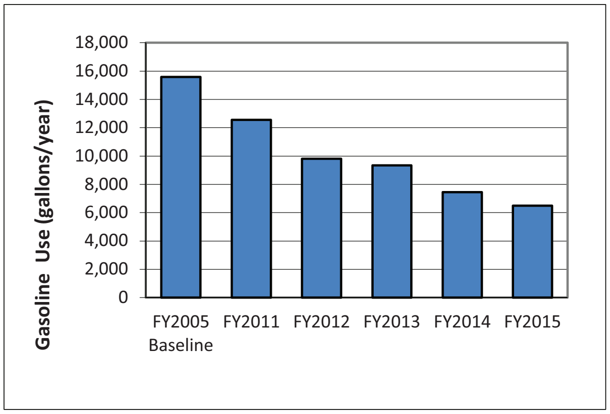


Water Use. The volume of water used at the site in 2015 has not changed significantly from the volume used in 2014. CHBWV continued to modify its drinking and process water system in 2015. With the exception of backup fire suppression water and augmentation water used during lagoon discharges, all site water has been supplied by two groundwater wells since the fall of 2014. An iron filtration system was installed to improve the water quality in 2015. Chlorination and distribution of the water supply currently takes place in the MPPB utility room which is being prepared for demolition. Plans are in progress to relocate the water treatment and distribution system to facilitate deactivation of the MPPB utility room.

Installation of new drinking water line

Vehicle Fleet Fuel Use. Gasoline usage continued to be reduced in CY 2015 and has been reduced by 58.3% from the FY 2005 baseline as shown in Figure 1-3. There has also been a reduction in the site's motor vehicle fleet size by 23% since the start of the Facilities Disposition Contract in 2011. The use of electric vehicles on the site has increased by obtaining electric carts from the government surplus list.

FIGURE 1-3
Vehicle Energy Use



Sustainable Acquisition. In support of DOE sustainability goals, the WVDP continues to purchase products that save energy, conserve water, and reduce health and environmental impacts. Routine activities or projects which require the purchase of chemicals, equipment, and supplies, prompt evaluations for potential purchases of green products. Warehouse stock items are selected through site procedures with objectives to meet recycled and/or bio-based content preferences, such as copy paper with at least 30% postconsumer fiber. Reused material is also considered for major purchases. For example, the office trailers installed at the site were refurbished after prior use at other locations.

In an effort to reduce the procurement of toxic or hazardous materials, all proposed chemical purchases are evaluated to ensure they meet the requirement for utilization of non-toxic or less toxic alternative chemicals. All 2015 construction and custodial subcontracts incorporated sustainability requirements of DOE acquisition regulations.

Pollution Prevention and Waste Reduction. Waste minimization and recycling of non-hazardous, non-radioactive solid waste is maximized through EMS involvement in project planning. The WVDP's "Waste Minimization and Pollution Prevention Awareness Plan" establishes the strategic framework for integrating waste minimization and pollution prevention into waste generating and reduction activities, and encourages procuring recycled products, reusing existing products, and using methods that conserve energy. The comprehensive program drives continual effort to prevent or minimize pollution, with the overall objective of reducing health and safety risks, and protecting the environment.

Materials have been routinely recycled, reused, or donated by the WVDP for many years. The scrap metal recycling program was re-started in January 2015. A total of approximately 103.4 tons of material was diverted from landfills in FY 2015. The quantity of each type of material recycled/reused or donated is summarized in Table 1-3.

TABLE 1-3
Recycled/Reused/Donated Material in FY 2015

Material	*FY 2015 Quantity (tons)*
Mixed paper and corrugated cardboard	20.4
No longer needed supplies or equipment (negotiated sales)	0.1
Electronics for reuse or recycling	2.9
Fluorescent bulbs	0.1
Batteries	1.9
Donations	0.2
Transfers to other DOE sites	17.9
Sales to other government agencies	57.2
Returned to vendor	0.4
Miscellaneous	2.3
Total	103.4

Electronic Stewardship. The site purchased 100% of eligible computer and electronic equipment certified through the Electronic Product Environmental Assessment Tool (EPEAT) program, exceeding the FY 2015 electronic stewardship goal of 95%. EPEAT is a global environmental rating system that helps purchasers identify high-performance, environmentally preferable computers and other electronics. Electronic equipment that is no longer needed is either donated through the government surplus "Computers for Learning" program or sent out for recycling through approved facilities.

Checking and Feedback

Evaluation of Compliance and Regulatory Requirements. Throughout CY 2015, comprehensive evaluations, reviews, audits, assessments, and inspections were performed to evaluate the implementation of EMS elements at the WVDP and to provide objective and independent review of site functions. Many of these evaluations are performed through the QA program to confirm functional compliance with site procedures, applicable local, state, and federal environmental regulations, and applicable DOE directives. The WVDP's QA program also ensures and documents consistency, precision, and accuracy in collecting and analyzing environmental samples and in interpreting and reporting environmental monitoring data. The integrated QA program incorporates the requirements from the consensus standard "Quality Assurance Program Requirements for Nuclear Facility Applications" (American Society of Mechanical Engineers [ASME] Nuclear Quality Assurance Level 1 [NQA-1-2008/2009a]).

Overall results from the 2015 assessments, audits and inspections indicate that an effective EMS has been implemented at the WVDP. Of particular note was the 2015 annual DOE audit of the environmental monitoring program. The environmental monitoring personnel interviewed were noted to be "exceptionally knowledgeable of the WVDP systems and had a thorough understanding of documents and procedures." This assessment identified two recommendations for improvement related to subcontract management of off-site sewage waste disposal record-keeping and reporting practices.

Environmental Quality Assurance (QA) / Quality Control (QC) Program. All environmental laboratories are required to participate in applicable crosscheck programs. Subcontract laboratories at the WVDP are required to have at least 80% of reported results falling within control limits. Crosscheck samples (used to test the accuracy of environmental measurements) contain a constituent of interest at a concentration known to the agency conducting the crosscheck, but unknown to the participating laboratory. Crosscheck results that fall outside of control limits are addressed by formal corrective actions to determine any conditions that could adversely affect sample data and to ensure that actual sample results are reliable.

After demolition of the building which previously housed the environmental laboratory, CHBWV Environmental Services (ES) maintained its on-site environmental laboratory capabilities to perform limited radiological analysis of air and water samples. These include quick turnaround-time water sample analysis (for gross alpha, gross beta, strontium-90 and gamma emitters) in support of site operations, and analysis of air samples (for gross alpha, gross beta, tritium, select gamma-emitters, and iodine-129) in support of the environmental monitoring program. Analyses requiring NYSDOH Environmental Laboratory Accreditation Program (ELAP) certification are performed by off-site subcontract laboratories. On-site ELAP certification was relinquished in 2012.

In 2015, the WVDP and its subcontract laboratories participated in the DOE Radiological Environmental Sciences Laboratory Mixed Analyte Performance Evaluation Program (MAPEP), which provides performance evaluation samples for both radiological and nonradiological constituents, and in the EPA Discharge Monitoring Report Quality Assurance (DMR-QA) study required of major and select minor SPDES permit holders. Results of these studies are summarized in Appendix G and in Table 1-4. As presented, 99.1% of the crosschecks performed in 2015 were acceptable.

TABLE 1-4
Summary of Crosschecks Completed in 2015

Type	Number Reported	Number Within Acceptance Limits	Percent Within Quality Control Limits
Radiological	90	90	100.0%
Nonradiological	232	229	98.7%
All types	322	319	99.1%

Best Practices/Lessons Learned. During the ISO 14001 audit that resulted in re-certification, the following EMS program strengths were noted:

- plant system operators demonstrated an excellent system for integrating monitoring of environmental systems through efficient delegation to personnel with trade expertise (electricians, welders, etc.);
- environmental concerns were routinely evaluated during development of Industrial Work Permits (IWPs) and were appropriately implemented during deactivation and decontamination operations;
- personnel demonstrated improved internal communications and regulatory issues were effectively communicated with DOE; and

- project-wide efforts were made to consolidate and simplify procedures and documentation.

Management Review. An internal EMS senior management briefing was conducted at an Executive Safety Review Board (ESRB) meeting on August 12, 2015 to review the site's environmental performance to ensure the continuing suitability, adequacy and effectiveness of the EMS. No findings were identified during this review.

Summary

The benefit of the WVDP EMS program to DOE's mission at the WVDP in 2015 includes an outstanding worker safety record, compliance with all major environmental regulations, reduction of energy and supply water expenses, reduced waste inventory through reuse/recycling and shipping, and safe removal of asbestos.

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CHAPTER 2
ENVIRONMENTAL MONITORING

Monitoring Program

The goal of the WVDP environmental monitoring program is to ensure that the public's health and safety and the environment continue to be protected with respect to releases from site activities. To achieve this goal, possible exposure pathways are monitored.

The monitoring program primarily focuses on surface water, air, and groundwater pathways, as these are the principal means by which potential contaminants are transported off site. Water, air, groundwater, and other environmental media samples are collected and measured for radiological and chemical constituents. A description of and schedule for the sampling program at each location and discussion of the environmental monitoring program drivers and rationale, as well as maps showing the 2015 sampling locations, are presented in Appendix A. Groundwater monitoring data are discussed in Chapter 4. Monitoring data for all other media are discussed in this chapter. In accordance with DOE Order 458.1 (Change 3), the monitoring program includes both effluent monitoring and environmental surveillance.

Effluent Monitoring. Liquid effluents and air emissions are monitored by collecting samples at locations on site where radioactivity or chemical constituents are (or might be) released. Release points include discharge outfalls, storm water outfalls, site drainage points, and air ventilation stacks. At some locations, direct measurements (e.g., direct radiation or flow rates) are also collected. The WVDP maintains required permits and/or certificates from regulatory agencies applicable to releases to air and water, as listed in the Environmental Compliance Summary (ECS), Table ECS-3.

Environmental Surveillance. Surface water, drinking water, air, sediment, soil, venison, fish, milk, and food crops are collected at locations where the highest concentrations of transported contaminants might be expected. Samples are also collected at remote locations to provide background data for comparison with data from on-site and near-site samples. This includes samples collected from the ambient air monitors surrounding the WNYNSC. Direct radiation is monitored on site, at the site perimeter, and at a remote background location.

Data Evaluation. Environmental sampling results are assessed to determine whether the constituents of interest are present and, if so, their concentrations. Data from each sampling location are compared with applicable regulatory or guidance limits. The current guidance levels for evaluating radiological constituents in air and water are defined as Derived Concentration Standards (DCSs) and are dictated in DOE-STD-1196-2011. These DCSs are presented in Table UI-4 in the "Useful Information" section of this report, and are used throughout this ASER as comparative standards. Regulatory limits for chemical constituents in discharges to surface water under the SPDES program, and additional water quality and potable water standards are listed in Appendix B-1. DCSs for air are provided on the tables in Appendix C and groundwater standards are shown in Appendix D-1.

Data from near-site locations are compared with background concentrations using standard statistical methods to assess possible site impacts to the environment. Results from each location are also compared to historical data from that location to determine if any trends, such as increasing constituent concentrations, are occurring. If indicated, follow-up actions are evaluated and implemented as warranted.

Waterborne Effluent Monitoring

The Project is drained by several small streams. Franks Creek enters from the south and receives drainage from the south plateau. As it flows northward, Franks Creek is joined by Erdman Brook, which receives effluent from the LLW2 (through the lagoon system). After leaving the Project at the site security fence, Franks Creek receives drainage from the northeast swamp areas on the north plateau and from Quarry Creek, which receives drainage from the north swamp location WNSW74A. Franks Creek then flows into Buttermilk Creek, which, after flowing northward through the WNYNSC, enters Cattaraugus Creek and flows westward away from the WNYNSC. Cattaraugus Creek ultimately drains into Lake Erie, to the northwest. (See Figures A-2 and A-5.)

Waterborne Radiological Releases. The primary sources of radionuclide releases from the site to surface waters occur at two locations, the lagoon 3 weir at outfall 001

(WNSP001 shown on Figure A-2) and natural drainage from the northeast swamp (monitoring point WNSWAMP shown on Figure A-2). Natural drainage from the north swamp (monitoring point WNSW74A) on the north plateau also contributes a minor amount to the radiological releases from the site to downstream surface water. WNSW74A is included in the estimated dose from waterborne releases from the site.

Discharge through the lagoon 3 weir at SPDES outfall WNSP001 into Erdman Brook is the only remaining controlled point source liquid release from the Project since the WWTF discharge through outfall 007 was discontinued in 2014. Three batch releases totaling about 5.2 million gal (19.6 million L) were discharged from WNSP001 in 2015. Natural drainage from the WNSWAMP location in CY 2015 was estimated to be approximately 21.1 million gal (79.9 million L). Flow weighted estimates of curies released from these two sources in 2015 and average radionuclide concentrations are summarized in Tables 2-1 and 2-2.

Concentrations from the WNSP001 outfall and WNSWAMP effluents are reported together with DCSs in Tables 2-1 and 2-2 for comparison purposes rather than regulatory compliance. DOE-STD-1196-2011 defines DCSs as radionuclide concentrations that, under conditions of continuous exposure for one year by one exposure mode, would result in an effective dose equivalent of 100 mrem (1 millisievert [mSv]). Members of the public

TABLE 2-1
Total Radioactivity Discharged at Lagoon 3 (WNSP001) in 2015
and Comparison of Discharge Concentrations with DOE DCSs

Isotope [a]	*Discharge Activity* [b]		*Average Concentration*	*DCS* [d]	*Ratio of Average Concentration to DCS*
	(Ci)	*(Becquerels)* [c]	*(µCi/mL)*	*(µCi/mL)*	
Gross Alpha	6.15±0.62E-04	2.27±0.23E+07	3.13±0.32E-08	NA[e]	NA
Gross Beta	9.45±0.09E-03	3.50±0.03E+08	4.81±0.04E-07	NA[e]	NA
H-3	1.56±0.15E-02	5.76±0.56E+08	7.93±0.77E-07	1.9E-03	0.0004
C-14	-2.00±3.24E-04	-0.74±1.20E+07	-1.02±1.65E-08	6.2E-05	<0.0003
K-40	4.32±4.81E-04	1.60±1.78E+07	2.20±2.45E-08	NA[f]	NA
Co-60	3.74±3.15E-05	1.38±1.17E+06	1.91±1.61E-09	7.2E-06	0.0003
Sr-90	3.18±0.07E-03	1.18±0.03E+08	1.62±0.04E-07	1.1E-06	0.1474
Tc-99	2.63±0.31E-04	9.74±1.13E+06	1.34±0.16E-08	4.4E-05	0.0003
I-129	5.61±1.63E-05	2.07±0.60E+06	2.86±0.83E-09	3.3E-07	0.0087
Cs-137	9.43±0.79E-04	3.49±0.29E+07	4.81±0.40E-08	3.0E-06	0.0160
U-232[g]	1.23±0.07E-04	4.54±0.24E+06	6.25±0.34E-09	9.8E-08	0.0638
U-233/234[g]	1.01±0.07E-04	3.73±0.25E+06	5.14±0.34E-09	6.6E-07[h]	0.0078
U-235/236[g]	4.57±1.46E-06	1.69±0.54E+05	2.33±0.74E-10	7.2E-07	0.0003
U-238[g]	8.37±0.60E-05	3.10±0.22E+06	4.26±0.31E-09	7.5E-07	0.0057
Pu-238	1.72±0.76E-06	6.35±2.80E+04	8.74±3.86E-11	1.5E-07	0.0006
Pu-239/240	1.99±0.79E-06	7.35±2.94E+04	1.01±0.40E-10	1.4E-07	0.0007
Am-241	3.27±1.14E-06	1.21±0.42E+05	1.67±0.58E-10	1.7E-07	0.0010
Sum of Ratios					**0.25**

NA - Not applicable.

[a] Half-lives are listed in Table UI-4.

[b] Total volume released: 1.96E+10 milliliters (mL) (5.19E+06 gal).

[c] 1 curie (Ci) = 3.7E+10 becquerels (Bq): 1Bq = 2.7E-11 Ci; 1 microcurie (µCi) =1E-06 Ci.

[d] DCSs are used as reference values for the application of best available technology per DOE Order 458.1.

[e] DCSs do not exist for indicator parameters gross alpha and gross beta.

[f] The DCS is not applied to potassium-40 (K-40) activity because of its natural origin.

[g] Total uranium (g) = 2.47±0.04E+02; Average uranium (µg/mL) = 1.26±0.02E-02.

[h] The DCS for U-233 is used for this comparison.

TABLE 2-2
Total Radioactivity Released at Northeast Swamp (WNSWAMP) in 2015 and Comparison of Discharge Concentrations with DOE DCSs

Isotope [a]	*N*	*Discharge Activity* [b]		*Average Concentration*	*DCS* [d]	*Ratio of Average Concentration to DCS*
		(Ci)	*(Becquerels)* [c]	*(µCi/mL)*	*(µCi/mL)*	
Gross Alpha	26	-9.78±7.07E-05	-3.62±2.62E+06	-1.22±0.88E-09	NA[e]	NA
Gross Beta	26	2.45±0.01E-01	9.08±0.02E+09	3.07±0.01E-06	NA[e]	NA
Tritium	26	5.01±2.66E-03	1.86±0.99E+08	6.28±3.33E-08	1.9E-03	< 0.0001
C-14	2	0.21±1.60E-03	0.78±5.92E+07	0.27±2.00E-08	6.2E-05	< 0.0003
Sr-90	12	1.02±0.01E-01	3.76±0.02E+09	1.27±0.01E-06	1.1E-06	1.16
I-129	2	2.22±5.39E-05	0.82±1.99E+06	2.78±6.75E-10	3.3E-07	< 0.0020
Cs-137	12	3.14±7.79E-05	1.16±2.88E+06	3.93±9.75E-10	3.0E-06	< 0.0003
U-232[f]	2	-0.26±4.80E-06	-0.10±1.77E+05	-0.33±6.00E-11	9.8E-08	< 0.0006
U-233/234[f]	2	1.40±0.54E-05	5.18±2.01E+05	1.75±0.68E-10	6.6E-07[g]	0.0003
U-235/236[f]	2	4.47±3.08E-06	1.65±1.14E+05	5.59±3.85E-11	7.2E-07	0.0001
U-238[f]	2	8.91±4.23E-06	3.30±1.57E+05	1.12±0.53E-10	7.5E-07	0.0001
Pu-238	2	0.20±2.27E-06	0.75±8.39E+04	0.25±2.84E-11	1.5E-07	< 0.0002
Pu-239/240	2	2.07±2.79E-06	0.77±1.03E+05	2.59±3.49E-11	1.4E-07	< 0.0002
Am-241	2	1.08±2.16E-06	4.00±7.99E+04	1.35±2.70E-11	1.7E-07	< 0.0002
Sum of Ratios						**1.16**

Notes: Average concentrations represent sample composite concentrations weighted to monthly stream flow.
The average pH at this location was 7.4 Standard Units (SU).
N - Number of samples.
NA - Not applicable.
[a] Half-lives are listed in Table UI-4.
[b] Total estimated volume released: 7.99E+10 mL (2.11+07 gal).
[c] 1 Ci = 3.7E+10 Bq: 1Bq = 2.7E-11 Ci.
[d] DCSs are used as reference values for the application of best available technology per DOE Order 458.1.
[e] DCSs do not exist for indicator parameters gross alpha and gross beta.
[f] Total Uranium (g) = 2.62±0.09E+01 ; Average Total Uranium (µg/mL) = 3.28±0.11E-04.

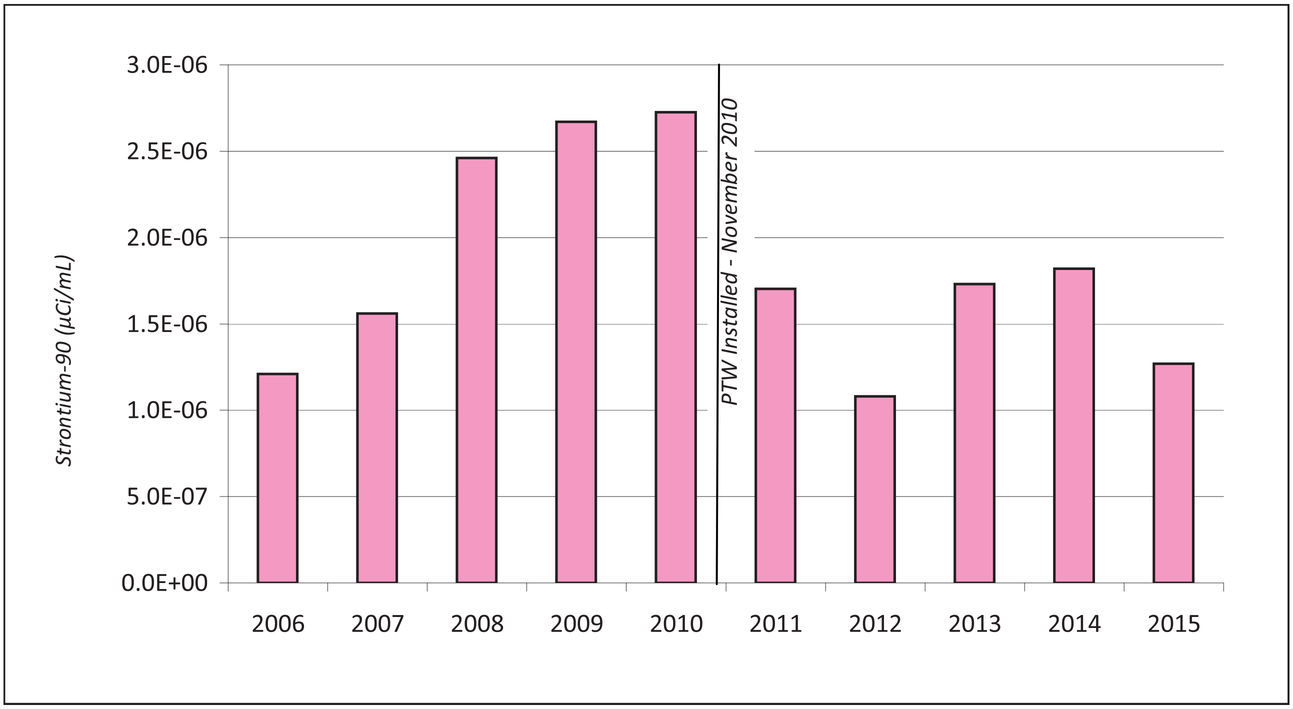
do not have access to the WVDP and therefore do not have any potential of direct exposure at outfall WNSP001 and WNSWAMP. (Note that DCSs are not used for dose assessment. Methods for estimating dose from the liquid pathway are discussed in Chapter 3.)

To evaluate each radionuclide released with respect to the DCSs, each annual average radionuclide concentration was divided by its respective DCS and the ratios from all nuclides were summed. As a DOE policy, the sum of the ratios (also called the “sum of fractions”) should not exceed 1.0, or otherwise expressed as the sum of percentages, should not exceed 100%. Tables 2-1 and 2-2 list the sum of ratios for each release point.

The sum of ratios for the release from WNSP001 in 2015 was approximately 0.25, below the 1.0 criterion. The sum of ratios from WNSWAMP was 1.16, above the DOE-STD-1196-2011 criterion. The maximum sum of ratios calculated at WNSWAMP to date was 2.67 in 2009, prior to installation of the PTW. The sum of ratios for both liquid releases from the site decreased from 2014 to 2015.

As in past years, the sum of ratios at WNSWAMP was almost entirely attributable to strontium-90. Drainage through the WNSWAMP sampling location largely consists of emergent groundwater supplemented by surface water run-off. Elevated gross beta concentrations were first measured at this location in 1993. Subsequent investigations delineated a plume of strontium-90-contaminated groundwater on the north plateau that discharges to the surface water flowing through the WNSWAMP location. In November of 2010, a PTW designed to remove strontium-90 from the groundwater was installed

FIGURE 2-1
Flow-Weighted Annual Average Strontium-90 Concentrations at WNSWAMP



upgradient of the WNSWAMP drainage ditch. A description of the PTW and other remedial measures designed to limit migration of the strontium-90 groundwater plume are discussed in Chapter 4, "Groundwater Protection Program."

As in previous years, the 2015 flow weighted annual average strontium-90 concentration at WNSWAMP (1.27+0.01E-06 microcurie per milliliter [µCi/mL]) was above the DCS (1.1E-06 µCi/mL]). The strontium-90 concentration at WNSWAMP first exceeded the DCS in 1995. The 2015 strontium-90 concentrations at WNSWAMP are somewhat lower than both the 2014 and 10-year annual average concentrations (Figure 2-1).

Waters with elevated strontium-90 concentrations drain from WNSWAMP into Franks Creek, then into Buttermilk Creek, and ultimately into Cattaraugus Creek. Water samples are collected monthly for strontium-90 analysis from Cattaraugus Creek downstream of the WVDP at the first point of public access (at WFFELBR). (See Table B-4I in Appendix B-4.) All strontium-90 results at WFFELBR in 2015 were below detection limits.

State Pollutant Discharge Elimination System (SPDES) Permit-Required Monitoring. Liquid discharges from the WVDP are regulated for chemical constituents under a SPDES permit, as identified in Table ECS-3. The permit identifies compliance points from which liquid effluents are released to Erdman Brook (Figure A-2), and specifies the sampling and analytical requirements for each. In July 2015, NYSDEC issued a modification to the July 2011 SPDES permit for the WVDP to include the change in the discharge location for the S09 storm water outfall.

The conditions and requirements of the current SPDES permit are summarized in Appendix B-1. The permit identifies 23 outfalls and compliance points with monitoring requirements and discharge limits. The monitored outfalls include:

- outfall 001 (monitoring point WNSP001), discharge from the LLW2 through the lagoon system;

- outfall 007 (monitoring point WNSP007), discharge from the WWTF, which was discontinued in November 2014 but is still on the SPDES permit;

- outfall 116 (pseudo-monitoring point WNSP116, as noted on the permit), a location in Franks Creek that represents the confluence of outfalls WNSP001 and WNSP007, as well as storm water runoff, groundwater seepage, and augmentation water. Samples from upstream sources are used to calculate total dissolved solids (TDS) at this location and to demonstrate compliance with the SPDES permit limit for this parameter;

- outfall 01B (monitoring point WNSP01B), an internal monitoring point for the liquid waste treatment system evaporator effluent, which was historically monitored for flow and total mercury. No effluent has been released from this outfall since 2006; and

- nineteen storm water discharge outfalls that receive flow from other minor sources, such as fire hydrant testing and groundwater seepage, monitored on a rotational basis. Requirements of the SPDES permit for monitoring storm water runoff include measurements of:

  (1) the water quality for specific chemical parameters in storm water discharges from specified WVDP locations;
  (2) the amount of rainfall;
  (3) the storm event duration, and
  (4) the resulting flow at the outfalls.

  The 19 WVDP storm water outfalls are grouped into eight representative drainage basins that could potentially be influenced by industrial or construction activity runoff. One representative outfall from each of the eight outfall groups listed in Appendix A must be sampled on a semiannual basis. (Note: Storm water outfall S09 was relocated during the summer of 2015. See the "Special Projects" section at the end of this chapter for additional description of this outfall relocation project.)

The SPDES permit specifies the following conditions for a qualifying storm water event eligible for storm water discharge monitoring:

(1) a total rainfall of more than 0.1 inch;
(2) a period of 72 hours between the monitored event and the previous measurable event of 0.1 inches of precipitation; and
(3) resultant storm discharge at the outfall.

During CY 2015, storm water samples were collected from all eight outfall groups during both semiannual periods.

Appendix B-2 presents 2015 process effluent data with SPDES permit limits provided for comparison. Appendix B-3 presents 2015 storm water runoff monitoring data for outfalls designated in the WVDP SPDES permit.

There were no SPDES effluent limit exceedances and no SPDES noncompliance events during 2015.

Airborne Effluent Monitoring

Radiological Air Emissions. Federal law allows air containing small amounts of radioactivity to be released from plant ventilation stacks during normal operations. The releases must meet dose criteria specified in the NESHAP regulations to ensure that public health and safety and the environment are protected. During 2015, WVDP radiological releases were measured and/or estimated from six of seven permitted emission points (see Table ECS-3) and from diffuse sources. (There was no activity requiring ventilation in the CSRF in 2015.) These seven permitted emission sources include the new emission point from the Replacement Ventilation System (RVS). No radiological facilities were demolished in 2015. Consequently there were no radiological emissions in 2015 due to demolition. As in previous years, the wastewater storage lagoons were one of the primary sources of the diffuse radiological releases to air at the WVDP in 2015. Sampling locations for point source air emissions are shown on Figure A-6 in Appendix A.

Air releases are evaluated and reported to the EPA in the annual NESHAP report. Measured radionuclide concentrations in air are also compared with DCSs. (See Appendix C). DCSs for radionuclides of interest at the WVDP are found in Table UI-4 in the "Useful Information" section of this report. When only gross alpha and beta measurements are available in WVDP air sample results, activity is assumed to come from plutonium-239/240 and strontium-90, respectively, because the DCSs for these radionuclides are the most limiting for major WVDP particulate emissions.

Ventilation and Emission Systems. Exhaust from each EPA-permitted ventilation system on the WVDP is continuously filtered and the permanent systems are monitored as air is released to the atmosphere. Because radionuclide concentrations in air emissions from the site are quite low, a large volume of facility air must be sampled to measure the radionuclide quantity released. Emissions are sampled for radioactivity in both particulate (e.g., strontium-90 and plutonium-239/240) and gaseous forms (e.g., tritium and iodine-129). The total release of each radionuclide varies from year to year in response to changing site activities. For instance, releases of iodine-129 dropped sharply after vitrification was completed in 2002. Over the years, the annual dose from WVDP air emissions has remained a small fraction (less than 5.2%) of the NESHAP standard. (See "Dose From Airborne Emissions" in Chapter 3.)

MPPB HEV Replacement Ventilation System (RVS)

The Main Plant Process Building (MPPB) Ventilation Stack and Replacement Ventilation System (RVS). The primary controlled air emission point at the WVDP is the MPPB ventilation stack, ANSTACK, which vents to the atmosphere at a height of 208 ft (63.4 m). This stack has historically released ventilation exhaust from several MPPB facilities, including the LWTS, the analytical laboratories, and off-gas from the former VIT system. The former VIT off-gas system and the tank off-gas system have been shut down. In 2015, the MPPB stack continued to release ventilation exhaust from spaces within the MPPB that are being prepared for demolition. Emissions from the MPPB are an order of magnitude lower than the emissions were during VIT operations in 2002.

In August 2015, some areas of the MPPB began to be ventilated by the new RVS. Ventilation of the MPPB is provided by two distinct systems. The RVS replaced the Head-End Ventilation (HEV) system, which ventilates rooms in the MPPB that were the most highly contaminated during NFS fuel reprocessing operations. Decontamination activities have been performed in the majority of these rooms and debris and vessels have been removed, reducing overall contamination levels. The replacement system will allow dismantling of the HEV system and continued decommissioning of the MPPB. The RVS is made up of two Replacement Ventilation Units (RVUs) with a single emission point.

Total curies released from the MPPB stack in 2015 are listed in Table 2-3, together with annual averages, maxima, and a comparison of average isotopic concentrations with the applicable DCSs. The sum of ratios for radiological concentrations from ANSTACK was 0.0117, well below the DOE guideline of 1.0. Airborne concentrations from the stack to the WVDP site boundary are further reduced by dispersion. The total curies released from the RVS for the first five months of operation in 2015 are significantly less than the total curies released from ANSTACK in 2015. The RVU results are reported in Table C-2 of Appendix C.

Results from air samples taken near the site boundary have confirmed that WVDP operations have had no discernible effect on off-site air quality.

Other On-Site Air Sampling Systems. Sampling systems similar to those of the MPPB are used to monitor airborne effluents from the former VIT heating ventilation and air conditioning system (ANVITSK), the STS/permanent ventilation system stack (ANSTSTK), the container sorting and packaging facility (CSPF) ventilation stack (ANCSPFK), and the RHWF stack (ANRHWFK). (See Figure A-6.) Ventilation from the CSRF ventilation stack (ANCSRFK) was discontinued in 2011, and replaced by a portable ventilation unit (PVU). The CSRF PVU was not operated in 2015. The 01-14 building ventilation stack (ANCSSTK) was demolished with the 01-14 building in 2013. Ventilation from the CSPF in the LSA #4 building was suspended in October 2014 due to lack of repackaging activity. There were no emissions from the CSPF stack in 2015.

Permitted outdoor ventilation enclosures (OVEs) for the PVUs are used to provide the ventilation necessary for personnel safety while working with radioactive materials in areas outside permanently ventilated facilities or in areas where permanent ventilation must be augmented. Air samples from PVUs are collected continuously while emission points are discharging, and the data collected are included in annual evaluations of airborne emissions.

Appendix C presents total radioactivity released for specific radionuclides at each on-site air sampling location. No DCSs were exceeded by airborne emissions on an annualized basis during CY 2015. Locations with radiological results statistically greater than background values are summarized in Table 2-4.

TABLE 2-3
Total Radioactivity Released at Main Plant Stack (ANSTACK) in 2015 and Comparison of Discharge Concentrations with DOE DCSs

Isotope [a]	*N*	*Total Activity Released* [b] *(Ci)*	*Average Concentration (µCi/mL)*	*Maximum Concentration (µCi/mL)*	*DCS* [c] *(µCi/mL)*	*Ratio of Average Concentration to DCS*
Gross Alpha	26	7.07±0.60E-07	9.52±0.81E-16	4.88E-15	NA[d]	NA
Gross Beta	26	1.63±0.03E-05	2.20±0.04E-14	2.60E-13	NA[d]	NA
H-3	26	1.91±0.06E-03	2.57±0.08E-12	5.04E-12	2.1E-07	<0.0001
Co-60	2	3.47±4.25E-08	4.68±5.72E-17	< 1.05E-16	3.6E-10	<0.0001
Sr-90	2	3.27±0.13E-06	4.40±0.17E-15	7.12E-15	1.0E-10	<0.0001
I-129	2	1.26±0.04E-05	1.70±0.05E-14	1.83E-14	1.0E-10	0.0002
Cs-137	2	7.89±0.14E-06	1.06±0.02E-14	1.74E-14	8.8E-10	<0.0001
Eu-154	2	-1.41±8.01E-08	-0.19±1.08E-16	< 1.73E-16	7.5E-11	<0.0001
U-232[e]	2	3.93±4.34E-09	5.30±5.84E-18	9.69E-18	4.7E-13	<0.0001
U-233/234[e]	2	2.45±0.65E-08	3.30±0.87E-17	3.47E-17	1.0E-12[f]	<0.0001
U-235/236[e]	2	2.34±2.69E-09	3.15±3.63E-18	< 5.38E-18	1.2E-12	<0.0001
U-238[e]	2	1.33±0.51E-08	1.79±0.69E-17	2.57E-17	1.3E-12	<0.0001
Pu-238	2	1.31±0.20E-07	1.76±0.27E-16	2.85E-16	8.8E-14	0.0020
Pu-239/240	2	2.24±0.26E-07	3.02±0.34E-16	4.17E-16	8.1E-14	0.0037
Am-241	2	4.06±0.31E-07	5.47±0.42E-16	8.18E-16	9.7E-14	0.0056
Sum of Ratios						**0.0117**

N - Number of samples.
NA - Not applicable.
[a] Half-lives are listed in Table UI-4.
[b] Total volume released at 50,000 cubic feet per minute = 7.42E+14 mL/year.
[c] DCSs are used as reference values for the application of best available technology per DOE Order 458.1.
[d] DCSs do not exist for indicator parameters gross alpha and gross beta.
[e] Total Uranium = 5.99±0.16E-02 g; average = 8.07±0.21E-11 µg/mL, includes uranium contribution from glass fiber filter matrix.
[f] DCS for Uranium-233 used for this comparison.

Unplanned Radiological Airborne Release. No unplanned radiological airborne releases occurred in 2015.

Nonradiological Air Emissions. Nonradiological air emissions at the WVDP are regulated under an air facility registration certificate that caps (limits) nitrogen and sulfur oxide emissions (NO_X and SO_X, respectively) from the facility at 49.5 tons per year each. (See Table ECS-1.) The certificate primarily applies to two site utility steam boilers, which are the only non-exempted sources of NO_X and SO_X at the site. In April 2013 the boilers were taken out of service. Other units with the potential to emit nonradiological pollutants, such as generators listed in the certificate, are exempted with the understanding that each unit operates less than 500 hours per year. Consequently, there were no reportable NO_X and SO_X emissions in 2015.

Environmental Surveillance

Ambient Air. The sixteen ambient air monitoring stations encircling the WVDP have been sampled since October 2012. The first quarter of sampling data was used for operational baselining and equipment testing. CY 2015 represents the third full year of routine ambient air monitoring. The ambient air sampling program provides continuous environmental air sampling during all site activities for surveillance and regulatory compliance.

TABLE 2-4
2015 Comparison of Environmental Monitoring Results with Applicable Limits and Backgrounds

Sample Type	*Number of and Names of Sampling Locations*	*Locations with Results Greater than Applicable Limits or Screening Levels* [a] *(Constituent)*	*Number of Locations with Results Greater Than Background*	*Locations with Radiological Results* [b] *Statistically Greater than Background (Constituent)*
Air (1 background location=AFGRVAL)				
On-site air emission points	6 ANSTACK ANRVEU1 ANSTSTK ANVITSK ANRHWFK OVE/PVUs	0	4	**ANSTACK** (H-3, Sr-90, I-129, Cs-137, Pu-238, Pu-239/240, Am-241); **ANRVEU1** (I-129); **ANSTSTK** (I-129); **ANVITSK** (I-129)
Surface water (2 background locations, one on Buttermilk Creek=WFBCKBG and one [historical] on Cattaraugus Creek=WFBIGBR)				
On-site controlled effluents	1 WNSP001	**0**	1	**WNSP001** (Gross alpha, Gross beta, H-3, Sr-90, Tc-99, I-129, Cs-137, U-232, U-233/234, U-235/236, U-238, Pu-238, Pu-239/240, Am-241)
On-site surface water	7 WNSP006 WNSP005 WNSWAMP WNSW74A WNNDADR WNERB53 WNFRC67	**WNSWAMP** (Sr-90, Gross beta)	6	**WNSP006** (Gross beta, Sr-90, Cs-137, U-232, U-233/234, U-238); **WNSP005** (Gross beta, Sr-90,); **WNSWAMP** (Gross beta, Sr-90, U-235/236, U-238); **WNSW74A** (Gross beta, Sr-90); **WNNDADR** (Gross beta, H-3, Sr-90); **WNERB53** (Gross beta)
Off-site surface water	2 WFBCTCB WFFELBR	**0**	2	**WFBCTCB** (Gross beta); **WFFELBR** (Gross beta)
Soil (1 background location=SFGRVAL)				
Off-site soil	3 SFFXVRD SFRT240 SFRSPRD	NS	NS	NS
Sediment (2 background locations, one on Buttermilk Creek=SFBCSED and one [historical] on Cattaraugus Creek=SFBIGSED)				
On-site sediment/soil	3 SNSW74A SNSWAMP SNSP006	NS	NS	NS
Off-site sediment	3 SFTCSED SFSDSED SFCCSED	NS	NS	NS

NA = Not applicable; no regulatory, guidance, or screening limits are available.
NS = Not sampled in 2015. (Will be sampled again in 2017).
[a] Applicable regulatory, guidance, or screening limits are listed in Table UI-4 (radionuclides in air and water), and Appendix B-1 (water).

TABLE 2-4 *(concluded)*
2015 Comparison of Environmental Monitoring Results with Applicable Limits and Backgrounds

Sample Type	*Number of and Names of Sampling Locations*	*Locations with Results Greater than Applicable Limits or Screening Levels [a] (Constituent)*	*Number of Locations with Results Greater Than Background*	*Locations with Radiolocial Results Statistically Greater than Background (Constituent)*
Biologicals (3 background venison=BFDCTRL; 1 background milk=BFMCTLS)				
Milk	1 BFMFLDMN	0	0	None
Venison	3 BFDNEAR BFDNEAR BFDNEAR	0	0	None
Fish	2 BFFCATC BFFCATD	NS	NS	NS
Vegetables	3 BFVNEAA BFVNEAB BFVNEAC	NS	NS	NS
Environmental dosimetry (1 background=DNTLD23)				
On-site/near-site, near facilities	11 DNTLD24,28 32,33,34,35 36,38,40,43,44	0	3	**DNTLDs #24, 38, 40**
Off-site, perimeter	17 DFTLD01 to 16 and DFTLD20	0	0	None

NA = Not applicable; no regulatory, guidance, or screening limits are available.
NS = Not sampled in 2015. (Will be sampled again in 2017).
[a] Applicable regulatory, guidance, or screening limits are listed in Table UI-4 (radionuclides in air and water), and Appendix B-1 (water).

Samples from the ambient air monitoring locations are composited over a period of time. Filter samples are collected biweekly for gross alpha and gross beta screening and charcoal cartridges are collected monthly for iodine-129 screening analysis. Samples collected on a biweekly or monthly basis are also composited quarterly and analyzed for radioisotopes known to have been managed on the site. Samples of ambient air will include naturally occurring radioisotopes such as radon decay products which will be detected in the gross radioactivity analyses.

A high-volume sampler is included in the ambient air network located downwind in the prevailing wind direction, which is the direction of the hypothetical critical receptor (the historical MEOSI). This sampler operates at a flow rate more than five times the low-volume samplers and was installed to confirm the results of the lower volume sampling. The low-volume sampling system is able to detect site-managed radioisotopes to approximately 1% of each radioisotope's environmental regulatory compliance level. The high-volume sampler can detect particulate radioisotopes down to approximately 0.1% to 0.2% of the compliance level. (Although the high-volume sampler does not include a sample for iodine-129, the co-located low-volume sampler does measure iodine-129.)

Data collected from the ambient air monitors from January to December 2015 are summarized in Tables C-9, C-10, and C-11 of Appendix C. Gross alpha and gross beta data, collected biweekly, as well as the quarterly composited isotopic results have displayed average activities from the ambient air network that are very similar in all sixteen sectors to the concentrations observed at AFGRVAL, the background ambient air sampler located 18 miles (29 km) south of the site in Great Valley, New York that has been monitored for many years (see Figure A-14). Throughout 2015, samples for radionuclides in air continued to be collected at this distant background location which samples regional air with very low potential to be affected by radiological releases from the WVDP.

None of the 2015 annual average radioisotopic results at the ambient air locations were positive (with a result greater than the uncertainty), and none exceeded 4.7% of the NESHAP concentration levels for regulatory compliance. (See Table C-11). The computed ratios of the observed concentrations to the compliance levels are primarily a consequence of the minimum detection limits that can be obtained by the ambient air samplers. This is demonstrated by the fact that the sum of ratios for the high volume sampler AF16HNNW, is less than half the ratio of the low volume sampler at the same location due to the high volume sampler's ability to detect lower concentrations.

Continuous on-site air sampling is also performed close to the work area during demolition of all radiologically contaminated facilities for health and safety purposes by radiological control technicians. Samples collected from these local samplers are analyzed for gross radioactivity on a daily basis during demolition activities.

Surface Water. On-site surface water drainage is routinely sampled at several points on the north and south plateaus, as shown in Appendix A, Figure A-2. Monitoring points are sited at locations where releases from possible source areas on the north and south plateaus could be detected. Off-site sampling locations are shown on Figure A-5. Appendix B-4 presents data for site surface water drainage and ambient surface water monitoring locations. Also provided for side-by-side comparison with these data are reference values, where available, including background water monitoring data and/or pertinent water quality standards and guidelines.

Radiological and nonradiological results from surface water samples were compared with applicable water quality standards and guidelines. Radiological results from on-site and downstream locations on Franks Creek and Buttermilk Creek in 2015 were also compared with 2015 results from the background location on Buttermilk Creek (WFBCBKG), upstream of the WVDP. Results from Cattaraugus Creek near Felton Bridge (sampling point WFFELBR) were compared with historical results from the upstream Cattaraugus Creek background at Bigelow Bridge (former sampling point WFBIGBR). Locations with results exceeding applicable limits and those with results statistically greater than background values are summarized in Table 2-4.

South Plateau Surface Water. Surface water surrounding the two inactive underground radioactive waste disposal areas (the NDA, under DOE's control, and the SDA, under NYSERDA's control) is monitored on the south plateau. Four of the VSCs, loaded with five vitrified HLW canisters each, were stored on the HLW Cask Storage Pad at the end of CY 2015 on the south plateau. A hardstand on the south plateau is being used to temporarily store the three steel boxes containing LLW that was removed from the VIT facility. The disposal sites, the VSCs, and the steel waste boxes are all potential (although not anticipated) contaminant sources to surface water on the south plateau.

Nearby areas are also being used to temporarily store and stage empty waste containers. Empty fabricated VSCs will also be staged for a few months on an existing hardstand on the south plateau during cask relocation. Temporary storage of the empty casks is needed for a short time period during which it is expected the rate of cask construction will exceed the rate at which the empty casks can be loaded with canisters. Also located on the south plateau is the drum cell, a building formerly used to store drums of processed LLW. The drum cell has been empty since 2007, when the waste drums were shipped off site.

Surface water drainage downstream of the NDA is monitored at location WNNDADR, immediately north of the NDA, and further downstream at location WNERB53 on Erdman Brook. Some drainage from the western and northwestern portions of the SDA is also captured at WNNDADR and WNERB53. Although no radionuclide concentrations from these two locations are greater than (or even approach) DCSs, gross beta and strontium-90 concentrations have historically exceeded background concentrations at both WNNDADR and WNERB53, and tritium has exceeded background at WNNDADR. See the list of locations in Table 2-4 with radioactivity levels that exceeded background concentrations in 2015. Residual soil contamination from past waste burial activities is thought to be the source of this radioactivity.

As part of an IM to limit groundwater, surface water, and precipitation infiltration into the NDA, a geomembrane cap and slurry wall were constructed at the NDA. The IM was completed in December 2008. (For more detail, see Chapter 4, "Interim Measures [IMs]" under the discussion of "Groundwater Sampling Observations on the South Plateau Including the NRC-Licensed Disposal Area [NDA].")

Figure 2-2 is a plot of average gross beta and strontium-90 concentrations in surface water at sample points WNNDADR and WNERB53 before completion of the IM compared to the current annual average concentrations. In CY 2015, average concentrations after the IM were over 80% lower at WNNDADR and over 60% lower at WNERB53 than historical concentrations, indicating the IM's effectiveness in reducing groundwater migration through the NDA, which affects surface water drainage at these points.

Tritium concentrations at WNNDADR in CY 2015, shown on Figure 2-3, remained above background concentrations with the annual average decreasing as compared to 2014. Tritium concentrations at WNNDADR have been decreasing overall since routine monitoring began at this location. Since tritium's half-life is slightly longer than 12 years, decreasing tritium concentrations may be partly attributable to radioactive decay. Concentrations at WNNDADR have decreased from a high of 1.79E-05 µCi/mL in 1992 to 3.35E-07 µCi/mL in 2015.

Northeast of the SDA, Franks Creek is sampled to monitor drainage downstream of the drum cell and the eastern and southern borders of the SDA (point WNFRC67, on Figure A-2). In 2015, the gross beta concentrations at this sampling point were statistically indistinguishable from background, and well below the DCSs.

North Plateau Surface Water. On the north plateau, possible contaminant sources that could affect surface water include the WTF, MPPB, the lagoon system associated with the LLW2, waste handling and storage facilities, and seepage from the strontium-90 groundwater plume.

Besides the effluent and drainage locations discussed earlier in the liquid effluents section, a location on the east side of the MPPB (point WNSP005) monitors surface drainage on the north plateau. Annual average gross beta and strontium-90 concentrations statistically exceeded background concentrations at this sampling location during CY 2015 but were well below DCSs. One other sample point, WNSP006, is sampled at Franks Creek at the security fence. WNSP006 is downgradient of the lagoon 3 outfall (point WNSP001). In 2015, as in previous years, concentrations at WNSP006 statistically exceeded background for gross beta, strontium-90, cesium-137, uranium-232, uranium-233/234, and uranium-238. The observed radioisotope concentrations were all well below DCSs.

Off-Site Surface Water. Surface water samples were collected at three off-site locations in 2015: one upstream background location on Buttermilk Creek (WFBCBKG), one downstream location on Buttermilk Creek (WFBCTCB), and one downstream location on Cattaraugus Creek (WFFELBR) (see Figure A-5). These three locations are described below:

- Buttermilk Creek receives surface drainage from the WNYNSC. The background monitoring point is located upstream of the WVDP at Fox Valley Road (WFBCBKG) and the downstream location on Buttermilk Creek is located at Thomas Corners Bridge (WFBCTCB), just before Buttermilk Creek flows into Cattaraugus Creek.

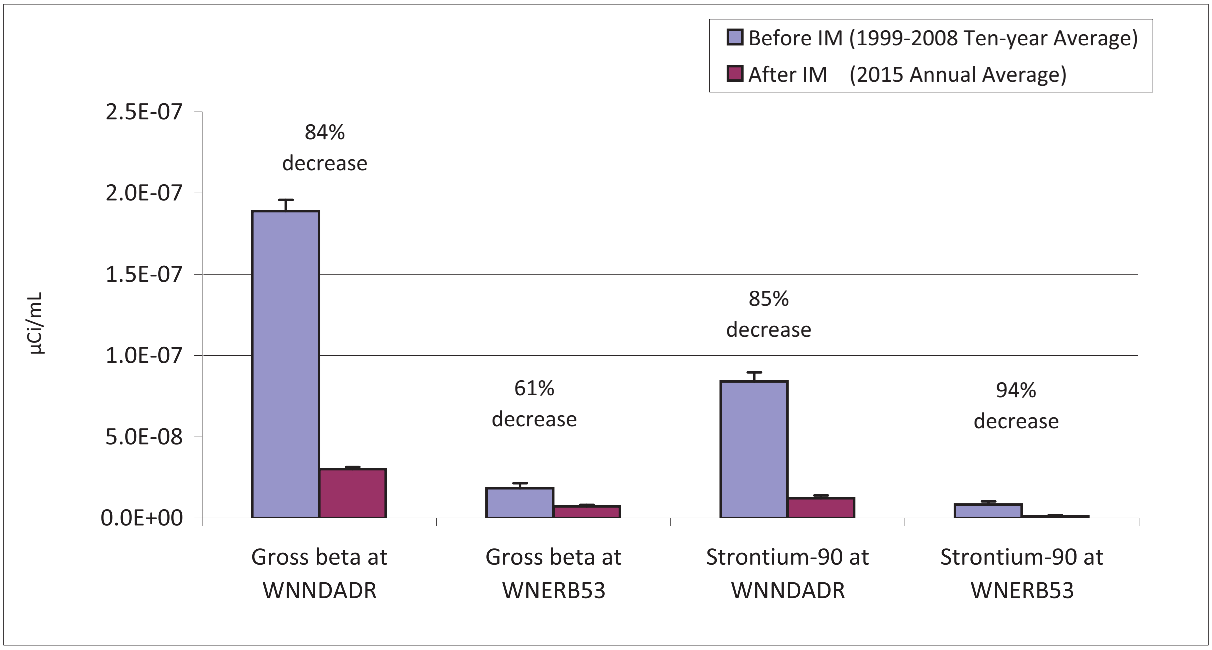
- Further downstream of Thomas Corners Bridge, samples are collected from Cattaraugus Creek at Felton Bridge (WFFELBR), the first point of public access to surface water downstream of the WVDP.

Until discontinuing sampling in 2008, background samples were also collected from Cattaraugus Creek at Bigelow Bridge, at Route 240, upstream of the confluence of Buttermilk Creek and Cattaraugus Creek (WFBIGBR). Historical data from this location from 1991 through 2007 have been used to establish upstream background concentrations for Cattaraugus Creek for comparison to samples collected at WFFELBR (see Table B4-I).

Samples from all three off-site surface water locations are analyzed for radioactivity. As noted earlier, strontium-90 concentrations were below detection limits in 2015 in the surface water at WFFELBR, the first point of public access downstream of the site on Cattaraugus Creek. The annual average strontium-90 concentration at this location was a non-detect value of <8.36E-10 µCi/mL. Upstream of WFFELBR, at Thomas Corners Bridge (WFBCTCB) which is located downstream of the site on Buttermilk Creek, the average measured strontium-90 concentration in 2015 (1.05E-09 µCi/mL) is slightly higher than the ten-year average background concentration (<7.83E-10 µCi/mL) upstream of the site on Buttermilk Creek (WFBCBKG). The WFBCTCB average is less than 0.1% of the strontium-90 DCS and is an estimated result below the contract required detection limit for strontium-90 in water of 2.0E-09 µCi/mL.

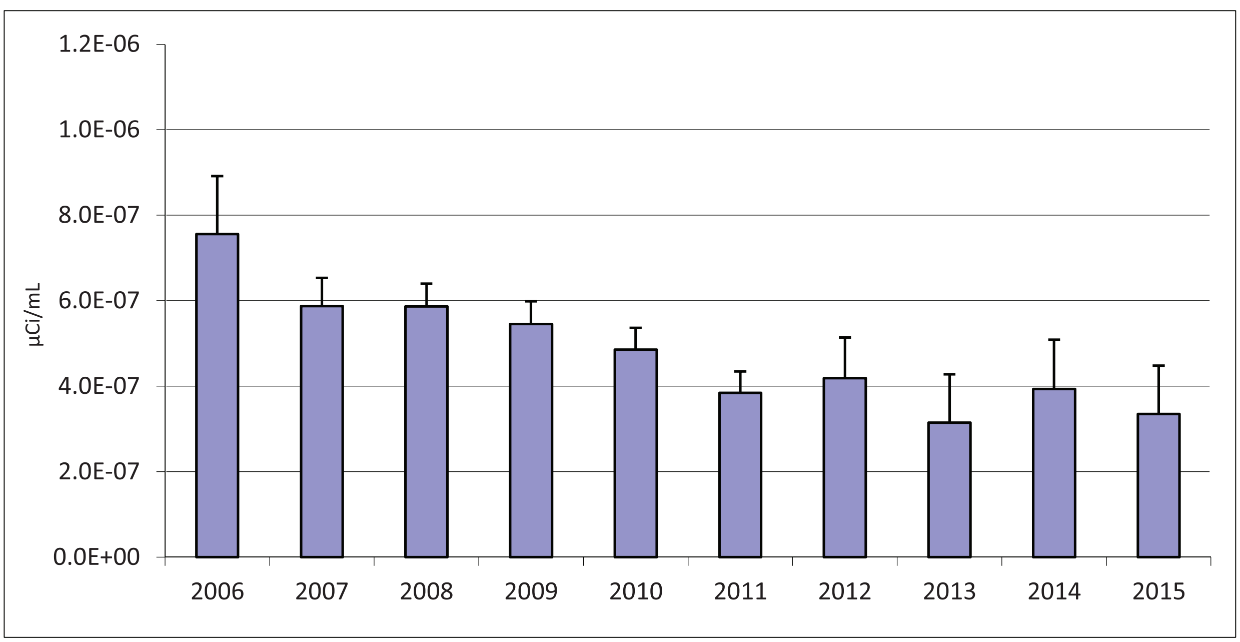
Consistent with historical data, gross beta was detected in both downstream locations as well as upstream (see Tables B-4H, B-4I, and B-4J) in 2015. Gross beta is naturally occurring and is frequently detected in surface water samples due to minor amounts of sediment in the samples. All of these concentrations are well below the DCS. The annual average gross beta result at WFFELBR in 2015 (3.43E-09 µCi/mL) was less than 0.3% of the DCS.

FIGURE 2-2
Average Gross Beta and Strontium-90 Concentrations in Surface Water on the South Plateau at WNNDADR[a] and WNERB53[b] Before and After the NDA Interim Measure (IM) was Installed



Note: The upper limit of the uncertainty term is indicated with each point. Average gross beta and strontium-90 background concentrations in Buttermilk Creek (WFBCBKG) in CY 2015 were 1.88±0.83E-09 and -1.46±5.76E-10 µCi/mL, respectively.
[a] Sample point WNNDADR is located downstream, immediately north of the NDA.
[b] Sample point WNERB53 is located farther downstream, on Erdman Brook.

FIGURE 2-3
Average Concentration of Tritium in Surface Water at WNNDADR: 2006-2015



Note: The upper limit of the uncertainty term is indicated with each point. Average background tritium concentration in Buttermilk Creek (WFBCBKG) in CY 2015 was <9.19E-08 µCi/mL.

Sediment and Soil. Airborne particulates may be deposited onto soil by wind or precipitation. Particulate matter in streams can adsorb radiological constituents in liquid effluents and settle on the stream bottom as sediment. Soils and sediment may subsequently be eroded or resuspended, especially during periods of high winds or high stream flow. The resuspended particles may provide a pathway for radiological constituents to reach humans either directly via exposure or indirectly through the food pathway.

As part of the monitoring program, on-site sediment/soil samples are collected every five years at three locations on the north plateau where drainage has the potential to be contaminated. On-site soils are collected at SNSP006, SNSWAMP, and SNSW74A (see Figure A-2). Soil samples are also collected at one background location (SFGRVAL, shown on Figure A-14) and three former near-site air sampling locations (SFRSPRD, SFFXVRD, and SFRT240), shown on Figure A-5. Additional off-site sediment samples are collected at one background location on Buttermilk Creek (SFBCSED) and at three downstream locations, one on Buttermilk Creek (SFTCSED) and two on Cattaraugus Creek (SFCCSED and SFSDSED) (see Figure A-5). Soil and sediment samples were last collected in 2012 and will next be collected in 2017.

Food. Food samples are collected from locations near the site (Figure A-11) and from remote locations (Figure A-14). Milk and venison samples are collected every year. Fish, apples, beans, and corn are collected every five years, with 2012 being the most recent collection year. Fish and deer are collected during seasons when they would normally be taken by sportsmen. Corn, apples, and beans are collected at harvest time. Edible portions are analyzed for radionuclides. Data from 2015 for milk and venison samples are presented in Appendix E. Fish and food crops will be sampled next in 2017.

In 2015, milk and venison data continue to demonstrate that the Project has a minimal effect on local food sources. Concentrations of cesium-137 have been observed in both background and near-site deer since venison sampling was initiated at the WVDP. The low concentrations of cesium-137 detected in 2015 in deer close to the site were statistically indistinguishable from the background concentrations in deer more than 9.3 miles (15 km) from the site, as has been observed historically. No radionuclides were detected in milk or venison samples statistically above background in 2015. Dose calculations based on results from food sources have consistently helped confirm the low dose estimates modeled on the basis of results from air and water monitoring. (See Chapter 3, "Dose Assessment.")

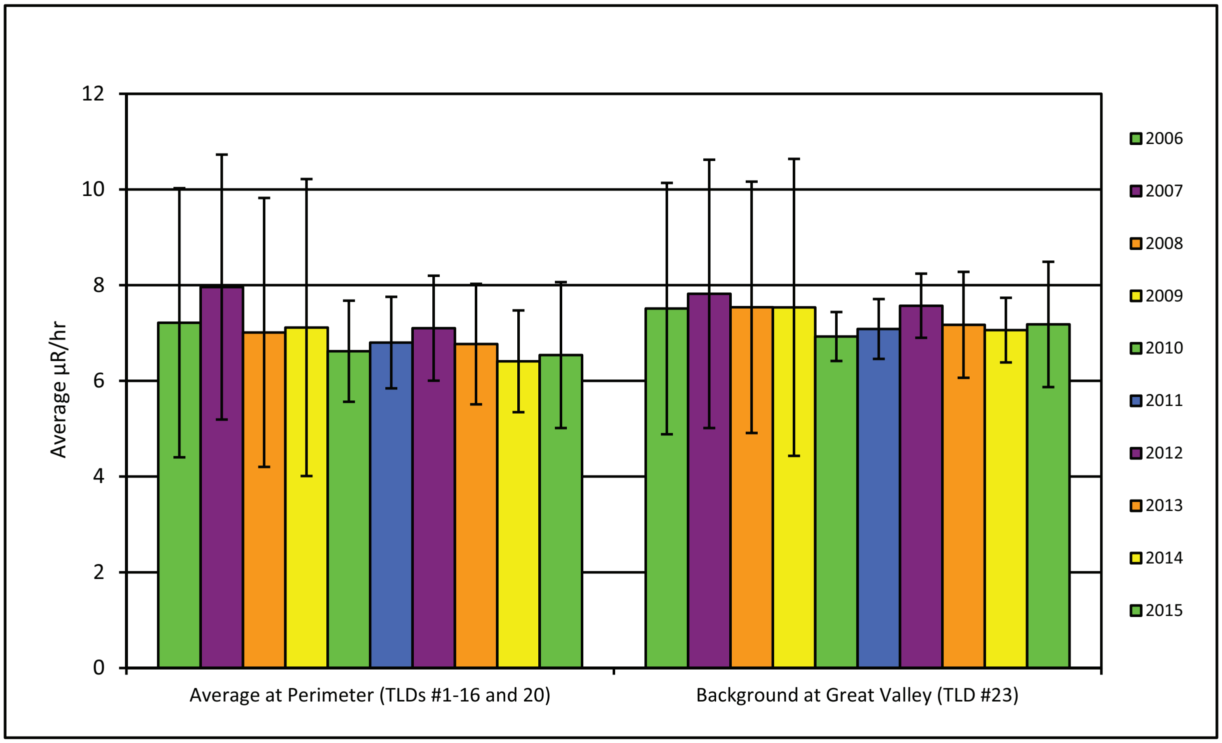
Environmental Radiation. Thermoluminescent Dosimeters (TLDs) are placed on site at waste management units, at the WVDP security fence, around the WNYNSC perimeter and the access road, and at a background location in Great Valley, remote from the WVDP. The TLDs directly measure radiation in the environment. A new TLD (#44) was deployed in early 2014 along Rock Springs Road on the property fence nearest the southwest corner of the HLW Cask Storage Pad to monitor any potential radiation from the HLW casks stored on the pad. No elevated radiation was measured at this TLD in 2015 as a result of the first four casks stored on the pad at the end of 2015. Monitoring of TLD #34 at the Drum Cell was discontinued in March 2015. No other changes were made to the location of TLDs from 2014 to 2015.

TLD results at perimeter locations were statistically the same as results from the background TLD (DNTLD23), indicating no measurable dose from Project activities at these locations. Figure 2-4 presents a graph of average annual exposure rates (in microroentgen per hour) over the last 10 years at perimeter and background locations. As shown, results at perimeter locations are comparable to background. In addition, no discernible trends over time are evident. Perimeter TLD locations (off-site) are shown on Figure A-13 in Appendix A, and the data are presented in Table F-1 in Appendix F.

Consistent with historical data, results from three on-site/near-site TLDs (DNTLD24, DNTLD38, and DNTLD40) located near north plateau on-site waste storage facilities in 2015 were generally higher than background. These locations are within the WNYNSC boundary and are not accessible by the public. On the south plateau, on-site/near-site TLD results remained at background levels. On-site/near-site TLD locations are shown on Figure A-12 in Appendix A, and the data are presented in Table F-2 in Appendix F.

Meteorological Monitoring. Meteorological monitoring at the WVDP provides representative and verifiable data that characterize the local climatology. These data are used to assess potential effects of routine and non-routine releases of airborne radioactivity and to provide input to dispersion models which can be used to calculate dose to off-site residents. The on-site 197-ft (60-m) meteorological tower (Figure A-1) continuously monitors wind speed, wind direction, and temperature at both the 197-ft (60-m) and 33-ft (10-m) elevations. Site barometric

FIGURE 2-4
10-Year Trends of Environmental Radiation Levels at Perimeter and Background Thermoluminescent Dosimeters (TLDs)



Note: The upper and lower limits of the uncertainty term are plotted with each result.

pressure is also measured at ground level. Precipitation was monitored east of the main parking lot in 2015. Monthly CY 2015 precipitation totals compared with 10-year monthly averages are presented in Table 2-5.

The meteorological tower supplies data to the primary digital and analog data acquisition systems on site. The systems are provided with either uninterruptible or standby power backup in the event of site power failures. In 2015, the data recovery rate (the time valid data were logged versus the total elapsed time) was 92.7%. Documentation, such as meteorological system calibration records, site log books, and analog strip charts, is stored in protected archives.

"Wind roses" showing the predominant wind direction as measured at the meteorlogical tower (60-m and 10-m elevations) are shown on Figure 2-5. The wind measurements at the 10-m elevation are influenced by the orientation of the topography around the site. As expected, wind speeds measured at the 10-m elevation were lower than those from the 60-m elevation.

TABLE 2-5
WVDP 2015 Monthly Precipitation Totals Compared with 10-Year Monthly Averages

Month	*2015 Monthly Total (inches)*	*10-Year Monthly Average (2005 through 2014)*
January	2.05	2.48
February	1.06	2.70
March	1.58	2.86
April	2.16	3.72
May	2.77	2.33
June	4.62	3.11
July	4.92	4.61
August	3.00	4.38
September	4.58	4.05
October	3.61	3.64
November	2.75	3.07
December	3.31	4.68
Total (inches)	36.4	41.6
Total (centimeters)	92.5	105.7

FIGURE 2-5

Wind Frequency and Speed From the Meteorological Tower (10-m and 60-m Elevations)
January 1-December 31, 2015

Key:

Numbers indicate sector mean wind speed.

Sectors are directions from which the wind is blowing.

Wind Speed Range (m/sec)

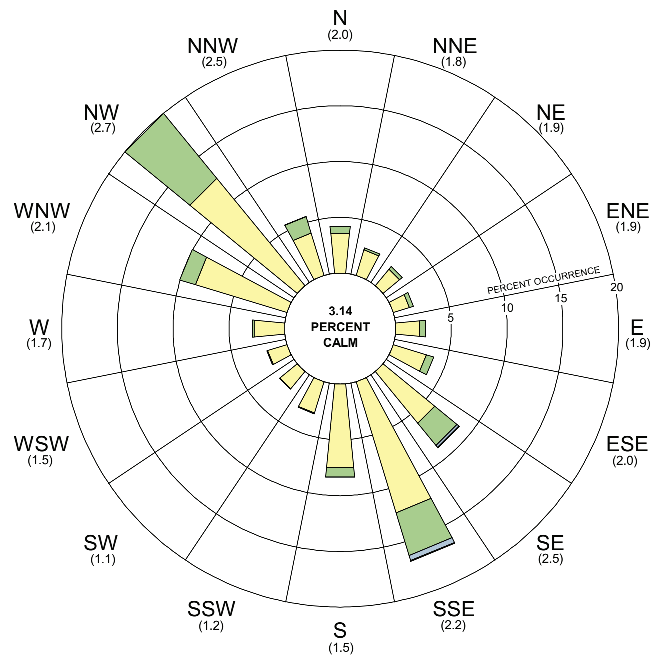
0.5-3.0

3.0-6.0

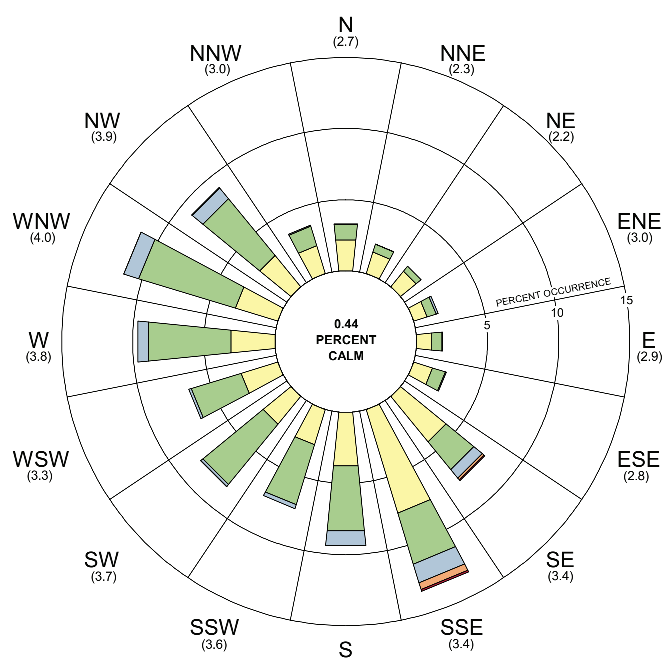
6.0-9.0

9.0-12.0

>12.0



Meteorological Tower (10-m)



Meteorological Tower (60-m)

Because dispersive capabilities of the atmosphere are dependent upon wind speed, wind direction, and atmospheric stability (which includes a function of the difference in temperature between two elevations), these parameters are closely monitored and are available to the Emergency Response Organization (ERO) at the WVDP. If an air release occurred, meteorological data would be used to predict the direction of plume migration.

Drinking Water

Project drinking water (potable water) and utility water were drawn from two surface water lakes located within the WNYNSC through September 18, 2014 when the supply source was converted to groundwater. Two bedrock wells were installed in the central area of the site in 2014 capable of satisfying the current and anticipated future potable and process water requirements. Supplemental water needed for emergencies, such as a major fire, and SPDES flow augmentation water, will continue to be supplied by the lakes. Conversion to groundwater as the primary source of potable water was undertaken to allow for closure and demolition of the site utility room attached to the MPPB. A new drinking water treatment and distribution system is being designed to replace the drinking water components that are currently housed in the utility room, such as the chlorinator and iron treatment system.

Drinking water continues to be monitored for both radiological and chemical constituents, with slightly different sampling requirements for the groundwater source. It is monitored at the distribution entry point and at other site tap water locations to verify compliance with EPA, NYSDOH, and Cattaraugus County Health Department regulations. The water supply is also monitored at the groundwater supply wells and at three nearby bedrock wells as part of the source water protection plan. Results from 2015 indicated that the Project's drinking water continued to remain below the local, state, and federal Maximum Contaminant Levels (MCLs) and drinking water standards. Radiological measurements for the supply wells and the nearby bedrock wells were consistent with background levels. The 2015 results for the potable water supply system are presented in Appendix B-5.

Special Projects

In order to mitigate erosion, new engineering controls were constructed in 2015 to channel the S09 storm water outfall discharge water from the top of the lagoon 3 embankment into Franks Creek.

Rerouted S09 storm water outfall discharge

The relocated discharge shown above includes a grout lined catch basin that collects storm water runoff, a 4-foot pipe with a drop structure that lowers the elevation of the discharge several feet to minimize erosion, followed by a pipe discharge to a grout lined surface channel that directs flow to the Parshall Flume at Franks Creek, at the bottom of the hill.

The re-designed discharge included re-grading, seeding and erosion controls to provide a passive sustainable landscape for this drainage for the foreseeable future. This construction project was completed in October 2015.

Construction of the RVS for the HEV portion of the MPPB air ventilation was also completed in CY 2015. A new building was constructed on the east side of the MPPB to house the two RVUs that make up the RVS. Extensive duct work was reconfigured to enable the change in ventilation systems. Construction and pre-emissions testing of the RVS was completed in the spring of 2015. In August 2015, the new RVS became operational. The HEV ventilation was shut down in December 2015.

Monitoring Program Changes

The only major change to the environmental sampling program that took place in 2015 was the new air effluent sampling from the newly constructed RVS. HEPA filtered air from the two parallel RVUs is discharged, monitored, and sampled at a single point. Sampling from Emission Unit 1, ANRVEU1, began in August 2015.

Additional minor changes to the 2015 environmental monitoring program include:

- The WWTF discharge at WNSP007 was not sampled in 2015 because the treatment facility is no longer discharging. Waste waters are transported off site for treatment.

- The biweekly collection frequency at WNSP006 and WFFELBR during Lagoon 3 discharge period was standardized in 2015.

- Semi-annual sampling of water quality parameters at WFBCTCB was discontinued in 2015.

- TLD #44, located at the property fence near the HLW Cask Storage Pad, was deployed along Rock Springs Road at the end of CY 2014 and monitored throughout CY 2015. Monitoring of TLD #34, located south of the Drum Cell, was discontinued in March 2015. Both TLDs were monitored during the first sampling round of 2015.

Environmental Monitoring Summary

As in the past, although concentrations of certain radiological and nonradiological constituents from samples collected within the security fence exceeded comparison levels or background concentrations, few results from near-site or downstream locations accessible to the public exceeded comparison levels or background. (See Table 2-4.)

Monitoring results from CY 2015 continued to demonstrate minimal or no adverse effects of the WVDP on the surrounding environment and confirmed the effectiveness of radiological control measures practiced at the WVDP.

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CHAPTER 3
DOSE ASSESSMENT

Radiation Sources at the WVDP

Members of the public are routinely exposed to natural and man-made sources of ionizing radiation. An individual living in the U.S. is estimated to receive an average annual effective dose equivalent (EDE) of about 620 mrem (6.2 mSv) (National Council on Radiation Protection and Measurements [NCRP] Report 160, 2009). NCRP Report No. 160, an update of NCRP Report No. 93 (1987), noted that the average member of the U.S. population was exposed to significantly more radiation from medical procedures than from any other source. (See the "Useful Information" section of this report for discussions of ionizing radiation. See the inset on page 3-3 for discussions of "Radiation Dose" and "Units of Dose Measurement.")

Half of the typical radiation dose to a member of the public, about 310 mrem/year, is from natural background sources such as cosmic radiation (from outer space) and terrestrial radiation and radon (from the subsurface), (see Figure 3-1). The other half is from man-made sources, such as consumer products and medical diagnostic procedures.

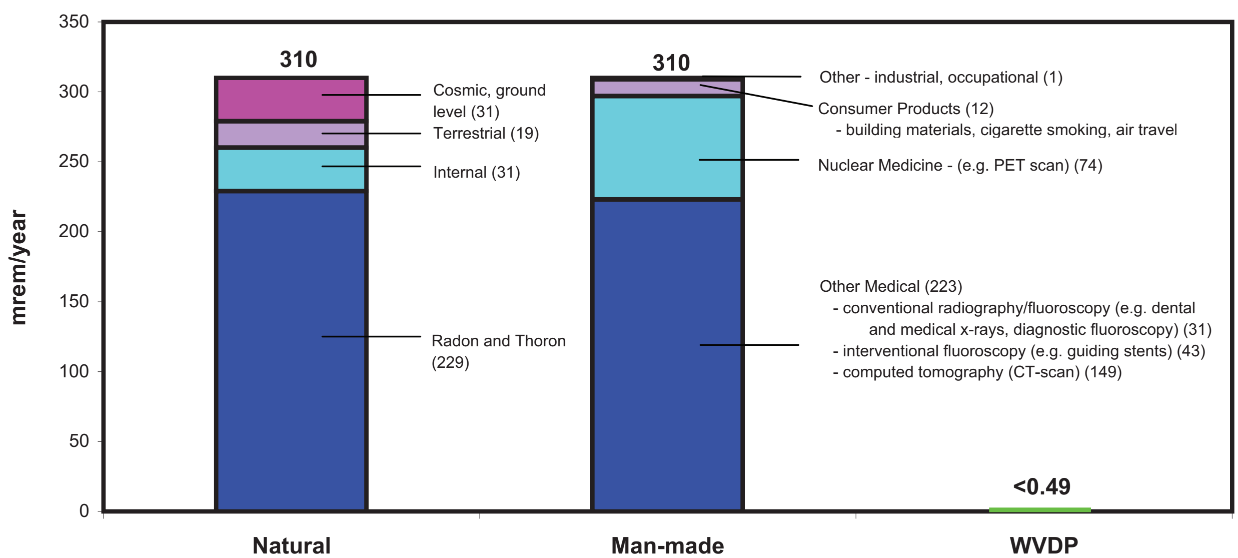
Each year, very small quantities of the radioactive materials remaining at the WVDP are released to the environment. Radioactive materials at the WVDP are residues from the commercial reprocessing of nuclear fuel by NFS in the 1960s and early 1970s. Emissions and effluents are strictly controlled so that release quantities are kept ALARA.

Exposure Pathways

An exposure pathway consists of a route for contamination to be transported by an environmental medium from a source to a receptor. Table 3-1 summarizes the potential exposure pathways to the local off-site population and describes the rationale for including or excluding each pathway when calculating dose from the WVDP.

Potential exposure pathways include: inhalation of gases and particulates, ingestion of locally grown food products and game, and exposure to external penetrating radiation emitted from contaminated materials. Drinking water is not considered a pathway from the WVDP to the public because surveys have determined that no off-site public

FIGURE 3-1
Comparison of Doses From Natural and Man-Made Sources to the Dose From 2015 WVDP Effluents



Reference: NCRP 160 (2009).

TABLE 3-1
Potential Exposure Pathways from the WVDP to the Local Off-Site Population

Exposure Pathway and Transporting Medium	*Reason for Including/Excluding*
Inhalation of gases and particulates in air (included)	Off-site transport of contaminants from stacks, vents, diffuse sources, or resuspended particulates from soil or water.
Ingestion of vegetables, cultivated crops, venison, milk, and fish (included)	Local agricultural products irrigated with potentially contaminated surface or groundwater; airborne deposition on leaves and uptake of deposited contaminants; venison and milk from animals that have inhaled or ingested contaminants; fish that have been exposed to or ingested contaminants in surface water and sediment.
Ingestion of surface and groundwater (excluded)	No documented use of local surface water or downgradient groundwater wells as drinking water by local residents.
External exposure to radiation from particulates and gases directly from air or surface water or indirectly from surface deposition (included)	Transport of air particulates and gases to off-site receptors; transport of contaminants in surface water and direct exposure when swimming, wading, boating, or fishing.

water supplies are drawn from downstream Cattaraugus Creek before Lake Erie or from groundwater in aquifers potentially affected by the WVDP.

Land Use Survey and Population Data

Population information is required when using computer models for annual dose assessments. Periodic surveys of local residents provide information about family size, and sources of food. Population around the WVDP by sector and distance from the CY 2010 census is presented on Figure A-15. These data indicate an estimated 1.62 million people live within 50 mi (80 km) of the site. This total includes approximately 128,000 Canadians (Statistics Canada, 2011). The spatial distribution of population within the 50-mi (80 km) radius of the site may be utilized in both the air and waterborne dose calculations. Information from the most recent land use survey, conducted in early 2002, was used to update the residential locations within 3.1 mi (5 km) of the site. In 2008, a field verification of the residents closest to the site was conducted to confirm the location of the nearest receptor in each sector. Updates to the nearest residents are performed periodically when there are local population changes.

Dose to the Public

Each year an estimate is made of the potential radiological dose to the public that is attributable to WVDP operations and effluents during that calendar year. Estimates are calculated to confirm that no individual could have received a dose that exceeded the limits for protection of the public, as established by DOE or EPA.

Figure 3-1 shows the estimated (all pathway) maximum individual dose from the WVDP in CY 2015 compared with the average annual dose a U.S. resident receives from man-made and natural background sources.

The 2015 estimated dose (<0.49 mrem [<0.0049 mSv]) from the Project to an off-site resident is far below the federal standard of 100 mrem for dose from all pathways allowed from any DOE site operation in a calendar year, confirming that efforts at the WVDP to minimize radiological releases are consistent with the ALARA philosophy of radiation protection.

Dose Assessment Methodology

Dose to the public is evaluated consistent with the requirements of DOE Order 458.1. Measurements (and/or estimates) of radionuclide concentrations in liquid and air released from the Project are summarized for the CY of interest. Ambient and background measurements are also collected. An estimate of the effective dose equivalent (EDE) to the potential maximally exposed member of the general public, and the collective EDE to the population within a 50-mi (80-km) radius of the site is made using these data as input to either EPA- and DOE-approved models, or using comparisons to EPA- and DOE-approved standards. (See the inset on "Radiation Dose" and "Units of Dose Measurement.")

Radiation Dose

The energy released from a radionuclide is eventually deposited in matter encountered along the path of the radiation. The radiation energy absorbed by a unit mass of material is referred to as the absorbed dose. The absorbing material can be either inanimate matter or living tissue.

Alpha particles leave a dense track of ionization as they travel through tissue and thus deliver the most dose per unit path-length. However, alpha particles are not penetrating and must be taken into the body by inhalation or ingestion to cause harm. Beta and gamma radiation can penetrate the protective dead skin layer of the body from the outside, resulting in exposure of the internal organs to radiation.

Because beta and gamma radiations deposit much less energy in tissue per unit path-length relative to alpha radiation, they produce fewer biological effects for the same absorbed dose. To allow for the different biological effects of different kinds of radiation, the absorbed dose is multiplied by a quality factor to yield a unit called the dose equivalent. A radiation dose expressed as a dose equivalent, rather than as an absorbed dose, permits the risks from different types of radiation exposure to be compared with each other (e.g., exposure to alpha radiation compared with exposure to gamma radiation). For this reason, regulatory agencies limit the dose to individuals in terms of total dose equivalent. Refer to the “Useful Information” section for discussion of ionizing radiation.

Units of Dose Measurement

The unit for dose equivalent in common use in the U.S. is the rem. The international unit of dose equivalent is the sievert (Sv), which is equal to 100 rem. The millirem and millisievert, used more frequently to report the low dose equivalents encountered in environmental exposures, are equal to one-thousandth of a rem or sievert, respectively. Other radioactivity unit conversions are found in the “Useful Information” section at the back of this report.

The effective dose equivalent (EDE), also expressed in units of rem or Sv, provides a means of combining unequal organ and tissue doses into a single “effective” whole body dose that represents a comparable risk probability. The probability that a given dose will result in the induction of a fatal cancer is referred to as the risk associated with that dose. For waterborne releases, the EDE is calculated by multiplying the organ dose equivalent by the organ-weighting factors developed by the International Commission on Radiological Protection (ICRP) in Publications 26 (1977) and 30 (1979). For airborne emissions, the EDE calculation is based upon factors in Federal Guidance Report 13, and National Council on Radiation Protection and Measurements (NCRP) report Number 123. The weighting factor is a ratio of the risk from a specific organ or tissue dose to the total risk resulting from an equal whole body dose. All organ-weighted dose equivalents are then summed to obtain the EDE.

The dose from internally deposited radionuclides calculated for a 50-year period following intake is called the 50-year committed effective dose equivalent (CEDE). The CEDE sums the dose to an individual over 50 years to account for the biological retention of radionuclides in the body. The total EDE for one year of exposure to radioactivity is calculated by adding the CEDE to the dose equivalent from external, penetrating radiation received during the year. Unless otherwise specified, all doses discussed here are total EDE values, which include the CEDE for internal emitters.

A collective population dose is expressed in units of person-rem or person-sievert because the individual doses are summed over the entire potentially exposed population. The average individual dose can therefore be estimated by dividing the collective dose by the population.

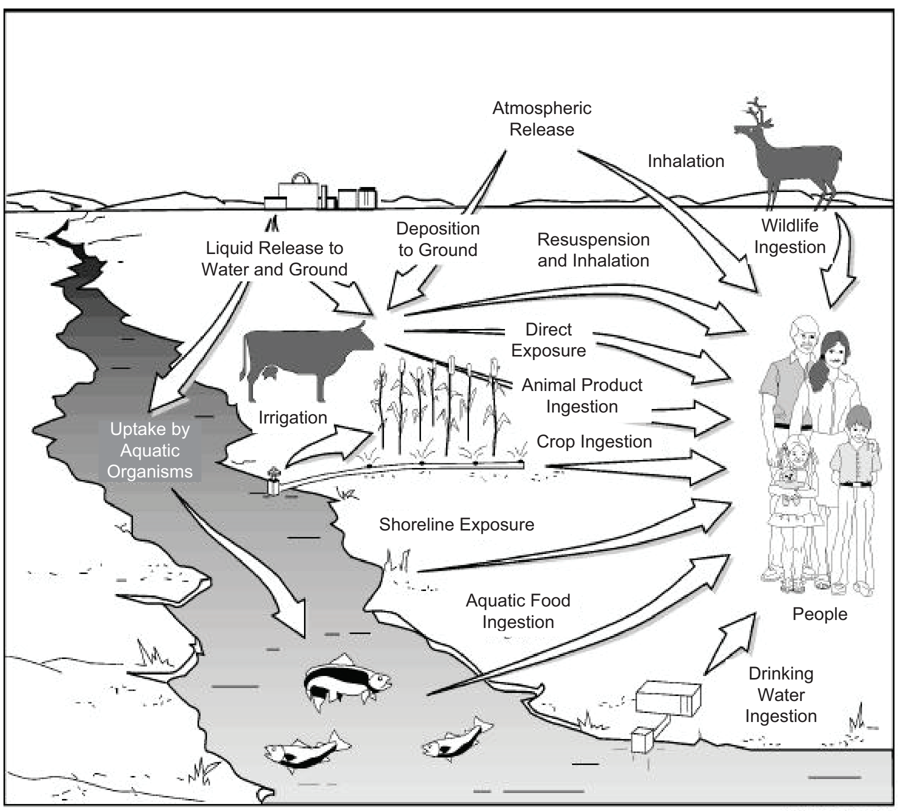
Potential dose to the public is also evaluated from radioactivity measurements in food from locations near the WVDP boundaries to corroborate results from the air and water pathways dose calculations (Figure 3-2). Vegetables, fruit, milk, venison, and fish samples from the WVDP vicinity are collected and analyzed for radiological constituents. (Biological sampling locations are shown on Figures A-11 and A-14.) Radioactivity measurements in food from locations near the site are compared with similar measurements from samples collected at background locations to the WVDP. If any near-site results are higher than background results, dose calculations are performed. These results are used as a conservative, independent confirmation of the dose estimates from all environmental pathways.

Potential dose to near-site residents and the local population from the waterborne pathway is estimated using dose conversion factors that are derived from a site-specific surface water exposure model. Potential dose via the air pathway was estimated by comparing measured ambient air radioactivity with EPA dose standards.

Potential dose via the air pathway historically was estimated using an air dose model with input from measured or estimated emissions from on-site sources. The use of the ambient air monitoring network has become increasingly important as point source discharges are curtailed and work activities at the WVDP progress toward decommissioning and/or facility demolition. Since vitrification was completed in 2002, the primary work performed in the MPPB has been decontamination of the rooms and cells, resulting in very low point source emissions. Consequently, in recent years, diffuse sources, such as radioactivity that is released to the air from natural evaporation from the surface of the lagoon system, have been a significant contributor to the overall airborne dose.

During demolition of the 01-14 building in 2013, no measured radioactivity increases were observed at either the off-site ambient air monitoring network encircling the site or at the on-site work area air monitors, indicating demolition of the 01-14 building was performed safely. The only structure demolished in 2015 was the uncontaminated men's restroom that was attached to the Administrative Building. There were no increases in radiological activity observed in the 2015 ambient air monitoring network during demolition of this structure.

FIGURE 3-2 Potential Radiation Exposure Pathways to Man



Reference: DOE-HDBK-1216-2015

Dose From Airborne Emissions

Airborne radionuclide emissions are regulated by EPA under the Clean Air Act (CAA) and its implementing regulations. DOE facilities are subject to 40 CFR 61, Subpart H, National Emission Standards for Hazardous Pollutants (NESHAP), which contains the national standards for emissions of radionuclides other than radon from DOE facilities. The applicable standard is a maximum of 10 mrem (0.1 mSv) EDE to any member of the public in any year. In July 2015, EPA gave final approval for use of the WVDP ambient air monitoring data to demonstrate compliance with the CAA regulations. Consequently, the method of estimating airborne dose was changed for the CY 2014 and CY 2015 annual NESHAP reports. (See the text box in the Useful Information section for additional explanation of the impact of this change in the method of demonstrating NESHAP compliance.)

The ambient air was monitored in 2015 at the sixteen low-volume ambient air samplers encircling the WVDP and at the high-volume sampler in the NNW sector, the predominant downwind direction and approximate location of the historically modeled maximally exposed individual. Figure A-7 shows the location of these samplers. Ambient air monitoring also continued at the background low-volume air sampler located in Great Valley, New York (AFGRVAL, shown on Figure A-14). Ambient air conditions have been monitored at this background location since 1984.

Low-Volume and High-Volume Samplers Located in the Historical Predominant Downwind Direction from the Site

The near site ambient air samplers are located within approximately a mile of the WVDP on NYSERDA or private property near the closest off-site receptor in each compass sector. The samplers were 98% operational in 2015, the third complete year the ambient network was in service.

Maximum Dose (Airborne) to an Off-Site Individual. The radiological dose that an individual could have received is calculated from the concentrations of radionuclides that are found to be present in the filter media from each ambient air sampler. To determine dose, the annual average radioactivity concentrations (without background subtracted) from each network perimeter sampler are compared to the concentration levels for environmental compliance (40 CFR 61, Subpart H, Table 2 of Appendix E) to determine a radionuclide specific compliance ratio (a value showing what fraction of the limit was measured in the ambient air for each radionuclide of interest). The concentration levels for environmental compliance represent the annual average radionuclide concentrations that correspond to a 10 mrem/year EDE. It follows that a measured concentration that is a fraction of the standard corresponds to an equivalent fraction of the 10 mrem dose. Therefore, the sum of fractions for each sampler location is converted to dose by multiplying the sum by 10 mrem. Compliance with the NESHAP standard is demonstrated when the sum of ratios is less than 1.

Filter media from each ambient air sampler around the WVDP were analyzed throughout 2015. The average sector specific airborne radioactivity measurements are summarized in Appendix C, Tables C-9 through C-11. Airborne releases of radionuclides from the WVDP are usually too small for their concentrations to be detected. Measurements at the ambient air samplers are similar to the background sampler at Great Valley, 18 miles (29 km) south of the site.

The estimated dose using the 2015 ambient air sampling data was based on the compliance ratios shown in the last column of Table C-10 and Table C-11, in Appendix C. When the measurements are below the detection limit of the instruments, a value “<detectable limit” is used to calculate the compliance ratio. The maximum value of the sum of ratios from the ambient air monitoring data was <0.047. Multiplying this sum of fractions by 10 produces a maximum potential dose of <0.47 mrem (<4.7E-03 mSv), which is below the 10 mrem (0.1 mSv) NESHAP limit established by EPA and mandated by DOE Order 458.1. The 2015 estimated dose is the hypothetical upper bound of the potential individual dose rather than an actual dose.

Continuous Air Effluent Monitoring. The on-site ventilation stacks are monitored continuously while in operation, and will continue to be monitored until building ventilation is terminated. There have been no significant changes in air emissions from the WVDP since vitrification was completed.

Iodine-129, a long-lived radionuclide, has routinely been found in main stack emissions and continued to be the largest contributor to the dose from airborne emissions through 2013. During the years when the HLW was being vitrified (1996 to 2002), iodine-129 releases increased because gaseous iodine was not as efficiently removed by the VIT process off-gas treatment system as were most other radionuclides. As more HLW was removed from the tanks and converted into glass, less waste was available to emit iodine-129 and the total emitted decreased. In 2015, measured iodine-129 concentrations in main stack emissions remained near pre-VIT levels.

At the WVDP, the maximum contribution to the modeled dose from airborne releases from point source emissions has historically originated from two primary locations, ANSTACK, the MPPB stack, which ventilates the process building, and ANSTSTK, the STS stack, which ventilates the underground HLW tanks. Trend graphs of annual average gross alpha, gross beta and iodine-129 concentrations at ANSTACK and ANSTSTK over the past sixteen years demonstrate that there were no significant changes in the emissions from these primary sources in 2015, as shown on Figure 3-3.

Collective Population Dose (Airborne). About 1.62 million people were estimated to reside in the U.S. and Canada within 50 mi (80 km) of the WVDP. (See Figure A-15.) Historically, the output from the CAP88-PC code was used to determine the total EDE from air emissions to the MEOSI and the collective EDE to the population within a 50 mile radius of the site. The model takes into account

Radon-220

Radon-220, also known as thoron, is a naturally occurring gaseous decay product of thorium-232 present in the airborne emissions from the WVDP MPPB. Radon-220 is also associated with the thorium reduction extraction (THOREX) process-related thorium-232 and uranium-232 in the HLW.

As reported in Chapter 2 of the 1996 WVDP ASER (West Valley Nuclear Services Company [WVNSCO] and Dames & Moore, June 1997), thoron levels were observed to increase during startup of the 1996 HLW VIT process. An estimate of thoron released during each waste concentration cycle was developed and used to determine a theoretical annual release. During the VIT phase, an average of about 12 curies per day were assumed to have been released. In 2015, with the VIT process long since completed, the average thoron release is conservatively estimated to be about three curies per day.

Although large numbers of curies were released relative to other radionuclides, the calculated dose from thoron is quite small because of its short decay half-life and other characteristics. The NESHAP rule specifically excludes thoron from air emission dose calculations, so a dose estimate using CAP88-PC was calculated separately. Based on the 2013 modeling results, the theoretical dose from radon to the MEOSI, located 1.2 mile (mi) (1.9 kilometer [km]) north-northwest of the site, would have been 0.094 mrem (0.00094 mSv), and the collective dose to the population within a 50-mi (80-km) radius would have been 4.5 person-rem (0.045 person-Sv). The dose contribution from radon would be approximately the same in 2015 as in 2013 because the source (3 Ci/day), the meteorology, and the population are basically the same. (See Table 3-2.) The theoretical dose from radon is within the same range as historical doses from radionuclides found in WVDP effluents.

With VIT completed, thoron releases have decreased to pre-VIT levels. The figure presented here provides a relative indication of recent trends in the estimated annual thoron releases.

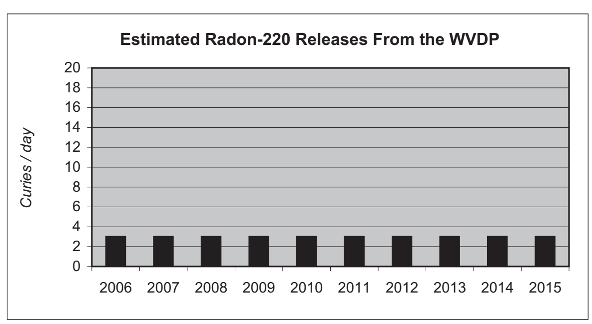
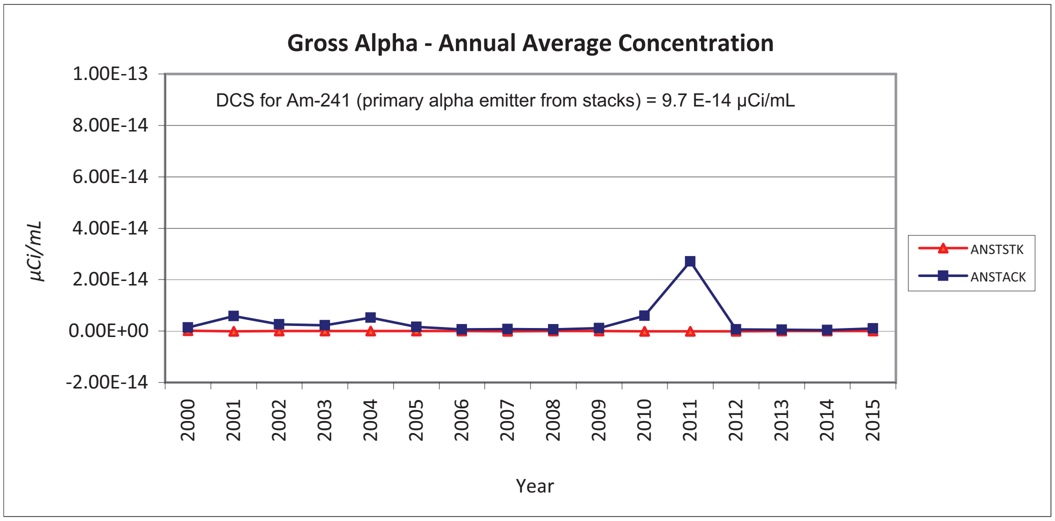
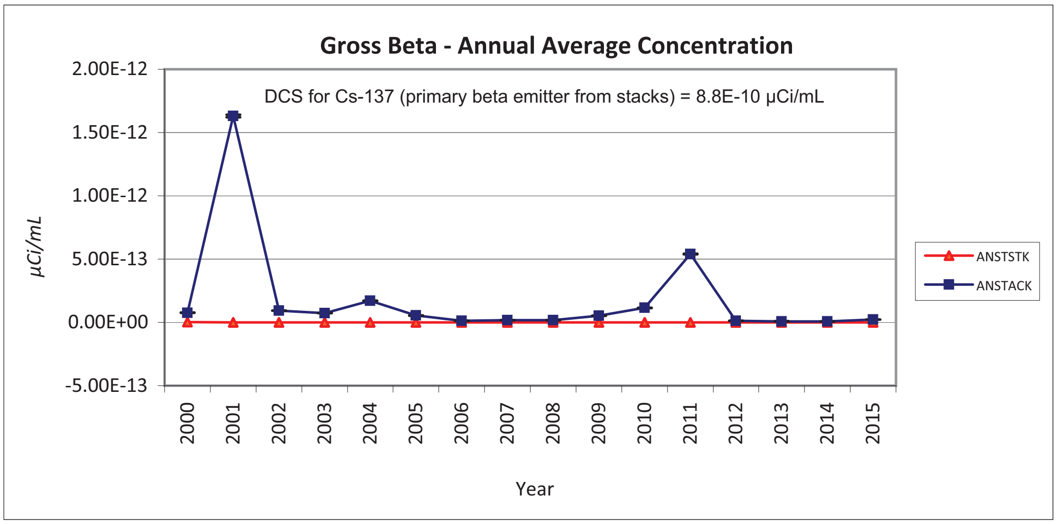
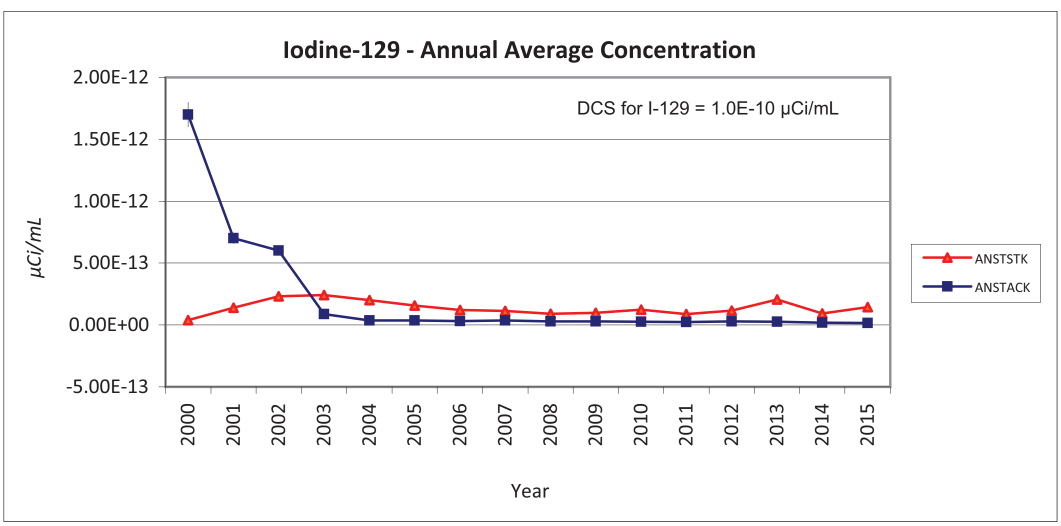


FIGURE 3-3
Historical Trends in Measured Concentrations from Primary Point Sources







meteorological data and the spatial distribution of the public surrounding the site to determine the total collective population dose.

Population dose conversion factors were developed using CAP88 in CY 2015. These dose conversion factors were used together with the estimated total emissions from the site to make a conservative estimate of the collective population dose for 2015. The 2015 population dose estimate is <0.50 person-rem (<0.0050 person-Sv) total EDE from radioactive nonradon airborne emissions released from the WVDP. The resulting average EDE per individual within 50 mi (80 km) of the WVDP computes to <0.00031 mrem (<0.0000031 mSv).

Table 3-2 summarizes the dose from both the air and water exposure pathways. Although radon is specifically excluded from the NESHAP regulation, an estimate of dose from radon at the WVDP is also included in Table 3-2 for comparison purposes. (For a detailed discussion of radon in air emissions from the WVDP, see the inset on "Radon-220.")

Predicted Dose From Waterborne Releases

There are currently no EPA standards establishing limits on the radiation dose to members of the public from liquid effluents, except as applied in 40 CFR Part 141, National Primary Drinking Water Regulations. Corollary limits for community water supplies are set by the NYSDOH in the New York State Sanitary Code (10 NYCRR 5-1). Radionuclides are not regulated under the site's SPDES permit. However, special requirements in the permit specify that radionuclide concentrations in the discharge are subject to requirements of DOE Order 5400.5 (replaced by DOE Order 458.1, "Radiation Protection of the Public and the Environment," in CY 2011.)

As indicated in Table 3-1, public drinking water does not represent a potential source of exposure to radioactivity from Project activities. Cattaraugus Creek is not used as a drinking water supply; therefore, a comparison of estimated doses from this source with the 4-mrem/year

TABLE 3-2
Summary of Annual Effective Dose Equivalents (EDEs) to an Individual and Population From WVDP Releases in 2015

Exposure Pathways	*Annual EDE*		
	Critical Receptor/MEOSI [a] mrem (mSv)	*Comparison to EPA and DOE Standards (mrem)*	*Collective EDE [b] person-rem (person-Sv)*
Airborne Releases[c]			
Total Airborne Dose (measured at the ambient air ring)	**<4.7E-01 (<4.7E-03)**	<4.7% of EPA standard for air (10 mrem)	**<5.0E-01 (5.0E-03)**
Waterborne Releases[d]			
Effluents only (001)	5.0E-03 (5.0E-05)		6.0E-03 (6.0E-05)
North plateau drainage (SWAMP+74A)	1.6E-02 (1.6E-04)		9.3E-02 (9.3E-04)
Total Waterborne Dose	**2.1E-02 (2.1E-04)**		**9.9E-02 (9.9E-04)**
Total From All Pathways	**<4.9E-01 (<4.9E-03)**	<**0.49%** of DOE standard for air and water combined (100 mrem)	**<6.0E-01 (6.0E-03)**
Estimated Airborne Radon-220[e]	9.4E-02 (9.4E-04)[f]		4.5 (4.5E-02)[f]
Dose from Natural Background Radiation	310 mrem	Total: mrem **=<0.16%** and person-rem = **<0.00012%** of natural background	502,836 person-rem

Note: Summed values may not exactly match totals due to rounding.
[a] The critical receptor applies to the airborne dose. The MEOSI applies to the waterborne dose.
[b] A population of 1.62 million is estimated to reside in the U.S. and Canada within 50 mi (80 km) of the site.
[c] Releases are from atmospheric nonradon point and diffuse sources.
[d] Dose calculated according to "Manual for Radiological Assessment of Environmental Releases at the WVDP" (CHBWV, 2012).
[e] Estimated radon activity based on indicator measurements and process knowledge; dose calculated using CAP88 for the MPPB stack.
[f] The estimated dose from radon-220 is specifically excluded by rule from NESHAP totals.

(0.04-mSv/year) EPA and NYSDOH drinking water limits is not appropriate (although values are well below the drinking water limits). Population dose estimates are based on the presumption that radionuclides are even further diluted in Lake Erie before reaching any municipal water supplies.

Because the Project's liquid effluents eventually reach Cattaraugus Creek, the most important waterborne exposure pathway is the consumption of fish from the creek by local sportsmen and residents. Exposure to external radiation from shoreline contamination or in the water is also considered in the model for estimating radiation dose.

The computer codes GENII version 1.485 (Pacific Northwest Laboratory, 1988), which implements the models in the NRC Regulatory Guide 1.109 (NRC, 1977), and LADTAP II (Simpson and McGill, 1980) were used to calculate site-specific unit dose factors (UDFs) for routine waterborne releases and dispersion of these effluents. The UDFs derived from those codes are tabulated in the "Manual for Radiological Assessment of Environmental Releases at the WVDP," WVDP-065 (CHBWV, 2012).

There are two controlled liquid effluent release points from the WVDP, WNSP001 (lagoon 3) and WNSP007 (the WWTF). Three batches of liquid effluents, totaling about 5.2 million gal (19.6 million L), were released from the lagoon 3 weir WNSP001 (SPDES point 001) during 2015. Measurements of the radioactivity discharged in these effluents were combined with the UDFs to calculate the EDE to the MEOSI and the collective EDE to the population living within a 50-mi (80-km) radius of the WVDP. (See Table 3-2.)

Since the WWTF was not operated in 2015, there were no measurements from WWTF effluents (WNSP007) included in the EDE calculations.

Besides the controlled release point at WNSP001, water from two natural drainage channels on the north plateau originating on the Project premises contain measurable concentrations of radioactivity: the northeast swamp (WNSWAMP) and north swamp (WNSW74A).

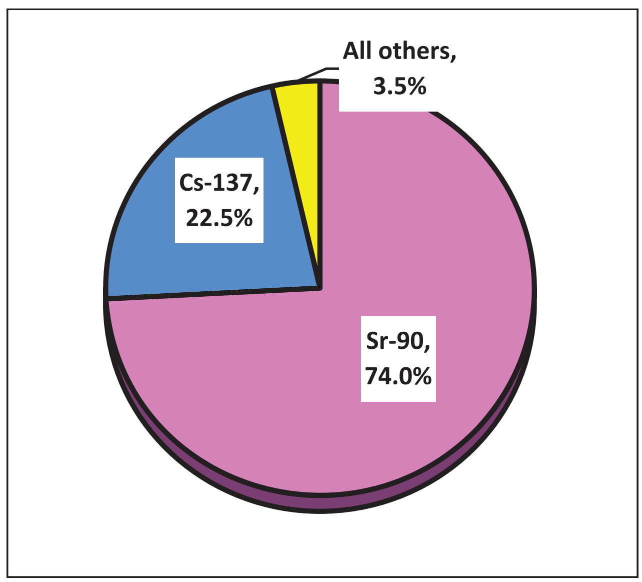
Although releases from WNSWAMP and WNSW74A are not considered "controlled" releases, they are well characterized and are routinely sampled and monitored. Results from these monitoring points are included in the EDE calculations for the MEOSI and the collective population.

There were no unplanned releases of waterborne radioactivity in 2015.

Maximum Dose (Waterborne) to an Off-Site Individual. Contributions to the waterborne dose from controlled releases and from natural drainage are estimated separately. An off-site individual could have received a maximum EDE of 0.0050 mrem (0.000050 mSv) from the radioactivity in liquid effluents discharged from the WVDP (lagoon 3 weir/SPDES point 001) during 2015. (See Table 3-2.) Most of the dose from the lagoon 3 discharge was from cesium-137. An off-site individual could have received a maximum EDE of 0.016 mrem (0.00016 mSv) due to drainage from the north plateau. Most of the north plateau dose was attributable to strontium-90, largely from the WNSWAMP drainage point.

A comparison of dose proportions attributable to specific waterborne radionuclides is shown on the pie chart on Figure 3-4. As presented, strontium-90 (primarily from WNSWAMP) and cesium-137 (primarily from lagoon 3) account for almost all of the estimated waterborne dose in 2015.

FIGURE 3-4
Dose Percent by Radionuclide from Waterborne Releases in 2015



The combined EDE to the MEOSI from liquid effluents and drainage was 0.021 mrem (0.00021 mSv). This annual dose is very small in comparison to the 310-mrem (3.10 mSv) dose that is received by an average member of the U.S. population from natural background radiation.

Collective Population Dose (Waterborne). As a result of radioactivity released in liquid effluents from the WVDP during 2015, the population living within 50 mi (80 km) of the site received an estimated collective EDE of 0.0060 person-rem (0.000060 person-Sv). The collective dose to the population from the effluents plus the north plateau drainage was 0.099 person-rem (0.00099 person-Sv). The resulting average EDE per individual is 0.000073 mrem (0.00000073 mSv), which is a very small percentage of the dose received by the average person from natural background radiation (310 mrem or 3.1 mSv).

Predicted Dose From All Pathways

The potential dose to the public from both airborne and liquid effluents released from the Project in 2015 is the sum of the individual dose contributions. (See Table 3-2.) The calculated maximum EDE from all pathways to a nearby resident was <0.49 mrem (<0.0049 mSv). This dose is <0.49% of the 100-mrem (1-mSv) annual limit in DOE Order 458.1. As in past years, CY 2015 results continued to demonstrate WVDP compliance with applicable radiation standards for protection of the public and the environment.

Table 3-3 presents the total curies released to air and water from all sources at the WVDP computed from measured air concentrations at the on-site stacks and from estimated diffuse sources, and measured water concentrations from surface water discharges and natural drainage. Table 3-3 shows that in 2015 the total curies released to surface water was greater than the total curies released to the air.

Historically, the largest portion of the total dose has been estimated to be due to waterborne contributions. Numerically, the dose estimated from the airborne pathway is larger than the estimated dose from the water pathway in 2015. However, the dose via the airborne pathway is an upper limit of the potential dose, since no radioisotopic activity was detected at the off-site ambient air samplers in 2015. The dose via the waterborne pathway was modeled mathematically using dose conversion factors, which can result in very low dose estimates.

In CY 2015, the total collective EDE to the population within 50 mi (80 km) of the site was <0.60 person-rem (<0.0060 person-Sv), with an average EDE of <0.00038 mrem (<0.0000038 mSv) per individual.

Radioactivity in the human pathway represented by these data confirms the continued very minor addition to the natural background radiation dose that individuals and the nearby WVDP population receive from Project activities.

Calculated Dose From Food. Radionuclide concentrations in near-site milk and venison samples collected in 2015 were statistically indistinguishable from concentrations in background samples collected in the western NY area (sampling locations shown on Figure A-14).

Conservative dose estimates for 2015 due to consuming near-site deer, fish, milk, beans, corn, and apples were estimated using concentrations measured in samples collected over the past five years to be about 0.053 mrem/year (0.00053 mSv/year), which is about 0.0098% of the dose received by an average individual due to natural and other man-made sources. (See Figure 3-1, "Comparison of Doses from Natural and Man-Made Sources to the Dose from 2015 WVDP Effluents.") This estimate assumes the individual consumes the maximum quantities of each food item. These independent estimates help confirm the low calculated doses based on air and water effluents, as summarized in Table 3-2.

Risk Assessment

Estimates of cancer risk from ionizing radiation have been presented by the NCRP (1987) and the National Research Council's Committee on Biological Effects of Ionizing Radiation (BEIR 1990 and 2005).

The NCRP estimates that the probability of fatal cancer occurring from exposure to radioactivity is between one and five cancer cases per 10,000 people who are each exposed to one rem (i.e., a risk coefficient of between 0.0001 and 0.0005). The Interagency Steering Committee on Radiation Standards suggests the probability might be slightly higher, or six per 10,000 people (January 2003) and DOE guidance also recommends using a risk factor of 0.0006.

The estimated risk to the hypothetical individual residing near the WVDP from airborne and waterborne releases can be calculated by multiplying the predicted dose to the critical receptor/MEOSI from all pathways (<0.49 mrem or <0.00049 rem in 2015) with the probability of cancer risk (0.0006). In 2015, this risk computes to approximately 29 per 100 million (a risk of 0.00000029). This risk is well below the range of 0.000001 to 0.00001 per year considered by the ICRP to be a reasonable risk for any member of the public (ICRP Report Number 26, 1977).

TABLE 3-3
WVDP Radiological Dose and Release Summary

Total Annual Dose for Calendar Year CY 2015									
Critical Receptor / MEOSI			Population						
Potential Dose to the Maximally Exposed Off-site Individual (from WVDP Sources)		% of DOE 100-mrem Limit	Population Within 50 Miles[a] of the WVDP (2010 census)	Potential Estimated Population Dose (from WVDP Sources)		Estimated Population Dose (from Natural Sources) (310 mrem/yr x population)		% of Natural Sources	
<0.49 (<0.0049)	mrem (mSv)	<0.49%	1,622,050	<0.60 (<0.0060)	person-rem (person-Sv)	502,836 (5,028.36)	person-rem (person-Sv)	<0.00012%	

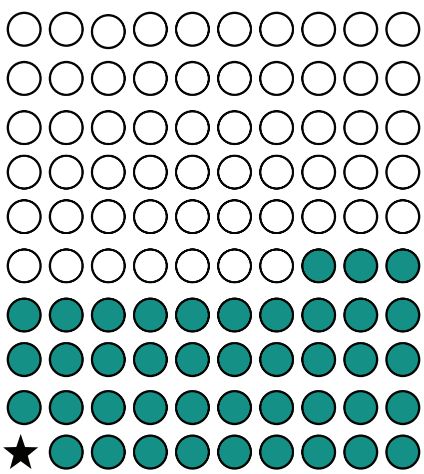
WVDP Radiological Atmospheric Emissions[b] CY 2015 in Curies and Becquerels										
Tritium	Kr-85	Noble Gases ($T_{1/2}$<40 days)	Short-Lived Fission and Activation Products ($T_{1/2}$<3 hr)	Fission and Activation Products ($T_{1/2}$>3 hr)	Total Radio-iodine	Total Radio-strontium	Total Uranium[c]	Total Plutonium	Total Other Actinides	Other (Rn-220)
5.29E-03 (1.96E+08)	NA	NA	NA	7.88E-05 (2.91E+06)	3.48E-05 (1.29E+06)	4.36E-06 (1.61E+05)	1.62E-07 (5.98E+03)	3.60E-07 (1.33E+04)	4.09E-07 (1.51E+04)	1.10E+03 (4.05E+13)

WVDP Liquid Effluent Releases[d] of Radionuclide Material - CY 2015 in Curies and Becquerels						
Tritium	Fission and Activation Products ($T_{1/2}$>3 hr)	Total Radioiodine	Total Radiostrontium	Total Uranium[e]	Total Plutonium	Total Other Actinides
2.13E-02 (7.90E+08)	3.21E-03 (1.19E+08)	6.99E-05 (2.58E+06)	1.05E-01 (3.89E+09)	3.47E-04 (1.29E+07)	7.60E-06 (2.81E+05)	4.97E-06 (1.84E+05)

Note: There are no known significant discharges of radioactive constituents from the site other than those reported in this table.
NA - Not applicable
[a] Total population includes the U.S. population from the 2010 census plus the Canadian population residing within a 50-mi (80-km) radius (Statistics Canada, 2011).
[b] Air releases are from point and diffuse sources.
[c] Total uranium (airborne) (g) = 1.19E-01, includes uranium contribution from glass fiber filter matrix.
[d] Water releases are from both controlled liquid effluent releases and from well-characterized site drainages.
[e] Total uranium (waterborne) (g) = 2.77E+02.

Over the past several decades the radiation health physics community has conducted considerable research into the biological effects of low dose radiation to develop up-to-date and comprehensive risk estimates for cancer and other health effects from exposure to "low-level ionizing radiation" (defined as near zero to 10 rem [10,000 mrem]). The most recent BEIR VII report (2005) reviewed all relevant, physical and epidemiological data since the previous committee report in 1990 which included 25 years of new data from the Japanese survivors of the atomic bomb (1945), from recovery workers in Chernobyl (1986), and from a population that has had increased exposure to low level radiation due to medical imaging (i.e., x-rays and CT scans). These data clearly show a correlation between radiation exposure and cancer from high levels of exposure (>10,000 mrem). However, the link between cancer and low dose radiation is not as readily discernible.

FIGURE 3-5
BEIR VII Cancer Risk Study



In a lifetime, approximately 42 of 100 people (solid circles) will be diagnosed with cancer NOT related to radiation exposure. Approximately an additional 1 cancer in 100 people (star) could result from a radiation exposure of 10,000 mrem (defined as low dose). Maximum potential dose from the WVDP in 2015 was <0.49 mrem.

The BEIR VII study put into perspective the risk of developing cancer from radiation relative to the much greater risk of developing cancer from all other causes as shown graphically on Figure 3-5. The BEIR VII lifetime risk model predicts that, assuming a sex and age distribution similar to that of the entire U.S. population, on average approximately 1 person in 100 would be expected to develop cancer from a radiation dose of 10,000 mrem, while approximately 42 of the 100 individuals would be expected to develop cancer from all other causes. The maximum potential all pathway dose of <0.49 mrem from WVDP operations in 2015 is five orders of magnitude lower than 10,000 mrem. The potential risk from <0.49 mrem represents a fraction so small that it could not be seen if plotted as a fraction of the star on the Figure 3-5 graphic.

Release of Materials Containing Residual Radioactivity

In addition to discharges to the environment, the release of property containing residual radioactive materials is considered a potential contributor to dose received by the public, as set forth in DOE Order 458.1.

In 2000, the Secretary of Energy placed a moratorium on the release of volumetrically contaminated metals, and suspended the unrestricted release of metals from radiological areas of DOE facilities for recycling. However, the DOE is currently re-evaluating these policies. In December 2012, DOE announced the availability for public review and comment of the draft "Programmatic Environmental Assessment (PEA) for the Recycling of Scrap Metals Originating from Radiological Areas." No decision has been made based on this re-evaluation to date. Consequently, the moratorium and suspension currently remain in effect.

Presently there are no approved criteria for releasing WVDP material to the public that may have been radiologically contaminated in depth or volume; therefore, no unrestricted release of potentially radiologically contaminated scrap metal or other material of this type has occurred. Compliance with the Secretary of Energy's suspension of unrestricted release of scrap metal for recycle continues at the WVDP.

The WVDP resumed recycling nonradiologically contaminated scrap metals in the Fall of 2015. At the WVDP, only scrap metal that has never been stored in a radiological area can be recycled. Recycling of nonradiologically contaminated scrap metals was made possible recently by improved record-keeping practices that include documentation of where materials were stored since first being received on-site. Recyclable scrap metal is collected in a special roll-off container that is closely monitored by waste management to prevent unauthorized disposal. All scrap metal determined recyclable must be accompanied by a "No Radioactivity Added Certification" form with waste description and history recorded by the waste generator and radiological survey data provided by waste management and radiological controls personnel that demonstrates the waste is not nonradiologically contaminated. In the fall of CY 2015, a total of 8.4 tons of copper and stainless steel were recycled under this program.

The DOE encourages efforts to promote reuse and recycling of excess property for use within the DOE complex. These transfers occur only when property is transferred to individuals authorized to use such material. A graded approach is utilized by the WVDP for the release of equipment and materials to the public for unrestricted use. This approach considers the historical material use, the potential for internal contamination, the location the material was used, and process knowledge of the item(s) to be released. In accordance with WVDP radiological controls manuals and procedures, these criteria are assessed and documented, and the material(s) may be radiologically surveyed to verify the survey results comply with the contamination limits presented for “Release and Clearance of Property” in DOE Order 458.1. Records of released property are maintained.

Dose to Biota

Radionuclides from both natural and man-made sources may be found in environmental media such as water, sediments, and soils. In the past, it has been assumed that if radiological controls are sufficient to protect humans, other living things are also likely to be sufficiently protected. This assumption is no longer considered adequate, because plant and animal populations residing in or near these media or taking food or water from these media may be exposed to a greater extent than are humans. Therefore, DOE prepared a technical standard that provides methods and guidance to be used to evaluate doses of ionizing radiation to populations of aquatic animals, riparian animals, terrestrial plants, and terrestrial animals.

Methods in this technical standard, “A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota” (DOE-STD-1153-2002, July 2002), were used in 2015 to evaluate radiation doses to aquatic and terrestrial biota within the confines of the WNYNSC, which includes the WVDP. Doses were assessed for compliance with DOE Order 458.1, which references dose criteria for biota protection proposed in Table 2.2 of DOE-STD-1153-2002 of 1 rad/d for aquatic animals and terrestrial plants and 0.1 rad/d for riparian and terrestrial animals. Note that the absorbed dose unit (rad) is used for biota instead of the units used for indicating human risk (rem).

RESRAD-BIOTA for Windows® (November 2009), a calculation tool provided by DOE for implementing the technical standard, was used to compare existing radionuclide concentration data from environmental sampling with biota concentration guide (BCG) screening values and to estimate upper bounding doses to biota. Data were taken from surface water samples obtained in 2015 and from the most recent sediment samples (2004–2007 and 2012). Soil data from the most recent 10 years for which special on-site surface soil sampling was conducted (1995-2004) and the most recent 10 years of routine on-site surface soil sampling (1999–2007 and 2012) were also used. Differing time periods were used because radionuclide concentrations change more rapidly over time in surface waters than in sediments and soils, as reflected in their sampling frequencies (monthly or quarterly for water, every five years for sediment and surface soil). Concentration data for radionuclides in each medium were entered into the RESRAD-BIOTA Code. The value for each radionuclide was automatically divided by its corresponding BCG to calculate a partial fraction for each nuclide in each medium. Partial fractions for each medium were added to produce a sum of fractions.

Exposures from the aquatic pathway may be assumed to be less than the aquatic dose limit from DOE Order 458.1 if the sum of fractions for the water medium plus that for the sediment medium is less than 1.0. Similarly, exposures from the terrestrial pathway may be assumed to be less than the proposed dose limits for both terrestrial plants and animals if the sum of fractions for the water medium plus that for the soil medium is less than 1.0.

It was found that the isotopes with the highest sums of fractions, the radionuclides that contributed the largest component of both aquatic and terrestrial dose to biota were strontium-90 and cesium-137. Per guidance in DOE-STD-1153-2002, the populations of organisms most sensitive to strontium-90 and cesium-137 in this evaluation; i.e., those most likely to be adversely affected via the aquatic and terrestrial pathways, were determined to be populations of riparian animals (such as the raccoon [aquatic dose]) and terrestrial animals (such as the deer mouse [terrestrial dose]). Populations of both animals are found on the WNYNSC.

In accordance with the graded approach described in DOE-STD-1153-2002, a general screening was first conducted using the maximum radionuclide concentrations from surface waters, sediments, and soils. Maximum radionuclide concentrations exceeded applicable BCG limits for both aquatic and terrestrial evaluations.

As recommended in DOE-STD-1153-2002, a site-specific screening was then done using estimates of average radionuclide concentrations derived from measurements in site-wide surface waters, sediments, and soils. Results are summarized in Table 3-4.

At the site-specific screening level, the sums of fractions for the aquatic and terrestrial evaluations were 0.33 and 0.45, respectively. The sum of fractions for each assessment was less than 1.0, indicating that applicable BCGs were met for both the aquatic and terrestrial evaluations.

Upper bounding doses associated with the aquatic system evaluation were 0.012 rad/day to an aquatic animal and 0.033 rad/day to a riparian animal, well below the guidance thresholds. Upper bounding doses associated with the terrestrial system evaluation were 0.0036 rad/day to a terrestrial plant and 0.045 rad/day to a terrestrial animal, again well below the guidance thresholds.

It was therefore concluded that populations of aquatic and terrestrial biota (both plants and animals) on the WNYNSC are not being exposed to doses in excess of the existing DOE dose standard for native aquatic animals (DOE, February 1990) and the international standards for terrestrial organisms (International Atomic Energy Agency [IAEA], 1992).

Summary

Tables 3-2, 3-3, and 3-4 summarize radiological dose and release information for CY 2015.

Predictive computer modeling of waterborne releases and measurements of radioactivity at near-site ambient air monitors resulted in estimated hypothetical doses to the maximally exposed individual that were orders of magnitude below all applicable EPA standards and DOE orders that place limitations on the release of radioactive materials and dose to individual members of the public.

TABLE 3-4
2015 Evaluation of Dose to Aquatic and Terrestrial Biota

AQUATIC SYSTEM EVALUATION							
Nuclide	***Water BCG [a] (pCi/L)***	***Mean Water Value (pCi/L)***	***Ratio***	***Sediment BCG [a] (pCi/g)***	***Mean Sediment Value (pCi/g)***	***Ratio***	***Water and Sediment Sum of Fractions***
Cesium-137	42.7	9.71	2.27E-01	3,130	5.49	1.76E-03	0.23
Strontium-90	279	22.7	8.13E-02	583	11.7	2.01E-02	0.10
All Others	NA	NA	4.40E-04	NA	NA	4.72E-04	0.00091
Sum of Fractions			3.09E-01			2.23E-02	**0.33**
Estimated upper bounding dose to an aquatic animal = **0.012 rad/day**; to a riparian animal = **0.033 rad/day**.							
TERRESTRIAL SYSTEM EVALUATION							
Nuclide	***Water BCG [a] (pCi/L)***	***Mean Water Value (pCi/L)***	***Ratio***	***Soil BCG [a] (pCi/g)***	***Mean Soil Value (pCi/g)***	***Ratio***	***Water and Soil Sum of Fractions***
Cesium-137	599,000	9.71	1.62E-05	20.8	4.57	2.20E-01	0.22
Strontium-90	54,500	22.7	4.16E-04	22.5	5.16	2.30E-01	0.23
All Others	NA	NA	2.19E-06	NA	NA	8.15E-04	0.00082
Sum of Fractions			4.34E-04			4.51E-01	**0.45**
Estimated upper bounding dose to a terrestrial plant = **0.0036 rad/day**; to a terrestrial animal = **0.045 rad/day**.							

NA - Not applicable
[a] The biota concentration guides (BCGs) are calculated values. Except for the sums of fractions and dose estimates, which are rounded to two signficant digits, all values are expressed to three signficant digits.

The collective population dose was also assessed and found to be orders of magnitude below the natural background radiation dose. Additionally, estimates indicated that populations of biota at the WVDP are exposed at a fraction of DOE and IAEA guidelines for dose to biota.

Based on the overall dose assessment, the WVDP was found to be in compliance with applicable effluent radiological guidelines and standards during CY 2015.

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CHAPTER 4
GROUNDWATER PROTECTION PROGRAM

Groundwater Monitoring Program (GMP)

The GMP at the WVDP has been designed to comply with all applicable state and federal regulations and to meet the requirements of DOE Order 458.1, "Radiation Protection of the Public and the Environment," (including Change 3, January 15, 2013) and the RCRA §3008(h) Administrative Order on Consent.

DOE Order 458.1, Section 4.i.2, states that "Groundwater must be protected from radiological contamination to ensure compliance with dose limits in the Order and consistent with ALARA process requirements. To this end, DOE must ensure that: baseline conditions of the groundwater quantity and quality are documented; possible sources of, and potential for, radiological contamination are identified and assessed; strategies to control radiological contamination are documented and implemented; monitoring methodologies are documented and implemented; and groundwater monitoring activities are integrated with other environmental monitoring activities." The "WVDP Groundwater Protection Management Program Plan" documents the Project's approach for groundwater protection from site activities.

Compliance with the Consent Order and the conclusions in the RFI reports require routine monitoring of certain analytes at specified groundwater monitoring locations. (See the "RCRA §3008(h) Administrative Order on Consent" and the "RFI" sections of the ECS.)

The primary objectives of the groundwater monitoring plan are to identify, delineate, and monitor groundwater migration pathways that could transport contaminants off site and to support mitigative actions. To accomplish these goals, the GMP describes a groundwater monitoring well network designed to monitor groundwater conditions in subsurface geologic units that represent potential routes of contaminant migration. For a description of these geologic units refer to "Geology and Hydrogeology" later in this chapter.

Groundwater Use and History. Site groundwater in shallow, unconsolidated geologic units is not used for drinking or operational purposes, nor is WVDP effluent discharged directly to groundwater. In 2014 the site installed two Health Department approved potable water supply wells into bedrock to depths greater than 100 feet beneath the ground surface. Chemical and radiological sampling of these wells was performed as part of the installation and development process. Sampling continues as part of ongoing system operation. These wells are upgradient of site facilities and areas of contamination. Drinking water quality samples are routinely collected with results provided to the Cattaraugus County Health Department.

The majority of site groundwater eventually flows to Cattaraugus Creek and then to Lake Erie. Surveys have determined that no community public water supplies are drawn from groundwater downgradient of the site or from Cattaraugus Creek downstream of the WVDP. However, upgradient of the site, groundwater is used as a public and private drinking water supply by local residents.

Highlights of the site groundwater monitoring history and the evolution of the GMP are summarized in Table 4-1. Groundwater monitoring to evaluate the performance of the full-scale PTW installed in November 2010 on the north plateau is discussed later in this chapter.

Geology and Hydrogeology

The WNYNSC is situated upon a layered sequence of glacial-age sediments that fill a steep-sided bedrock valley composed of interbedded shales and siltstones (Rickard, 1975). (See Figure 4-1.) Erdman Brook bisects the WVDP into the north and south plateaus. The MPPB, WTF, and lagoons are located on the north plateau. The drum cell, NDA, and SDA are located on the south plateau.

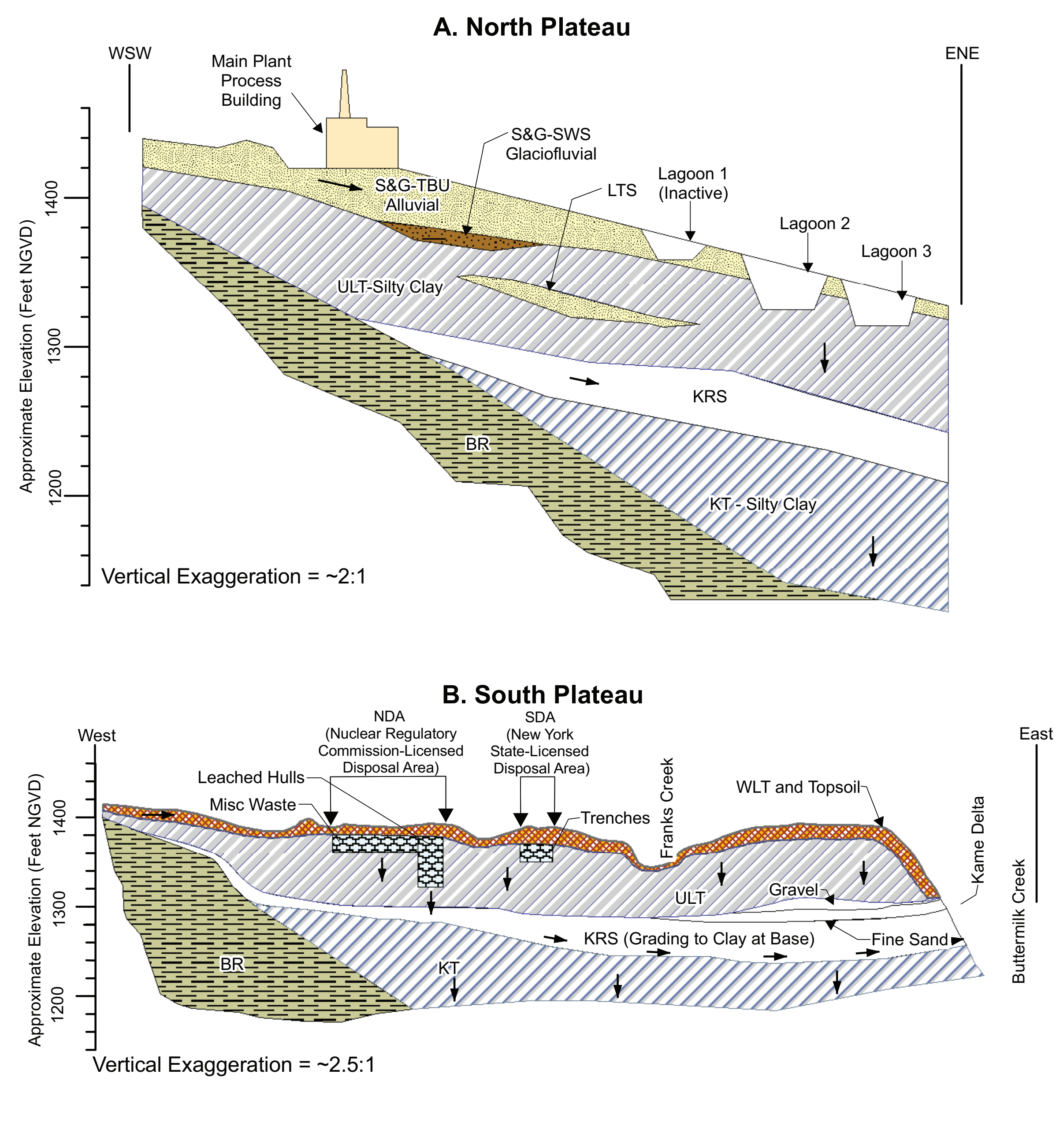
The glacial sediments overlying the bedrock consist of a sequence of three silt- and clay-rich glacial tills of Lavery, Kent, and possibly Olean age. The tills are separated by stratified fluvio-lacustrine deposits (silty or silty/sandy lakebed sediments). The glacial sediments above the Kent till include the Kent recessional sequence (KRS), the weathered Lavery till (WLT) and unweathered Lavery till (ULT), the intra-Lavery till-sand, and the alluvial sand and gravel (S&G) unit. The S&G unit and the WLT are generally regarded as the predominant routes for contaminant migration from the Project via groundwater.

TABLE 4-1
Highlights of Groundwater Monitoring History at the WVDP and the WNYNSC

Year	*Highlight*
1961–1980	From the time the WNYNSC was established in 1961, to passage of the WVDP Act in 1980, groundwater at the WVDP was periodically sampled by NFS, the New York State Geological Survey, and the United States Geological Survey during construction of the MPPB, for spill investigations, and for post-NFS research studies.
1982	Groundwater monitoring at the WVDP began in 1982 under DOE and the site subcontractor, WVNS.
1984	By 1984, 40 wells provided groundwater monitoring coverage near the MPPB and the NDA.
1986	Additional wells were installed to supplement the existing groundwater monitoring network.
1990–1991	Ninety-six wells were installed upgradient and downgradient of the WVDP SWMUs for DOE and RCRA monitoring programs. (The total included wells at the SDA area).
1992	The RCRA §3008(h) Order on Consent was signed.
1993	Elevated gross beta activity was discovered in groundwater from the sand and gravel (S&G) unit on the north plateau. Subsequent investigation delineated a plume of strontium-90-contaminated groundwater originating beneath the MPPB, extending northeast.
1993–1994	An RFI expanded characterization program was conducted to assess potential releases of hazardous constituents from on-site SWMUs. Results from the RFI influenced decisionmaking for the GMP.
1994	A Geoprobe® investigation of groundwater and soil beneath and downgradient of the MPPB was performed to characterize the elevated gross beta activity in the S&G unit. The presumed source was found to be near the southwest corner of the MPPB. The primary isotopes responsible for the beta activity were strontium-90 and its daughter product yttrium-90.
1995	The GMP was evaluated and analytical constituents were tailored to each sampling point for a more focused and cost effective program. The North Plateau Groundwater Recovery System (NPGRS) was installed near the leading edge of the main lobe of the strontium-90 plume to minimize migration, which consisted of three extraction wells to recover groundwater for treatment by ion exchange.
1996	Several groundwater seeps on the northeast edge of the north plateau were added to the monitoring program.
1997	A Geoprobe® soil and groundwater sampling program was conducted to delineate the leading edge of the strontium-90 plume.
1998	In response to recommendations from a 1997 external review of WVDP actions regarding the north plateau, another Geoprobe® soil and groundwater sampling program was carried out to further characterize the core area of the plume. The new radiological data were compared to the 1994 data.
1999	A pilot-scale PTW was installed in the eastern lobe of the plume to test this passive in-situ remediation technology. Well points were installed near the pilot-scale PTW.
2000–2001	Additional wells and well points were installed across the leading edge of the strontium-90 plume to monitor the plume's movement and assess the effectiveness of the pilot PTW.
2003	Four new wells were installed to monitor groundwater upgradient and downgradient of the newly constructed RHWF.
2005	Number of analytes or sampling frequencies were reduced at 14 groundwater monitoring wells.
2007	The GMP was evaluated, considering current site conditions, activities, and environmental exposure pathways. The analytes and sampling frequencies at 20 monitoring points were reduced and sampling at four wells was discontinued. Off-site drinking water sampling was also discontinued after an evaluation of historical data had confirmed that site operations had no impact on off-site downgradient groundwater.
2008	Two replacement wells, and 21 piezometers, were installed near the NDA during installation of a slurry wall and geomembrane cover at the NDA. On the north plateau, three subsurface investigations were performed upgradient, within, and downgradient of the strontium-90 plume.
2010	An approximately 860-ft-long full-scale PTW was installed along the leading edges of the strontium-90 plume. Sixty-six groundwater monitoring wells were installed upgradient, downgradient, and within the PTW to monitor wall performance. Four new wells were installed downgradient of the MPPB to supplement the strontium-90 source area monitoring.
2011-2015	Groundwater monitoring continued from CY 2011 through 2015 per the GMP, the "North Plateau Groundwater Monitoring Plan," and the "North Plateau PTW Performance Monitoring Plan." There were no changes to the monitoring programs, no new groundwater monitoring wells were installed, and no active monitoring wells were decommissioned from 2011 through 2015.

FIGURE 4-1
Geologic Cross Sections of the North and South Plateaus at the WVDP

J:/GIS/ArcMap/ASER/ASER_2010/ASER_2010_Fig4-1_20110602.mxd FJC/skw



Legend

S&G-TBU	Sand and Gravel - Thick-Bedded Unit	KT	Kent Till
S&G-SWS	Sand and Gravel - Slackwater Sequence	BR	Shale Bedrock
LTS	Lavery Till Sand	⟶	Conceptual Groundwater Flow Direction
WLT	Weathered Lavery Till	ENE	East-Northeast
ULT	Unweathered Lavery Till	WSW	West-Southwest
KRS	Kent Recessional Sequence	*(NGVD - National Geodetic Vertical Datum)*	

The S&G unit consists of two subunits: the thick-bedded unit (TBU) and the slackwater sequence (SWS). It only exists on the Project's north plateau. The ULT and Kent till have relatively low permeability, and groundwater from the S&G and WLT must flow through the ULT to reach the KRS. Therefore, the ULT, Kent till, and KRS do not provide predominant pathways for contaminant movement from the WVDP and are not discussed here. See Figure 4-1 and Table 4-2 for the geographic distribution and additional description of these units.

Routine Groundwater Monitoring

Groundwater Monitoring Network. The WVDP groundwater monitoring network is a vital component of the environmental monitoring performed to meet the requirements of DOE Order 458.1. Groundwater is routinely monitored across the north and south plateaus and in the six geologic units described in Table 4-2. In CY 2015, groundwater samples were collected from 69 on-site, routine groundwater monitoring locations, including 63 monitoring wells and well points, five groundwater seepage points, and one trench sump. (See Figures A-9 and A-10 in Appendix A.) Many of the wells monitor one or more of the SWMUs or SSWMUs per the Consent Order. Table 4-3 lists the monitoring locations in the routine groundwater monitoring network, the geologic units monitored, and the analytes measured in CY 2015. Table 4-4 identifies the analytical parameters defined in each analyte group.

The monitoring frequency and the constituents analyzed under the groundwater monitoring plan are a function of regulatory requirements, historical site activities, current operating practices, and ongoing groundwater data evaluations. Tables 4-5 and 4-6 provide an overview of groundwater monitoring performed during CY 2015, organized by geographic area and monitoring purpose.

Supplemental groundwater monitoring is also performed for evaluation of the PTW and the north plateau strontium-90 groundwater plume discussed later in this chapter.

Groundwater Elevation Monitoring. Groundwater elevations are measured at the monitoring network wells in conjunction with the quarterly analytical sampling. (See Figures A-9 and A-10 in Appendix A.) These data are used to produce maps depicting groundwater flow directions and gradients. Long-term trend graphs are used to illustrate variations in groundwater elevations over time, including seasonal fluctuations or changes resulting from installing water diversions, such as geomembrane covers, trenches, or slurry walls, and groundwater treatment systems (e.g., the North Plateau Groundwater Recovery System [NPGRS] and the full-scale PTW).

Groundwater elevation mapping of the WLT on the south plateau helps evaluate the effectiveness of the NDA interceptor trench, the slurry wall, and geomembrane cover. (See "Groundwater Sampling Observations on the South Plateau including the NRC-Licensed Disposal Area [NDA]".)

Groundwater Trigger Level Evaluation. A computerized data-screening program uses "trigger levels," preset conservative values for chemical and radiological concentrations and groundwater elevation measurements, to promptly identify anomalies in monitoring results that may require further investigation. The trigger levels are statistically derived from historical results, are based on regulatory criteria, or are based on analytical detection limits.

Trigger level exceptions, defined as measurements above an upper trigger level or below a lower trigger level, may be the result of normal seasonal fluctuations, laboratory analytical problems, or changes in groundwater quality. Response actions are identified for each analytical result exceeding a trigger level. After each sampling event, the current trigger level exceptions are compiled, evaluated, and summarized with recommended response actions. RCRA trigger level exceptions are reported to NYSDEC.

Groundwater trigger levels for selected chemical and radiological constituents were recalculated in September 2015, incorporating data collected through June 2015. Trigger levels in areas that have seen a process change were calculated only on data that was collected after the change occurred. There were no process changes in 2015. A process change may affect the analytical results collected from a monitoring location by altering the underlying physical conditions that are monitored at that sampling point. The upgradient NDA slurry wall and geomembrane cover installed in 2008 is an example of a process change that significantly altered the hydrogeologic conditions at monitoring points located on and downgradient of the NDA. The geomembrane cover and slurry wall have decreased water infiltration and migration into the NDA, which changes water levels in and downgradient of the NDA.

Groundwater Screening Levels (GSLs). In 2009, GSLs were developed during the CMS preparations as a tool to identify the presence of chemical and radiological constituents in groundwater above levels of concern

TABLE 4-2
Summary of Hydrogeology at the WVDP

Geologic Unit	*Description*	*Groundwater Flow Characteristics*	*Hydraulic Conductivity* [a]	*Location*
S&G; Thick-Bedded Unit (TBU)	Silty sand and gravel layer composed of younger Holocene alluvial deposits	Flow is generally northeast across the plateau toward Franks Creek, with groundwater near the northwestern and southeastern margins flowing radially outward toward Quarry Creek and Erdman Brook.	9 ft/day (3.2E-03 centimeters [cm]/second [sec])	Surficial unit on the north plateau
S&G; Slackwater Sequence (SWS)	Interbedded silty sand and gravel layers composed of Pleistocene-age glaciofluvial deposits partially separated from the S&G-TBU by a discontinuous silty clay interval	Flow is to the northeast along gravel layers toward Franks Creek.	17 ft/day (5.9E-03 cm/sec)	Underlies a portion of the north plateau
Weathered Lavery Till (WLT)	Upper zone of the Lavery till which has been exposed at the ground surface; weathered and fractured to a depth of 3–16 ft (0.9–4.9 m); brown in color due to oxidation; contains numerous desiccation cracks and root tubes	Flow has both horizontal and vertical components allowing groundwater to move laterally across the south plateau before moving downward into the unweathered lavery till or discharging to nearby incised stream channels.	0.07 ft/day (2.4E-05 cm/sec); the highest conductivities are associated with dense fracture zones found within the upper 7 ft (2 m) of the unit	Surficial unit on the south plateau
Unweathered Lavery Till (ULT)	Olive gray silty clay with intermittent lenses of silt and sand; ranges up to 130 ft (40 m) in thickness	Flow is vertically downward at a relatively slow rate; unit is considered an aquitard.	0.002 ft/day (8.1E-07 cm/sec)	Underlies both the north and south plateaus
Lavery Till Sand (LTS)	Thin, sandy unit of limited areal extent and variable thickness within the Lavery till	Flow is to the east-southeast toward Erdman Brook.	0.2 ft/day (8.6E-05 cm/sec)	Primarily beneath the southeastern portion of the north plateau
Kent Recessional Sequence (KRS)	Interbedded clay and silty clay layers locally overlain by coarser-grained sands and gravels; pinches out near the east side of Rock Springs Road	Flow is to the northeast; recharge from the overlying till and from bedrock to the southwest; discharges into Buttermilk Creek.	0.01 ft/day (4.3E-06 cm/sec)	Underlies most of the Project, except areas adjacent to Rock Springs Road

Note: Hydrologic conditions of the site are more fully described in "Environmental Information Document, Volume III: Hydrology, Part 4" (West Valley Nuclear Services Co. [WVNSCO], March 1996) and in the "RCRA Facility Investigation Report (RFI) Vol. 1: Introduction and General Site Overview" (WVNSCO and Dames & Moore, July 1997).

[a] Hydraulic conductivities represent an average of historical testing results.

TABLE 4-3
WVDP Groundwater Monitoring Network Sorted by Geologic Unit

Well ID	SSWMU	Gradient Position	Analyte Group (See Table 4-4)	Well ID	SSWMU	Gradient Position	Analyte Group (See Table 4-4)
Sand and Gravel Wells							
103[a]	1, 3	D	I, RI, V	803[a]	8	D	I, RI, SV, V
104	1	C	I, RI	804[a]	8	D	I, RI, V
105	1	C	I, RI	1302[b]	NA	U	I, RI, M,
106	1	D	I, RI	1304[b]	NA	D	I, RI, M, R
111[a]	1	D	I, RI, M, SV, V	8603	8	U	I, RI
116[a]	1, 8	C, U	I, RI, V	8604	1	C	I, RI
205	2	D	I, RI	8605[a]	1, 2	D	I, RI, M, SV, V
301[a]	3	B, U	I, RI	8607[a]	4, 6	D, U	I, RI, V
302	3	U	I, RI	8609[a]	3, 4, 6	D, D, U	I, RI, S, V
401[a]	3, 4	B, U	I, RI, R	8612[a]	8	D	I, RI, SV, V
402	4	U	I, RI	MP-01[a]	3	D	I, RI, M, R-MP, SV, V, T
403	4	U	I, RI	MP-02[a]	3	D	I, RI, M, R-MP, SV, V, T
406[a]	4, 6	D, U	I, RI, R, V	MP-03[a]	3	D	I, RI, M, R-MP, SV, V, T
408[a]	3, 4	D	I, RI, R, V	MP-04[a]	3	D	I, RI, M, R-MP, SV, V, T
501[a]	5	U	I, RI, S, V	WP-A[c]	NA	NA	I, RI
502[a]	5	D	I, RI, S, SM, V	WP-C[c]	NA	NA	I, RI
602A	6	D	I, RI	WP-H[c]	NA	NA	I, RI
604	6	D	I, RI	SP04[d]	NA	NA	RI
605	6	D	I, RI	SP06[d]	NA	NA	RI
706[a]	7	B, D	I, RI, M	SP11[d]	NA	NA	RI
801[a]	6, 8	D, U	I, RI, S, V	SP12[a,d]	8	D	I, RI, V
802	8	D	I, RI, V	GSEEP[a,d]	8	C, D	I, RI, V
Lavery Till Sand Wells							
204[a]	2, 3	D	I, RI	206	2	C	I, RI
Weathered Lavery Till Wells							
906[a]	9	D	I, RI	1005[a]	9, 10	C, U	I, RI
908R[a]	9	U	I, RI	1006[a]	9, 10	C, D	I, RI
909[a]	9	D	I, RI, M, R, SV, V	1008C[a]	9, 10	B, U	I, RI
NDATR[a]	9	D	I, RI, M, R, SV, V				
Unweathered Lavery Till Wells							
107	1	D	I, RI	704	7	D	I, RI
108	1	D	I, RI	707	7	C	I, RI
110[a]	1	D	I, RI, V	910R[a]	9	D	I, RI
405	4	D	I, RI, M	1301[b]	NA	U	I, RI
409	4	D	I, RI	1303[b]	NA	D	I, RI, M
Kent Recessional Sequence Wells							
901[a]	9	U	I, RI	1008B	10	B, U	I, RI
902[a]	9	U	I, RI	8610[a]	9	D	I, RI
903[a]	9	D	I, RI	8611[a]	9	D	I, RI

Gradient Positions: B (background); C (crossgradient); D (downgradient); U (upgradient)

[a] Monitoring for certain parameters is required by the RCRA §3008(h) Consent Order.
[b] Monitor upgradient and downgradient of the RHWF.
[c] Monitor north and east of the MPPB.
[d] Monitor groundwater emanating from seeps along the edge of the north plateau.

TABLE 4-4
WVDP Groundwater Sampling and Analysis Agenda

Analyte Group	*Description of Parameters*
Indicator Parameters (I)	pH, specific conductance (field measurements)
Radiological Indicator Parameters (RI)	Gross alpha, gross beta, tritium
Volatile Organic Compounds (V)	6 NYCRR Part 373-2 Appendix 33 Volatile Organic Compounds
Semivolatile Organic Compounds (SV)	6 NYCRR Part 373-2 Appendix 33 Semivolatile Organic Compounds and tributyl phosphate
Groundwater Metals (M)	6 NYCRR Part 373-2 Appendix 33 Metals (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, silver, thallium, tin, vanadium, zinc)
Special Monitoring Parameters for early warning wells (SM)[a]	Aluminum, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, silver, vanadium, zinc
Radioisotopic Analyses: alpha-, beta-, and gamma-emitters (R)	Carbon-14, strontium-90, technetium-99, iodine-129, cesium-137, radium-226, radium-228, uranium-232, uranium-233/234, uranium-235/236, uranium-238, total uranium
Radioisotopic Analyses MPPB Area (R-MP)	Carbon-14, potassium-40, cobalt-60, strontium-90, technetium-99, iodine-129, cesium-137, europium-154, neptunium-237, plutonium-238, plutonium-239/240, plutonium-241, uranium-232, uranium-233/234, uranium-235/236, uranium-238, americium-241, curium-243/244
Strontium-90 (S)	Strontium-90
Turbidity (T)	Turbidity

[a] Sampling for these parameters was conducted at well 502 to monitor upgradient of the NPGRS. The NPGRS is no longer operating. This sampling was therefore discontinued during the second half of 2015.

TABLE 4-5
2015 Groundwater Monitoring Overview by Geographic Area[a]

Number of…	*Total*	*North Plateau*	*South Plateau*
Monitoring Points Sampled - Analytical	69	55	14
Monitoring Events	4	4	4
Individual Analytical Results	7,293	6,131	1,162
Percent of results below detection limits	84%	83%	86%

[a] Does not include PTW monitoring.

TABLE 4-6
2015 Groundwater Monitoring Overview by Monitoring Purpose[a]

Number of…	*Total*	*Regulatory/Waste Management*	*Environmental Surveillance*
Monitoring Points Sampled - Analytical	69	38	31
Monitoring Events	4	4	4
Individual Analytical Results	7,293	6,268	1,025
Percent of results below detection limits	84%	89%	58%

[a] Does not include PTW monitoring.

(e.g., regulatory limits, guidance limits, or background). Methods used to develop the GSLs are discussed in detail in Appendix D. Table 4-8 shows groundwater sampling results for 2015 compared with applicable GSLs and background levels.

North Plateau Strontium-90 Plume

Elevated gross beta has been observed in groundwater from the S&G unit, the shallowest geologic unit on the north plateau, since 1993. (See the highlights for 1993 and for 1994 in Table 4-1.) The routine groundwater monitoring plan network for the S&G unit on the north plateau includes 36 monitoring wells, three well points, and five groundwater seepage locations that delineate this gross beta contamination.

In April 2011, DOE issued a new technical standard (DOE-STD-1196-2011) that established a revised set of Derived Concentration Standards (DCSs) for radiological environmental protection programs at DOE facilities and sites. These DCSs were used to evaluate groundwater data collected in 2015. Because there is no DCS for gross beta in liquid effluents, the strontium-90 DCS (1.1E-06 µCi/mL) is used as a conservative basis for comparison where beta-emitting radionuclides are detected in groundwater. Historical monitoring has established that strontium-90 is the most predominant beta emitter found in site groundwater. The strontium-90 concentrations would be expected to be about one-half of the gross beta result because the beta includes strontium-90 and its daughter product, yttrium-90. Therefore, monitoring wells are routinely sampled for gross beta concentrations, supported by periodic sample measurement at select wells for strontium-90 analysis. For the purpose of the following discussions, the strontium-90 DCS is used for comparison with both gross beta and strontium-90. (See the “Useful Information” section for a discussion of DOE DCSs, and Table UI-4 for a list of the DCSs for radionuclides of interest at the WVDP.)

Figure 4-2 shows the extent of the strontium-90 plume in the S&G unit as defined by the 1.0E-06 µCi/mL gross beta isopleth, at three time intervals spanning 21 years (1994, 2005, and 2015). As shown, the plume’s western boundary has remained relatively constant since 1994, but the plume’s northern and eastern extents have spread to the northeast and east. The leading edge has divided into three small lobes because of the variable groundwater flow rate across the north plateau due to the heterogeneous nature of the sediments within the S&G unit. The uneven distribution of coarse and fine soils within the S&G unit creates preferential pathways for groundwater flow. The GMP wells that monitor the plume and the measured gross beta concentrations are shown on the figure. Figure 4-2 shows that for 2015 the 1.0E-06 µCi/mL gross beta isopleth in the eastern lobe does not extend beyond the PTW.

Gross beta concentration trends over the last 10 years at monitoring wells located within the plume and near former lagoon 1 are shown on Figures 4-3 through 4-7 and 4-10. These data are plotted on a log scale; therefore, an increase from one gridline to the next represents a 10-fold increase in concentration. The log scale was used so that data from background locations (with concentrations in the 1.0E-09 µCi/mL range) and data from the central plume (with concentrations in the 1.0E-04 µCi/mL range, 100,000 times higher than background) could be plotted on the same graphs.

Figure 4-3 illustrates the gross beta concentrations in groundwater wells located immediately downgradient of the MPPB, the strontium-90 source area, and along the western edge of the plume (at well 8609). Well 408 and the four MPPB wells (MP-01, -02, -03, and -04, installed in CY 2010), located northeast of the MPPB closest to the source area, exhibit the highest gross beta concentrations (up to 5.23E-04 µCi/mL in June 2015, shown in Appendix D-2) of any routinely monitored wells in the GMP. The 2015 gross beta concentrations at these wells remained relatively stable throughout the year.

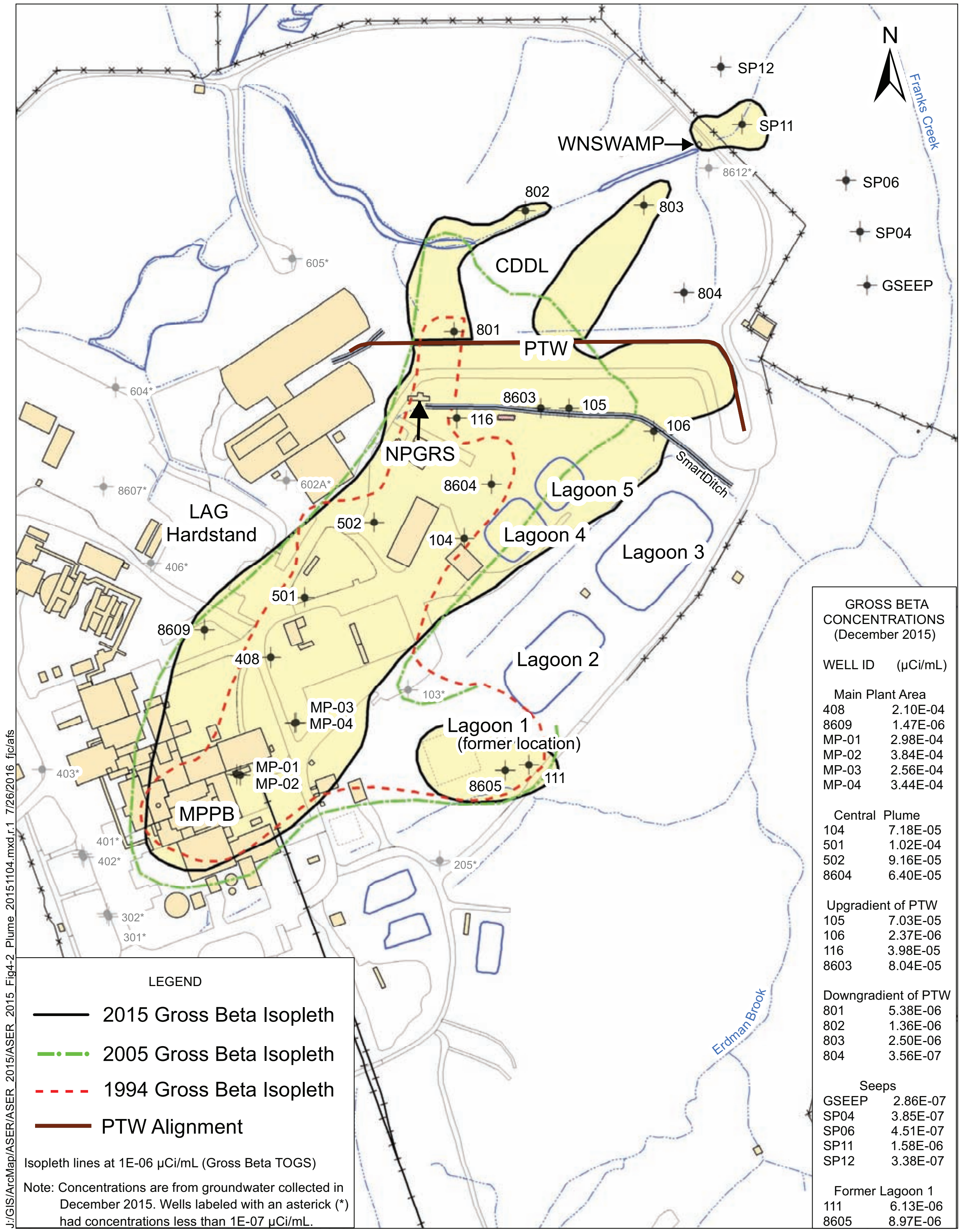
Figure 4-4 illustrates gross beta concentrations in wells 104, 501, 502, and 8604 centrally located within the plume area. Concentration ranges in these wells were also generally similar in 2015 as compared with 2014.

Figure 4-5 illustrates gross beta concentrations at monitoring wells 105, 116, and 8603, upgradient of the PTW. The gross beta concentration at well 116 shows a slowly increasing trend.

Figure 4-6 illustrates gross beta concentrations at monitoring wells 801, 803, 804, and 8612, downgradient of the PTW. The plume’s leading edge had migrated past the PTW before it was installed in 2010 as indicated by gross beta levels observed in downgradient wells prior to PTW installation in November 2010. Concentrations in these wells changed by relatively small amounts in 2015. Continued monitoring will determine whether gross beta concentrations decrease over time as more treated groundwater migrates out of the PTW.

Monitoring at North Plateau Seeps. Groundwater is also monitored along the northeast edge of the north plateau,

FIGURE 4-2
North Plateau Plume in the S&G Unit



where it seeps from the steep banks incised by Erdman Brook and Franks Creek. The downgradient seepage locations (GSEEP, SP04, SP06, SP11, and SP12), located east of the CDDL outside of the WVDP fence line, monitor conditions on the edge of the north plateau where groundwater discharges to the surface. (See Figure 4-2.) Gross beta concentrations began increasing at the seeps several years before the PTW was installed as shown by the ten-year trend graphs of gross beta concentrations at these five seep monitoring points (Figure 4-7). The strontium-90 concentrations in the north plateau plume have been demonstrated to be approximately half of the gross beta concentrations, suggesting the DOE DCSs have not been exceeded at any of the seep locations.

Annual average gross beta concentrations at the seeps were plotted against surface water background values because water from seepage points occasionally may include surface water (i.e., at seepage location SP11). Annual average concentrations at seep locations SP06, SP11, and SP12 increased slightly during 2015 as the leading edge of the plume continues to migrate downgradient. The strontium-90 in the groundwater migrates more slowly than the groundwater itself. The strontium-90 adsorbs to the subsurface soils and slowly desorbs back into the groundwater due to chemical processes. The 2015 gross beta concentrations at the two southernmost seeps, seeps SP04 and GSEEP, decreased compared with 2014, potentially due to PTW treated groundwater reaching this area.

Monitoring at the Northeast Swamp Drainage. The western and central lobes of the plume downgradient of the PTW are partially intercepted by the northeast swamp drainage ditch flowing west to east across the plume's leading edge. (See Figure 4-2 and Figure A-2 in Appendix A.) Totalized flow through the drainage ditch is recorded biweekly. Surface water samples are collected biweekly and analyzed for radiological constituents at sampling location WNSWAMP located at the WVDP project boundary. North plateau plume groundwater seeping into this ditch is believed to be the main source of the strontium-90 activity at WNSWAMP. Approximately 21.1 million gal (79.9 million L) of water flowed through this monitoring point in 2015. (See "Waterborne Effluent Monitoring" in Chapter 2.)

Gross beta and strontium-90 concentrations at WNSWAMP exhibit seasonal variability. As shown on Figure 4-8, annual average strontium-90 concentrations at WNSWAMP have been above the strontium-90 DCS for each of the last 10 years. The 2015 annual average strontium-90 concentration shown on Figure 4-8 is a non-flow-weighted average, and therefore differs slightly from the flow-weighted average shown in Table 2-2. The non-flow-weighted average shown on Figure 4-8 and the flow weighted annual average shown on Figure 2-1 both decreased slightly in 2015 as compared to 2014. Both averages remain below the annual averages from 2007 to 2010 prior to installation of the PTW. The strontium-90 released through WNSWAMP accounted for an annual estimated dose of 1.6E-02 mrem in 2015. (See "Maximum Dose [Waterborne] to an Off-Site Individual" in Chapter 3.)

Monitoring of surface water downstream of the WVDP at the first point of public access, Felton Bridge on Cattaraugus Creek (location WFFELBR), continued to show that strontium-90 concentrations in 2015 were similar to historical concentrations from the Cattaraugus Creek background surface water location at Bigelow Bridge (WFBIGBR). The 2015 annual average concentration at WFFELBR was a non-detect.

Strontium-90 Plume Remediation Activities

Full-Scale Permeable Treatment Wall (PTW). In November 2010, an 860-ft-long full-scale PTW was installed to treat the north plateau strontium-90 plume. The PTW has operated now for over five full years. The overall average concentrations of strontium-90 immediately downgradient of the PTW are lower than they were when the wall was installed indicating that the PTW is removing strontium-90 from the groundwater. A map view and cross-section of the PTW installation is shown on Figure 4-9.

The PTW was installed through the entire thickness of the S&G unit (including the TBU and the SWS, where present), and was keyed into the underlying, low-permeability ULT. Granular clinoptilolite (i.e., zeolite), a natural mineral with a porous structure that traps positively charged ions by ion exchange, including strontium, while allowing the groundwater to pass through, was used as the treatment media in the PTW. A lined storm water drainage ditch (Smart-Ditch™) was also installed in September 2010 south of the PTW to intercept storm water from upland site areas and route it around the PTW to Franks Creek.

The PTW was selected and designed to address three remedial action objectives (RAOs):

- RAO 1: Reduce or eliminate strontium-90 presence in groundwater seepage leaving or potentially exiting the north plateau to ALARA, with a goal to be less than the Derived Concentration Guide (DCG) of 1.0E-06 µCi/mL (the RAOs for the PTW were determined before the DCGs, found in superceded DOE Order 5400.1, were replaced by the DCSs);

- RAO 2: Minimize the future expansion of the strontium-90 plume beyond its current mapped limits; and

- RAO 3: Ensure that a technology selected for current containment of the strontium-90 plume does not preclude any strategies for addressing the plume during site decommissioning.

The PTW placement was chosen to not transect the CDDL and to limit the expansion of groundwater impacted by strontium-90 at or above the 1.0E-05 µCi/mL level, and consequently, by design, did not capture the plume's leading edge as it existed in November 2010. Strontium-90 concentrations that existed downgradient of the PTW prior to the PTW's installation were expected to increase for a period of time, and then eventually decrease when groundwater treated by the PTW begins to reach these downgradient areas. Recent north plateau monitoring shows evidence of treated groundwater exiting the PTW downgradient of the wall.

Removal of the MPPB and excavating subsurface soils in the plume source area are components of DOE's ROD for decommissioning and/or long-term stewardship of the WVDP and the WNYNSC. Long-term strategies for management of the non-source area of the plume, including the PTW, will be evaluated as part of the Phase 2 decision-making process for the WVDP and the WNYNSC.

PTW Performance Monitoring Plan (PTWPMP). The PTWPMP was developed and implemented immediately following the PTW installation. This plan describes the performance monitoring requirements for the PTW. Quarterly sampling and monthly inspections were performed throughout 2015. Collected data was evaluated consistent with the PTWPMP.

Performance monitoring data collected to date continue to indicate:

- groundwater flow patterns in the PTW area are similar to flow patterns observed prior to PTW construction, indicating that the PTW installation does not substantially alter groundwater flow conditions on the north plateau;

- groundwater treatment by ion exchange is occurring as evidenced by the fact that strontium-90 activity in groundwater inside the PTW typically is either not detected or substantially lower overall than strontium-90 activity levels upgradient of the PTW;

- geochemical differences observed in groundwater that has migrated into or through the zeolite also indicate that ion exchange (i.e., treatment) is occurring;

- the most elevated concentrations of strontium-90 observed inside the PTW occur within relatively narrow zones which are located where plume migration upgradient of the PTW follows preferential groundwater flow paths, such as preferential migration through the SWS;

- strontium-90 activity in groundwater immediately downgradient of the PTW has decreased overall; and

- strontium-90 activity that had already migrated past the PTW prior to its installation is continuing to migrate downgradient. However, strontium-90 concentrations are decreasing in some wells further downgradient of the PTW and are expected to continue to decrease over time as groundwater treated by the PTW flows towards these areas.

During 2015, there were no detected strontium-90 concentrations greater than 1.0E-05 µCi/mL (10,000 pCi/L) downgradient of the PTW and no detected strontium-90 concentrations above 1.0E-06 µCi/mL (1,000 pCi/L) in the downgradient eastern lobe of the strontium-90 plume.

These observations indicate the ongoing processes within the PTW continue to achieve the RAOs defined in the PTWPMP and shown in the previous section.

North Plateau Groundwater Monitoring Plan (NPGMP). A supplementary NPGMP was also developed in 2010, in conjunction with completing the full-scale PTW. The primary objective of the NPGMP is to monitor the strontium-90 plume migration in groundwater farther upgradient and downgradient of the PTW than the areas monitored under the PTWPMP. This monitoring program, which includes quarterly gross beta sampling at 26 well locations and water level measurements at 40 well locations, was performed concurrent with the PTWPMP throughout 2015. Data from these wells supports the development of groundwater elevation contours and gross beta isopleths.

PTW Protection and Best Management Plan. The north plateau PTW protection and best management plan describes best management practices implemented to increase the effectiveness and longevity of the PTW. The practices include elimination of road-salt use near the PTW (because the ions will compete with the strontium-90 or removal in the PTW), storm water management via the upgradient Smart-Ditch™, and monthly inspections.

North Plateau Groundwater Recovery System (NPGRS). In 1995, the NPGRS was installed to slow the advance of the strontium-90 plume. (See Figure 4-2.) The NPGRS consists of three wells used to extract contaminated groundwater. Extracted groundwater was transferred to the LLW2 for treatment by ion exchange to remove strontium-90. The treated groundwater was ultimately discharged through the lagoon system to Erdman Brook via the SPDES-permitted outfall 001.

Based on groundwater plume mitigation provided by the PTW, the NPGRS was shut down in April 2013. Closure of the NPGRS will be performed in accordance with SPDES closure requirements.

Pilot-Scale PTW. A pilot-scale PTW was constructed in 1999 with a clinoptilolite selected for its ability to adsorb strontium-90 ions from groundwater. The data collected during the testing of the pilot PTW helped determine that the PTW technology was an effective remediation method for strontium-90-contaminated groundwater. Three wells within the pilot-scale PTW were monitored in 2015 under the NPGMP to support delineation of flow and transport of the plume across the north plateau.

Other Groundwater Sampling Observations on the North Plateau

Monitoring Near Former Lagoon 1. Southeast of the strontium-90 plume, elevated gross beta concentrations are documented in groundwater downgradient of former lagoon 1, which was backfilled in 1984. (See Figure 4-2.) Gross beta concentrations in wells 8605 and 111 are consistently above the strontium-90 DCS and are remaining stable from year to year, as shown in the 10-year trend graph on Figure 4-10. The gross beta activity source is assumed to be the radiologically contaminated material used as backfill and the residual sediment within former lagoon 1.

Tritium in North Plateau Groundwater. On the north plateau, elevated tritium concentrations have historically been observed downgradient of the MPPB, near the LAG storage hardstand, and adjacent to and downgradient of the lagoon system. Tritium concentrations sitewide have been consistently decreasing. Tritium has a relatively short half-life (about 12.3 years) and dilution from surface water infiltration and groundwater recharge contributes to the decrease. Residual tritium activity is due to former nuclear fuel reprocessing operations. As shown in Table 4-7, the maximum tritium concentration measured in groundwater from the north plateau in 2015, 2.31E-05 µCi/mL, occurred at well point WP-C, downgradient of the MPPB. (See Figure A-9 for the well point location.) This concentration was approximately two orders of magnitude below the DCS for tritium of 1.9E-03 µCi/mL.

Radioisotopic Sampling Results on the North Plateau. In addition to being analyzed for gross alpha, gross beta, tritium, and strontium-90, samples from eight groundwater wells in the north plateau S&G unit (401, 406, 408, 1304, and MP-01 through MP-04) were analyzed for specific radionuclides. (See Tables 4-3 and 4-4.) The maximum radionuclide concentrations measured at either the north or south plateau during 2015 are presented in Table 4-7.

The MPPB wells (MP-01, -02, -03, and -04) are analyzed for the following additional radioisotopes to investigate their presence as a result of former MPPB operations: neptunium-237, plutonium-238, plutonium-239/240, plutonium-241, americium-241, and curium-243/244. Well MP-02 yielded a very low, estimated concentration of neptunium-237 (1.7E-10 µCi/mL), and a very low, estimated concentration of americium-241 (2.98E-11 µCi/mL) was observed in well MP-04 in CY 2015. (See Appendix D-2, Table D-2H.) Both results are only marginally above their detection limits.

Results for Volatile and Semivolatile Organic Compounds (VOCs and SVOCs). Per the 3008(h) Consent Order, select wells within the S&G unit are monitored for VOCs and SVOCs because concentrations of these compounds exceeding NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Class GA Groundwater Quality Standards were detected in some groundwater samples collected during the RFI.

The only S&G unit monitoring location with previously consistent positive VOC detections was well 8612, located northeast and downgradient of the CDDL at the northeast edge of the north plateau. Figure 4-11 illustrates the concentration ranges of four VOCs historically detected at well 8612. No VOCs were detected during 2015. The VOCs previously detected in well 8612 are presumed to be from wastes buried in the CDDL.

TABLE 4-7
2015 Maximum Concentrations of Radionuclides[a] in Groundwater at the WVDP
Compared With WVDP Groundwater Screening Levels[b] (GSLs)

Radionuclide	Regulatory Compliance			Environmental Surveillance			GSL (µCi/mL)
	Well ID With Maximum Concentration	Flag[c]	Maximum Concentration (µCi/mL)	Well ID With Maximum Concentration	Flag[c]	Maximum Concentration (µCi/mL)	
Tritium	909		**8.79E-07**	WP-C		**2.31E-05**	1.78E-07
Strontium-90	MP-02		**1.48E-04**	–			5.90E-09
Technetium-99	MP-02		**4.08E-08**	–			5.02E-09
Iodine-129	NDATR		**1.53E-08**	–			9.61E-10
Radium-226[d]	408		7.23E-10	1304		3.98E-10	1.33E-09
Radium-228[d]	909	J	8.54E-10	–			2.16E-09
Uranium-233/234[d]	NDATR		**1.38E-09**	1304		2.87E-10	6.24E-10
Uranium-235/236	MP-02	J	**2.36E-10**	1304	J	7.80E-11	8.07E-11
Neptunium-237	MP-02	J	1.73E-10	–			NE
Uranium-238[d]	NDATR		**1.02E-09**	1304		2.04E-10	4.97E-10
Americium-241	MP-04	J	2.98E-11	–			NE
Total Uranium[d] (µg/mL)	NDATR		**3.60E-03**	1304		4.17E-04	1.34E-03

Note: Bolding indicates that the radionuclide exceeds the GSL.
NE - GSL for this radionuclide not established.
- indicates that none of the regulatory or environmental surveillance wells exhibited positive results for these radionuclides.
[a] The table presents the maximum concentrations of radioculides that were positively identified in groundwater wells at the WVDP, all other radionuclides were not positively identified, or were not analyzed.
[b] GSLs for radiological constituents are set equal to the larger of the background concentrations or NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Class GA Groundwater Quality Standards (see Table D-1A).
[c] The "J" flag indicates the result is an estimated value.
[d] Radium-226, radium-228, uranium-233/234, uranium-238 and total uranium occur naturally in the environment.

TBP, an SVOC, has been continually detected in groundwater from well 8605, downgradient of former lagoon 1 since monitoring at this location began. A TOGS 1.1.1 water quality standard has not been established for TBP. The maximum concentration measured in 2015 (136 µg/L) was significantly lower than the historic high of 700 µg/L measured in December 1996. Overall concentrations of TBP at well 8605 are decreasing. (See Figure 4-12.) Historically, TBP has also been detected in well 111, located near well 8605, but at concentrations close to the detection limit of 10 µg/L. During 2015, TBP was detected in well 111 at estimated concentrations of 8.36 and 3.05 µg/L. These two wells are included on the bottom of Table 4-8. TBP is thought to be residual contamination from liquid waste management activities in the former lagoon 1 area during nuclear fuel reprocessing.

Metals Sampling on the North Plateau. In 2005, 2007, and 2008, select groundwater wells were sampled to evaluate metals concentrations in groundwater impacted by the strontium-90 plume migrating from the MPPB source area. No metals have been determined to be associated with the strontium-90 plume.

During 2015, routine metals sampling continued to be performed, as outlined in the GMP. The sampling results were compared with the established GSLs and background levels. (See Table 4-8.) The only metals detected above background in groundwater in 2015 were barium, chromium, copper, and nickel. Barium was detected above background concentrations at wells 502, MP-01, MP-03, and MP-04. Copper was detected above background concentrations at wells 502 and MP-04. Nickel was detected at concentrations above background and the GSL in wells 405, 502 and 706. Chromium was detected above background and the GSL at wells 405, 502, 706, MP-01, and MP-04. (See Table D-2G in Appendix D-2.) Wells 405, 502, and 706 are stainless-steel wells that have historically shown evidence of corrosion. Chromium and nickel can leach from the corroding well screen and adsorb to fine sediments within the well.

TABLE 4-8
2015 Groundwater Monitoring Results Exceeding GSLs and Background Levels

RADIOLOGICAL PARAMETERS								
Number of Locations exceeding GSLs [a] or Background [b]		***Geologic Unit (plateau)***	***Groundwater Sampling Location***					
Gross Alpha								
3 > GSL	4 > BKG	S&G (NP)	103	**111**	**8605**			
		WLT (SP)	**908R**					
Gross Beta								
21 > GSL	35 > BKG	S&G (NP)	GSEEP	**104**	**501**	804	8612	**WP-H**
			SP04	**105**	**502**	**8603**	**MP-01**	
			SP06	**106**	605	**8604**	**MP-02**	
			SP11	**111**	**801**	**8605**	**MP-03**	
			SP12	**116**	**802**	8607	**MP-04**	
			103	**408**	**803**	**8609**	WP-C	
		ULT (NP)	107					
		WLT (SP)	NDATR	908R	909			
Tritium								
13 > GSL	13 > BKG	S&G (NP)	**GSEEP**	**104**	**602A**	**8603**	**WP-C**	
			SP04	**106**	**803**	**WP-A**	**WP-H**	
		ULT (NP)	**108**	**110**				
		WLT (SP)	**909**					
Strontium-90								
11 > GSL	11 > BKG	S&G (NP)	**408**	**502**	**8609**	**MP-02**	**MP-04**	
			501	**801**	**MP-01**	**MP-03**		
		WLT (SP)	**NDATR**	**909**				
Technetium-99								
5 > GSL	5 > BKG	S&G (NP)	**408**	**MP-01**	**MP-02**	**MP-03**	**MP-04**	
Iodine-129								
2 > GSL	2 > BKG	WLT (SP)	**NDATR**	**909**				
Uranium-233/234[d]								
6 > GSL	6 > BKG	S&G (NP)	**408**	**MP-02**	**MP-03**	**MP-04**		
		WLT (SP)	**NDATR**	**909**				
Uranium-235/236								
5 > GSL	5 > BKG	S&G (NP)	**401**	**MP-02**	**MP-03**			
		WLT (SP)	**NDATR**	**909**				
Uranium-238[d]								
6 > GSL	6 > BKG	S&G	**408**	**MP-02**	**MP-03**	**MP-04**		
		WLT (SP)	**NDATR**	**909**				
Total Uranium[d]								
2 > GSL	2 > BKG	WLT (SP)	**NDATR**	**909**				

TABLE 4-8 (*concluded*)
2015 Groundwater Monitoring Results Exceeding GSLs and Background Levels

METALS							
Number of Locations exceeding GSLs [a] or Background [b]		***Geologic Unit (plateau)***	***Groundwater Sampling Location***				
Barium							
0 > GSL	4 > BKG	S&G (NP)	502	MP-01	MP-03	MP-04	
Chromium							
5 > GSL	5 > BKG	S&G (NP)	**405**	**502**	**706**	**MP-01**	**MP-04**
Copper							
0 > GSL	2 > BKG	S&G (NP)	502	MP-04			
Nickel							
3 > GSL	3 > BKG	S&G (NP)	**405**	**502**	**706**		
ORGANICS							
Tributyl phosphate							
No TOGS[c]	2 > DL	S&G (NP)	111	8605			

Note: Bolded wells indicate 2015 results that exceed GSLs. Unbolded wells indicated 2015 results that exceeded background.

Key:

BKG - Background
GSL - Groundwater Screening Level
DL - Detection Limit
NP - North
SP - South
S&G - Sand and Gravel
ULT - Unweathered Lavery Till
WLT - Weathered Lavery Till

[a] The site-specific GSLs for radiological constituents were set equal to the larger of the WVDP background concentrations or the NYSDEC TOGS 1.1.1 Class GA Groundwater Quality Standards as discussed on page D-1 and presented in Table D-1A. The GSLs for metals were set equal to the larger of the background concentration or NYSDEC TOGS 1.1.1 Class GA Groundwater Quality Standards as presented in Table D-1B. Organic constituents were compared directly with NYSDEC TOGS 1.1.1 Class GA Groundwater Quality Standards.

[b] The data used for the calculation of background values collected from 1991 through September 2009 were taken from background wells 301, 401, 706, and 1302 in the sand and gravel unit on the north plateau. The background concentration was set to the upper limit of the 95% confidence interval.

[c] No TOGS 1.1.1 standard has been established for tributyl phosphate.

[d] Uranium-233/234, uranium-238 and total uranium occur naturally in the environment.

The chromium GSL was exceeded on only one occasion during 2015 in the MP-wells, where metal concentrations have been observed to fluctuate. Naturally occurring levels of chromium and other metals have been observed in WVDP background monitoring wells.

Groundwater Sampling Observations on the South Plateau Including the NRC-Licensed Disposal Area (NDA)

Interim Measures (IMs). In 1990, a trench system was constructed through the WLT along the northeast and northwest sides of the NDA to intercept and collect potentially contaminated groundwater. Sampling location NDATR is a sump at the lowest point of the interceptor trench. Groundwater is collected at NDATR and transferred to the LLW2 for processing. In 2015, no organic constituents were detected in groundwater from the NDA interceptor trench. Groundwater elevations are monitored quarterly in and around the interceptor trench to ensure that an inward gradient is maintained.

A second IM, to improve the stability of the earthen cap and to limit infiltration of surface water and precipitation into the NDA, was completed in December 2008. This included installing a geosynthetic cap over the NDA, a low-permeability upgradient slurry wall, and surface water drainage diversions. (See also "Interim Measures [IMs]" under "RCRA §3008(h) Administrative Order on Consent" in the ECS.) Water level data from piezometers installed to monitor the effects of the IM indicate that the slurry wall and geomembrane cover are causing the WLT to become dry in some areas. The reduced water volume extracted from the interceptor trench since the cap and barrier wall were installed is another indication that the IM is effectively reducing flow through the NDA. The total volume pumped from the NDA trench in 2015 (63,035 gal [238,613 L]) was approximately one-sixth of the volume pumped in CY 2007, before the IM. (See Figure 4-14.) Refer to the Environmental Compliance section titled "RCRA §3008(h) Administrative Order on Consent" for further discussion of the NDA IMs.

Radioisotopic Sampling Results on the South Plateau. Two sampling locations on the south plateau (well 909 and the NDA sump [NDATR]) are analyzed for specific radionuclides. (See Appendix A, Figure A-10.) Results are tabulated in Appendix D-2.

Gross beta, strontium-90, iodine-129, total uranium, and several uranium radioisotope concentrations in groundwater from NDATR continued to be elevated with respect to GSLs or to concentrations in background monitoring locations on the south plateau. (See Table 4-8 and Figure 4-13.) Gross beta concentrations at NDATR have decreased from the maximum observed concentration of 1.75E-06 µCi/L in September 2009 after the 2008 IM to below the gross beta GSL of 1.00E-6 µCi/mL in 2013, 2014, and 2015. The increases immediately following the installation of the upgradient slurry wall and cap are believed to be attributable to less dilution of water collected in the trench because groundwater and surface water infiltration into the NDA was significantly reduced. Similar to the north plateau, strontium-90 is the predominant contributing radioisotope to the measured gross beta concentrations in the NDA trench water.

NDATR samples in 2015 exhibited concentrations for iodine-129 that were slightly above background and the GSL similar to the past several years. Elevated iodine-129 concentrations observed since the 2008 IM are believed to be attributable to less dilution of the water that collects within the trench. (See Table 4-7.)

WLT well 909 exhibited elevated tritium, iodine-129, strontium-90, total uranium, and several uranium radioisotope concentrations above their respective GSLs during 2015, consistent with historical values, as shown in Table 4-8 and Appendix D-2.

Radionuclide concentrations in groundwater downgradient of the NDA are presumed to be associated with former waste burial operations.

Additional Monitoring and Investigations

Groundwater Monitoring Downgradient of the Waste Tank Farm (WTF). Waste in the underground tanks was removed and solidified through the VIT process from 1996 to 2002. The underground waste tanks are being stabilized by a tank and vault drying system (T&VDS) that began operating in December 2010. Three of the tanks are dry and liquid levels are decreasing in the fourth tank. This system is successfully reducing the liquid volume in the tanks and vaults through evaporation. (See "WTF and the T&VDS" in the Environmental Compliance Summary.) Throughout waste processing activities, groundwater controls have been in place to (1) reduce the upward hydrostatic pressure on the tanks, and (2) to maintain an inward hydraulic gradient toward the tanks, thereby inhibiting potential leaks from the tanks. The natural inward hydraulic gradient is influenced by periodically pumping a dewatering well, located outside the tank vaults, that also controls the hydrostatic pressure near the tanks.

Radioactivity in groundwater near the WTF is routinely monitored and evaluated. Elevated gross beta concentrations from well 8607 have been observed since 1994, with the maximum concentration measured in 2005. Gross beta activity has also been observed in the dewatering well and the tank 8D-2 pan. During 2015, gross beta concentrations at well 8607 were lower, on average, than 2014 concentrations and were well below the highest historical concentration observed in 2005.

New WVDP Water Supply Wells. As indicated in Chapter 2, in 2014 the WVDP converted its water supply from a surface water source to a groundwater source provided by two newly installed bedrock wells located approximately 700 feet to the southwest of the MPPB. In addition to monitoring the drinking water, three source water protection plan wells are sampled to provide assurance that the bedrock groundwater is free of contamination. Analytical data for 2015 from these three wells, presented in Appendix B-5, show that radiological indicator results are within site background concentrations.

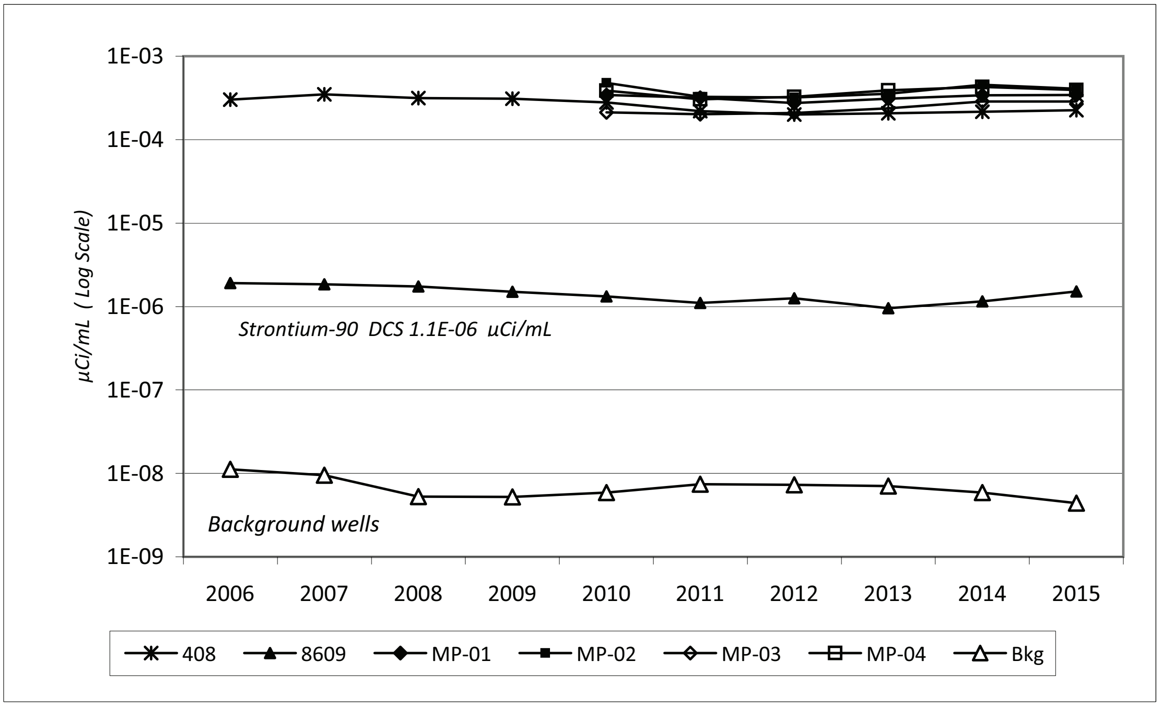
Summary

Evaluation of groundwater sampling data from 2015 continues to show that the most widespread area of groundwater contamination at the WVDP is the strontium-90 plume in the S&G unit on the north plateau. Efforts to reduce contaminant levels in the downgradient portions of the north plateau plume included the 2010 installation of the full-scale PTW across the leading edge of the plume and installation of the NPGRS in 1995. Five years of post-installation monitoring results indicate the PTW is removing strontium-90 from the groundwater passing through the wall.

Other localized areas of groundwater contamination have been observed downgradient of former lagoon 1, also on the north plateau, and downgradient of the NDA on the south plateau. Groundwater contaminant concentrations downgradient of Lagoon 1 are remaining stable or decreasing. Measures to reduce and collect water moving through the NDA including the NDA interceptor trench installed in 1990 and the slurry wall and geomembrane cover installed in 2008 are reducing the water level in the NDA and thus the potential for groundwater contamination flowing out of the NDA. The T&VDS is effectively drying out the waste tanks, further reducing the potential for groundwater contamination in the WTF.

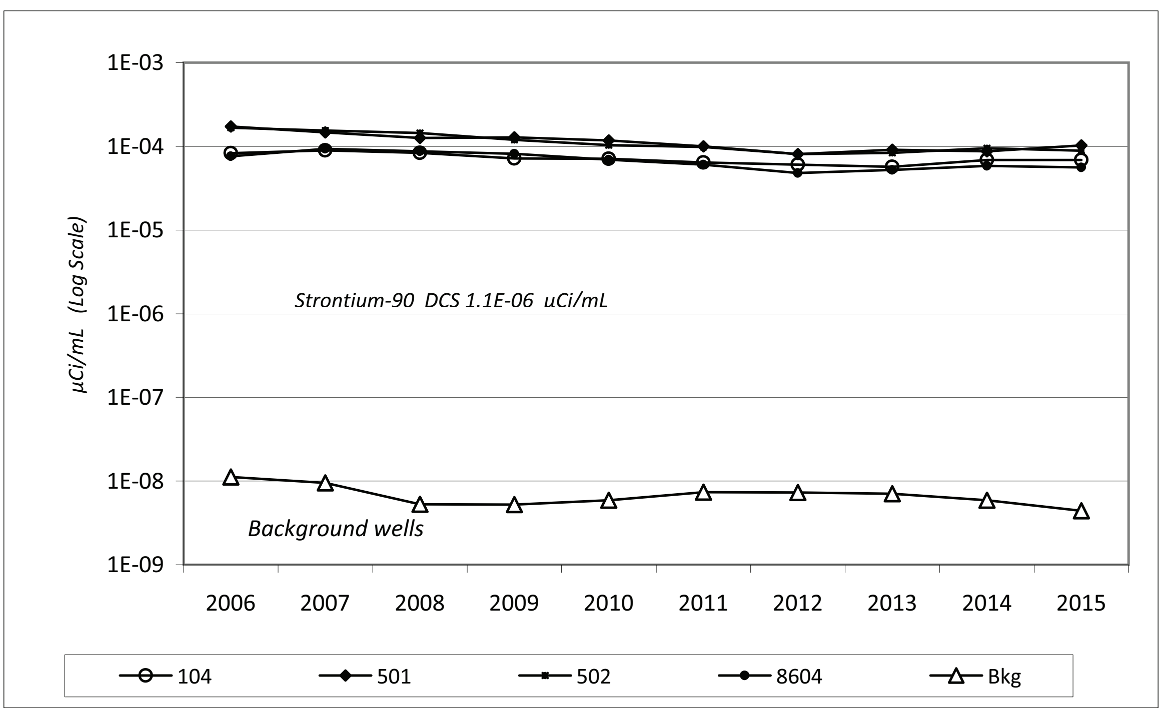
As discussed in the ECS, longer-term measures to reduce potential groundwater contamination as described in Phase 1 of the EIS preferred alternative selected by DOE in the ROD (April 2010), include removing the MPPB, removing the lagoons, and excavating the source area of the north plateau plume.

FIGURE 4-3
Annual Average Gross Beta Concentrations
at Monitoring Wells Downgradient of the North Plateau Strontium-90 Plume Source Area



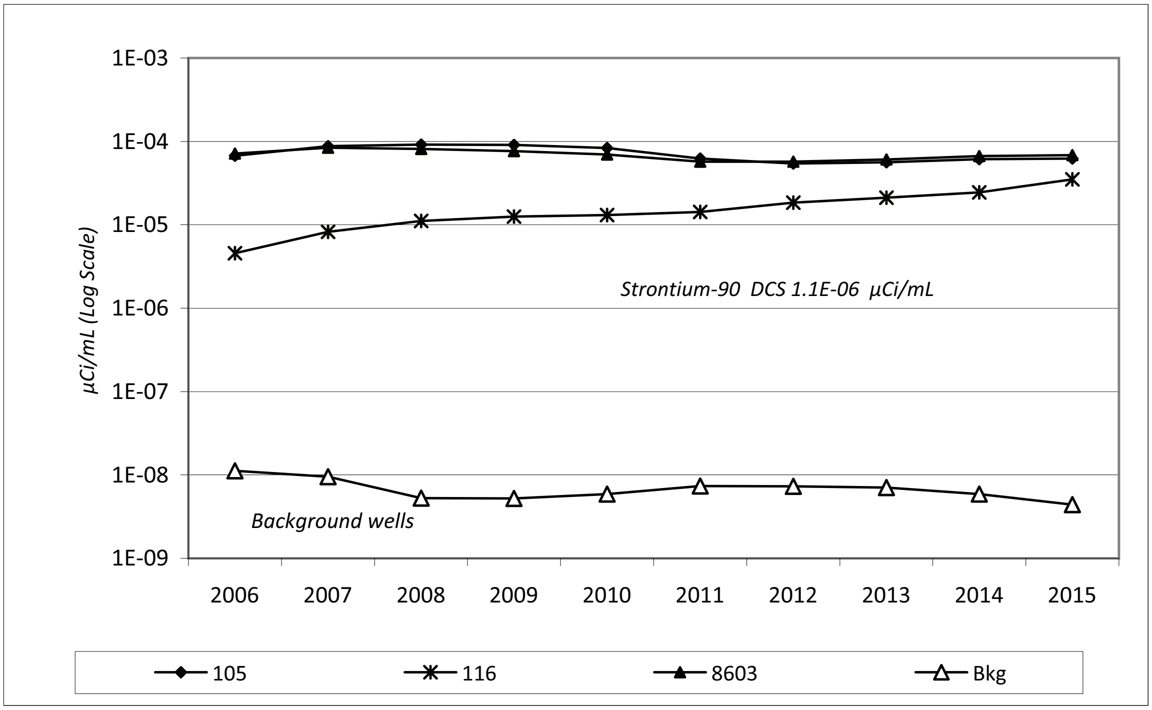
Note: S&G background (Bkg) wells 301, 401, 706, and 1302 are averaged for this comparison.

FIGURE 4-4
Annual Average Gross Beta Concentrations
at Monitoring Wells Centrally Located Within the North Plateau Strontium-90 Plume



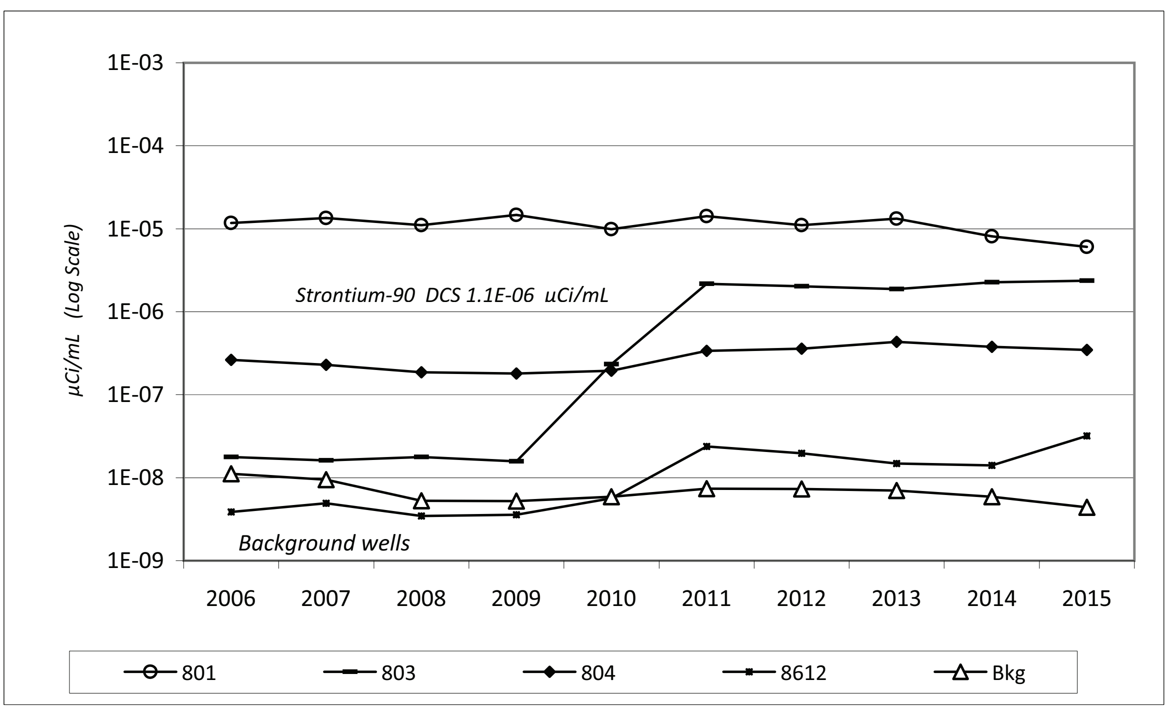
Note: S&G background (Bkg) wells 301, 401, 706, and 1302 are averaged for this comparison.

FIGURE 4-5
Annual Average Gross Beta at Monitoring Wells Upgradient of the PTW



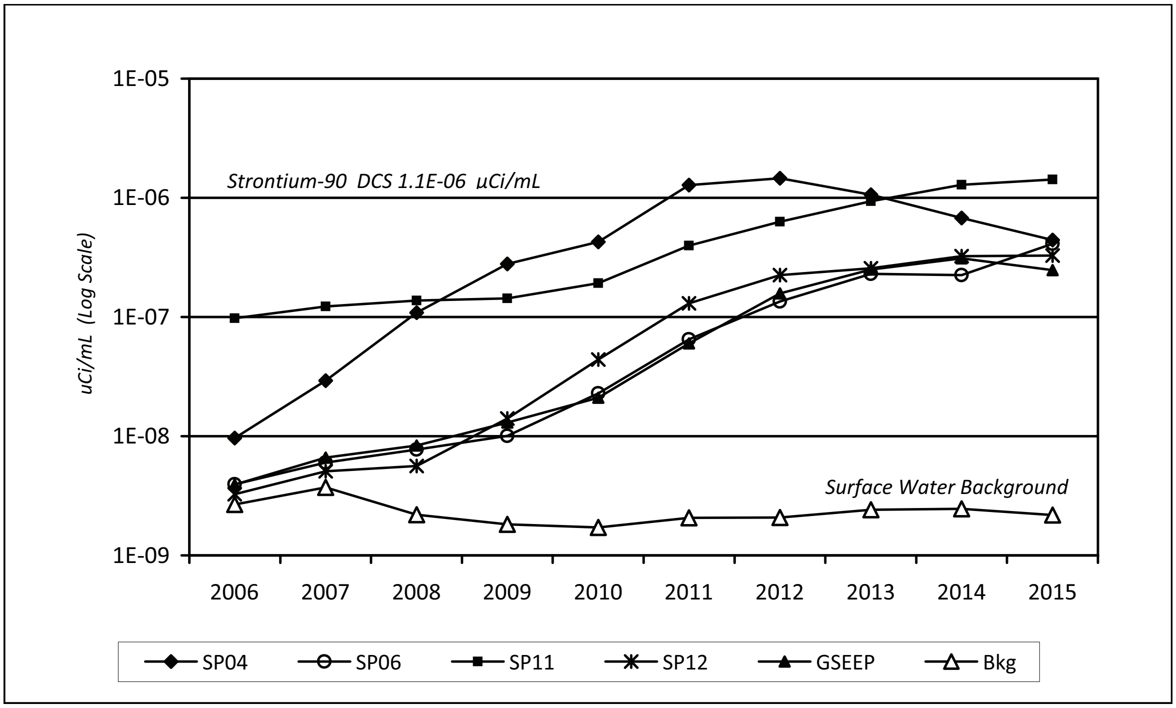
Note: S&G background (Bkg) wells 301, 401, 706, and 1302 are averaged for this comparison.

FIGURE 4-6
Annual Average Gross Beta at Monitoring Wells Downgradient of the PTW



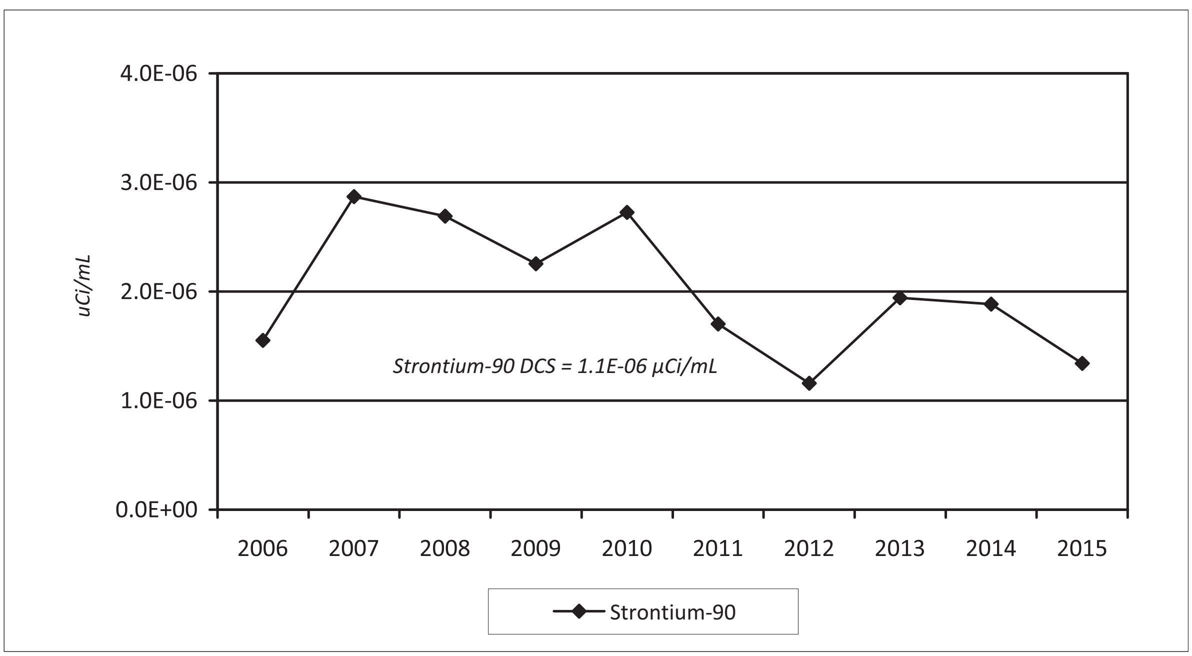
Note: S&G background (Bkg) wells 301, 401, 706, and 1302 are averaged for this comparison.

FIGURE 4-7
Annual Average Gross Beta Concentrations at Seeps From the Northeast Edge of the North Plateau



Note: Background (Bkg) from surface water sampling location WFBCBKG at Felton Bridge upgradient of the WVDP.

FIGURE 4-8
Annual Average Strontium-90 Concentrations at WNSWAMP



Note: Derived concentration standards (DCSs) are used as an evaluation tool for results from on-site locations as part of the routine environmental monitoring program. DCS quantities represent concentrations that would result in a member of the public receiving 100 mrem effective dose following continuous exposure for one year. The WNSWAMP location is not accessible to the public.

FIGURE 4-9

J:\GIS\ArMap\ASER\ASER_2015\ASER_2015_Fig4-9_PTW_20151104.mxd, r.1, skw/afs, 5/19/2016

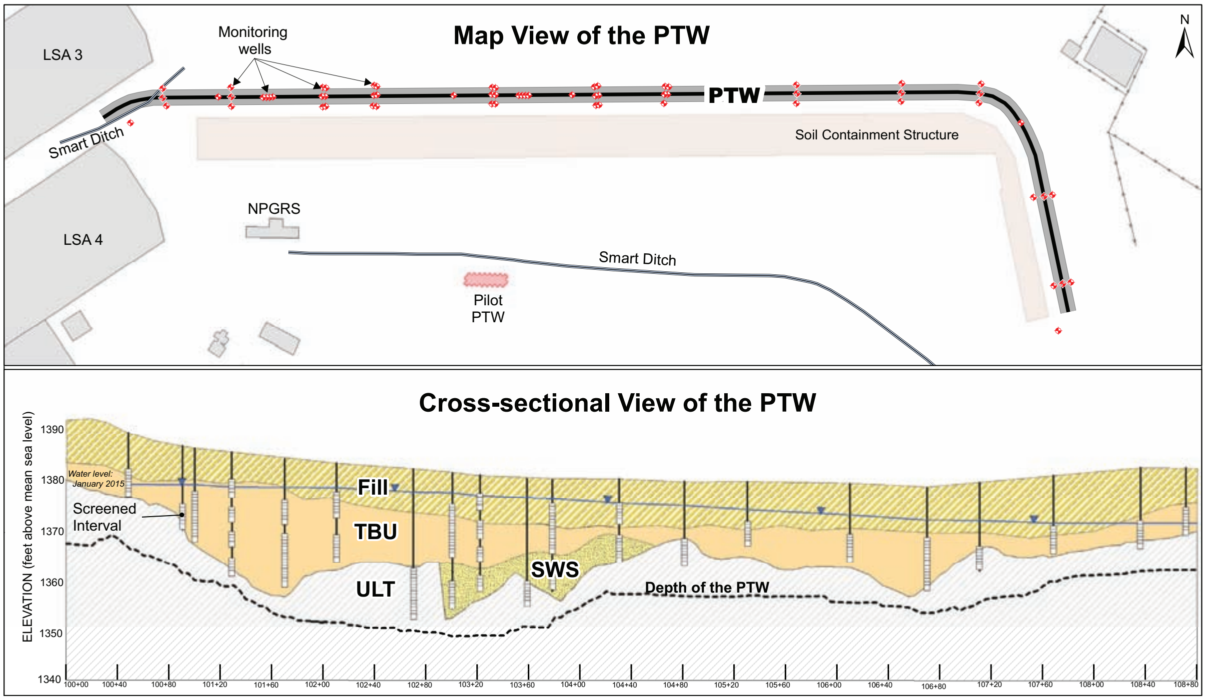
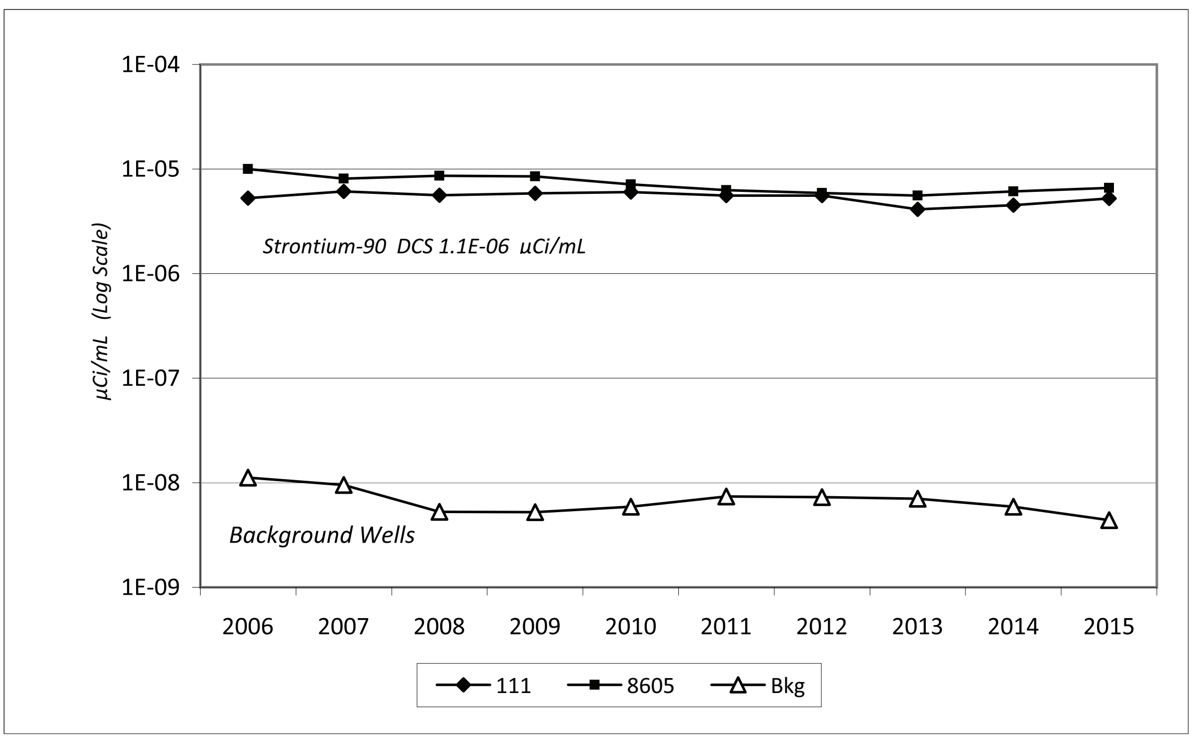
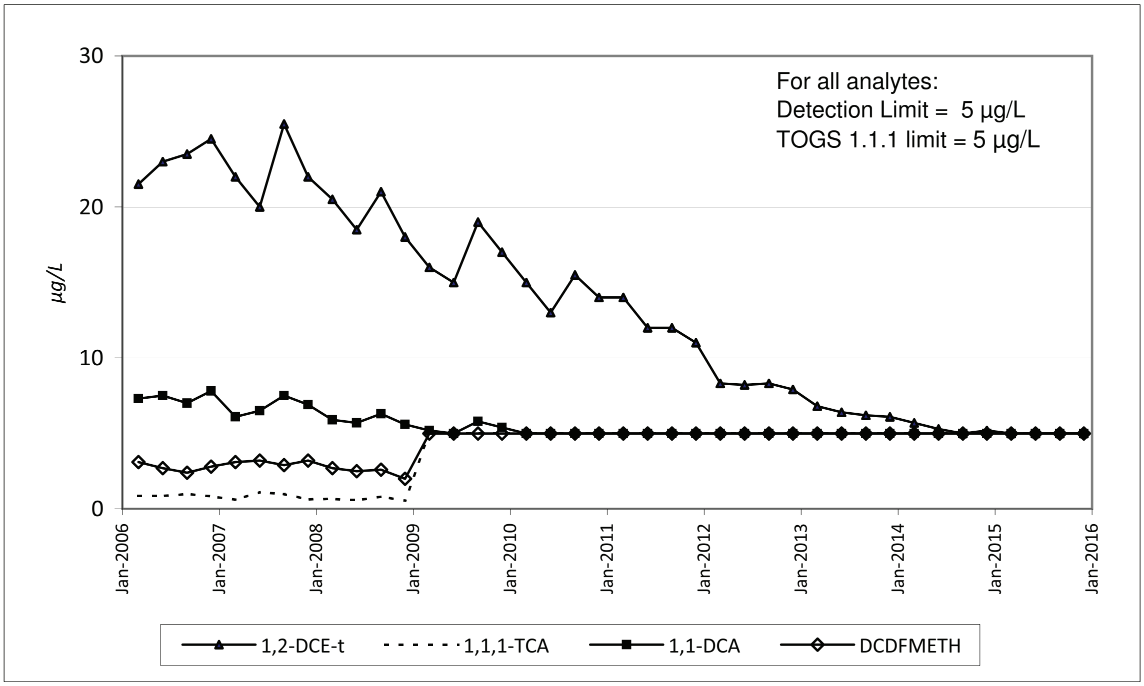


FIGURE 4-10
Annual Average Gross Beta Concentrations at Monitoring Wells Near Former Lagoon 1



Note: S&G background (Bkg) wells 301, 401, 706, and 1302 are averaged for this comparison.

FIGURE 4-11
Concentrations of 1,2-DCE-t, 1,1,1-TCA, 1,1-DCA, and DCDFMeth at Well 8612 in the S&G Unit



Note: 1,2-DCE-t = 1,2-Dichloroethylene (total) 1,1-DCA = 1,1-Dichloroethane
1,1,1-TCA = 1,1,1-Trichloroethane DCDFMeth = Dichlorodifluroromethane

FIGURE 4-12
Concentrations of Tributyl Phosphate at Monitoring Wells Near Former Lagoon 1 in the S&G Unit

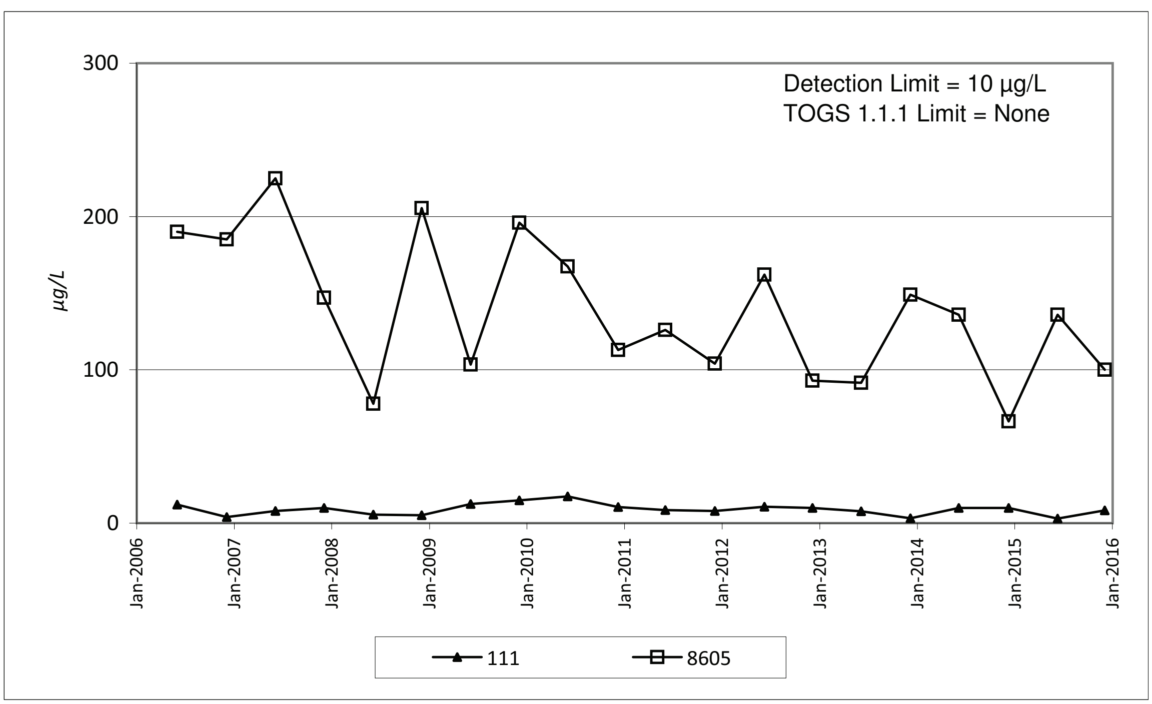
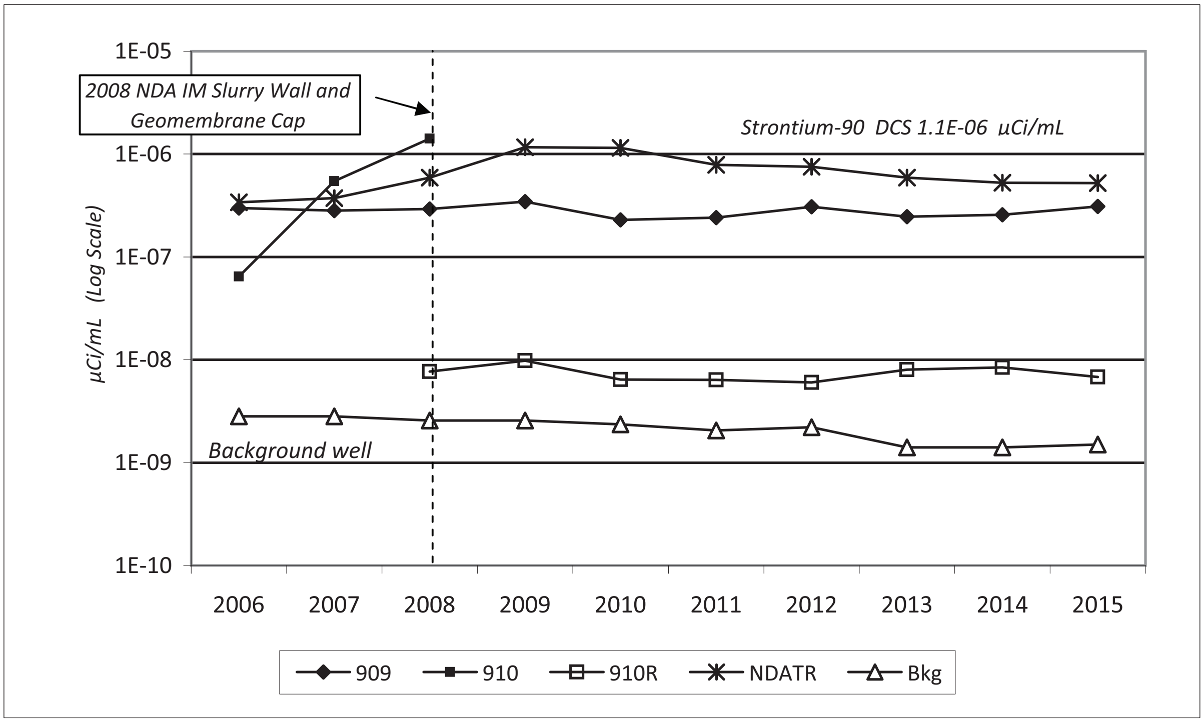
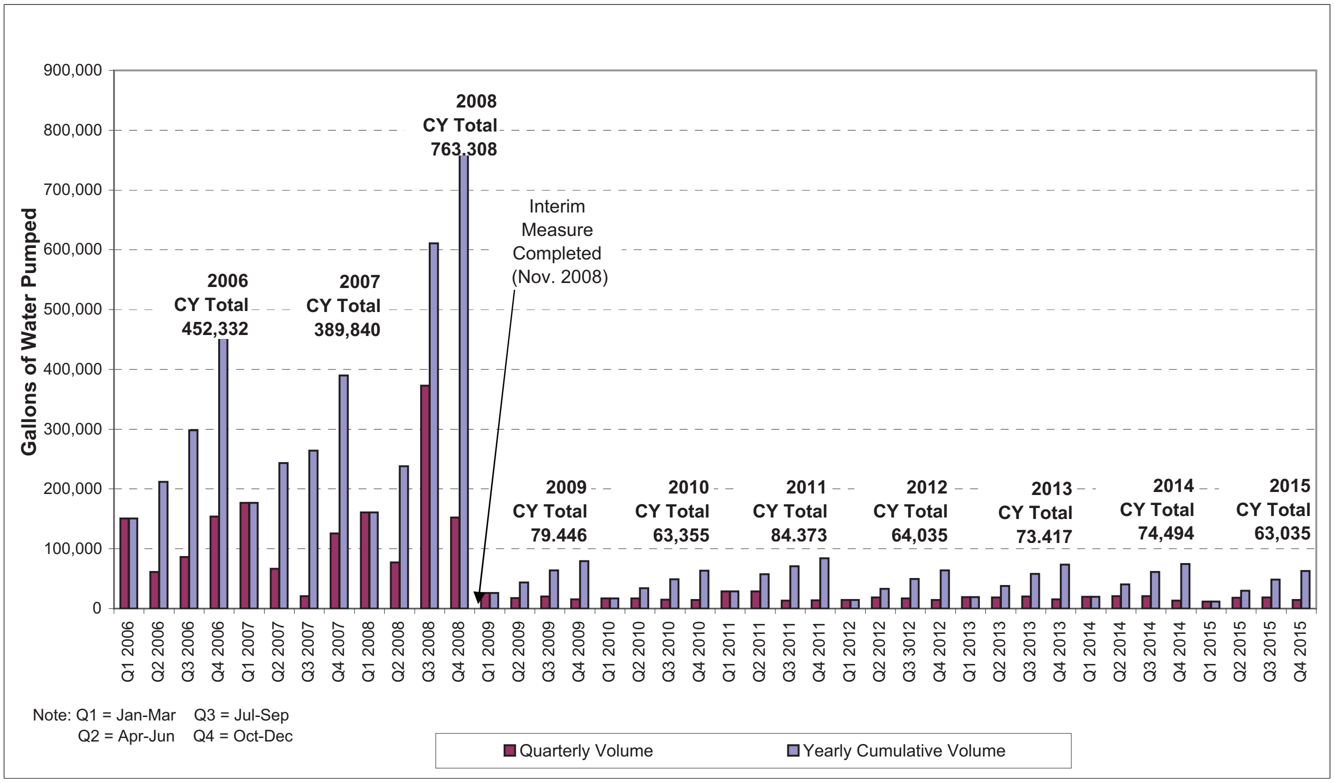


FIGURE 4-13
Annual Average Gross Beta Concentrations
at Monitoring Wells Downgradient of the NDA and at the NDA Trench



Notes: WLT background well for the south plateau is 1008C. In 2007, well 910 was determined to be damaged such that groundwater samples collected from this well were no longer representative of the ULT. Well 910 was therefore decommissioned in 2008 and replaced with well 910R.

FIGURE 4-14
Volume of Water Pumped from the NDA Interceptor Trench



USEFUL INFORMATION

This section provides background information that may be useful to the reader in understanding and interpreting the results presented in this ASER. First, it presents brief summaries of concepts pertaining to radiation and radioactivity, including:

- radioactive decay;
- types of ionizing radiation;
- measurement of radioactivity;
- measurement of dose;
- background radiation; and
- potential health effects of radiation.

It describes how data are presented in the ASER, and presents tables of unit prefixes, units of measure, and conversion factors. It discusses limits applicable to air emissions and water effluents, and describes (and presents a table of) the dose-based DOE DCSs. It includes a discussion of CAP88-PC, the computer code that can be used to evaluate compliance with the air dose standard. It also presents discussions of 1) water quality classifications, standards, and limits for ambient water; 2) potable water standards; 3) oil and sediment guidelines; and 4) evaluation of monitoring data with respect to limits.

Radiation and Radioactivity

Radioactivity is a property of atoms with unstable nuclei. The unstable nuclei spontaneously decay by emitting radiation in the form of energy (such as gamma rays) or particles (such as alpha and beta particles) (see inset on following page). If the emitted energy or particle has enough energy to break a chemical bond or to knock an electron loose from another atom, a charged particle (an "ion") may be created. This radiation is known as "ionizing radiation."

As used in this ASER, the term "radiation" refers only to ionizing radiation and does not include nonionizing forms of radiation such as visible light, radio waves, microwaves, infrared light, or ultraviolet light.

Radioactive Decay

An atom is the smallest component of an element having the chemical properties of the element. An atom consists of a central core (the *nucleus*), composed of positively charged particles (*protons*) and particles with no charge (*neutrons*), surrounded by negatively charged particles (*electrons*) that revolve in orbits in the region surrounding the nucleus. The protons and neutrons are much more massive than the electrons; therefore, most of an atom's mass is in the nucleus.

An element is defined by the number of protons in its nucleus, its atomic number. For example, the atomic number of hydrogen is one (one proton), the atomic number of strontium is 38 (38 protons), and the atomic number of cesium is 55 (55 protons).

The mass number of an atom, its *atomic weight*, is equal to the total number of protons and neutrons in its nucleus. For example, although an atom of hydrogen will always have one proton in its nucleus, the number of neutrons may vary. Hydrogen atoms with zero, one, or two neutrons will have atomic weights of one, two, or three, respectively. These atoms are known as *isotopes* (or *nuclides*) of the element hydrogen. Elements may have many isotopes. For instance, the elements strontium and cesium have more than 30 isotopes each.

Isotopes may be stable or unstable. An atom from an unstable isotope will spontaneously change to another atom. The process by which this change occurs, that is, the spontaneous emission from the nucleus of alpha or beta particles, often accompanied by gamma radiation, is known as *radioactive decay*. Depending upon the type of radioactive decay, an atom may be transformed to another isotope of the same element or, if the number of protons in the nucleus has changed, to an isotope of another element.

Isotopes (nuclides) that undergo radioactive decay are called *radioactive* and are known as *radioisotopes* or *radionuclides*. Radionuclides are customarily referred to by their atomic weights. For instance, the radionuclides of hydrogen, strontium, and cesium measured at the WVDP are hydrogen-3 (also known as tritium), strontium-90, and cesium-137. For some radionuclides, such as cesium-137, a short-lived intermediate is formed that decays by gamma emission. This intermediate radionuclide may be designated by the letter "m" (for metastable)

Some Types of Ionizing Radiation

Alpha Particles. An alpha particle is a positively charged particle consisting of two protons and two neutrons. Compared to beta particles, alpha particles are relatively large and heavy and do not travel very far when ejected by a decaying nucleus. Therefore, alpha radiation is easily stopped by a few centimeters of air or a thin layer of material, such as paper or skin. However, if radioactive material is ingested or inhaled, the alpha particles released inside the body can damage soft internal tissues because their energy can be absorbed by tissue cells in the immediate vicinity of the decay. An example of an alpha-emitting radionuclide is the uranium isotope with an atomic weight of 232 (uranium-232). Uranium-232 was in the HLW mixture at the WVDP as a result of a thorium-based nuclear fuel reprocessing campaign conducted by Nuclear Fuel Services, Inc. Uranium-232 has been detected in liquid waste streams.

Beta Particles. A beta particle is an electron emitted during the breakdown of a neutron in a radioactive nucleus. Compared to alpha particles, beta particles are smaller, have less of a charge, travel at a higher speed (close to the speed to light), and can be stopped by wood or a thin sheet of aluminum. If released inside the body, beta particles do much less damage than an equal number of alpha particles because beta particles deposit energy in tissue cells over a larger volume than alpha particles. Strontium-90, a fission product found in the liquids associated with the HLW, is an example of a beta emitting radionuclide.

Gamma Rays. Gamma rays are high-energy “packets” of electromagnetic radiation, called photons, that are emitted from the nucleus. Gamma rays are similar to x-rays, but are generally more energetic. If an alpha or beta particle released by a decaying nucleus does not carry off all the energy generated by the nuclear disintegration, the excess energy may be emitted as gamma rays. If the released energy is high, a very penetrating gamma ray is produced that can be effectively reduced only by shielding consisting of several inches of a dense material, such as lead, or of water or concrete several feet thick. Although large amounts of gamma radiation are dangerous, gamma rays are also used in lifesaving medical procedures. An example of a gamma-emitting radionuclide is barium-137m a short-lived daughter product of cesium-137. Both barium-137m and its precursor, cesium-137, are major constituents of the WVDP HLW.

following the atomic weight. For cesium-137, the intermediate radionuclide is barium-137m, with a half-life of less than three minutes.

The process of radioactive decay will continue until only a stable, nonradioactive isotope remains. Depending on the radionuclide, this process can take anywhere from less than a second to billions of years. The time required for half of the radioactivity to decay is called the radionuclide’s *half-life*. Each radionuclide has a unique half-life. The half-life of hydrogen-3 is slightly more than 12 years, both strontium-90 and cesium-137 have half-lives of approximately 30 years, and plutonium-239 has a half-life of more than 24,000 years.

Knowledge of radionuclide half-lives is often used to estimate past and future inventories of radioactive material. For example, a 1.0 millicurie source of cesium-137 in 2006 would have measured 2.0 millicuries in 1976 and will be 0.5 millicuries in 2036. For a list of half-lives of radionuclides applicable to the WVDP, see Table UI-4.

Measurement of Radioactivity

As they decay, radionuclides emit one or more types of radiation at characteristic energies that can be measured and used to identify the radionuclide. Detection instruments measure the quantity of radiation emitted over a specified time. From this measurement, the number of decay events (nuclear transformations) over a fixed time can be calculated.

Radioactivity is measured in units of curies (Ci) or becquerels (Bq). One Ci (based on the rate of decay of one gram of radium-226) is defined as the “quantity of any radionuclide that undergoes an average transformation rate of 37 billion transformations per second.” In the International System of Units (SI), one Bq is equal to one transformation per second. In this ASER, radioactivity is customarily expressed in units of Ci followed by the equivalent SI unit in parentheses, as follows: 1 Ci (3.7E+10 Bq).

In this report, measurements of radioactivity in a defined volume of an environmental media, such as air or water, are presented in units of concentration. Since levels of radioactivity in the environment are typically very low, concentrations may be expressed in µCi/mL, with SI units (Bq/L) in parentheses. (One microcurie is equal to one millionth of a curie.)

Measurement of Dose

The amount of energy absorbed by a material that receives radiation is measured in rads. A rad is 100 ergs of radiation energy absorbed per gram of material. (An erg is the approximate amount of energy necessary to lift a mosquito one-sixteenth of an inch.) "Dose" is a means of expressing the amount of energy absorbed, taking into account the effects of different kinds of radiation.

Alpha, beta, and gamma radiation affect the body to different degrees. Each type of radiation is given a quality factor that indicates the extent of human cell damage it can cause compared with equal amounts of other ionizing radiation energy. Alpha particles cause 20 times as much damage to internal tissues as x-rays, so alpha radiation has a quality factor of 20, compared to gamma rays, x-rays, or beta particles, each of which have a quality factor of one.

The unit of dose measurement to humans is the *rem*. The number of rem is equal to the number of rads multiplied by the quality factor for each type of radiation. In the SI system, dose is expressed in sieverts. One Sv equals 100 rem. One rem equals 1,000 mrem, the unit used to express standards for dose to man from air and water sources, as applicable to this ASER. This ASER expresses dose in standard units, followed by equivalent SI units in parentheses, as follows: 1 mrem (0.01 millisievert [mSv]).

Background Radiation

Background radiation is always present, and everyone is constantly exposed to low levels of such radiation from both naturally occurring and man-made sources. In the U.S. the average total annual exposure to low-level background radiation is estimated to be about 620 mrem or 6.2 mSv. About one-half of this radiation, approximately 310 mrem (3.1 mSv), comes from natural sources. The other half (about 310 mrem [3.1 mSv]) comes from medical procedures, consumer products, and other man-made sources (NCRP Report Number 160, 2009). (See Figure 3-1 in Chapter 3.)

Background radiation includes cosmic rays; the decay of natural elements, such as potassium, uranium, thorium, and radon; and radiation from sources such as chemical fertilizers, smoke detectors, and cigarettes. Actual doses vary depending on such factors as geographic location, building ventilation, and personal habits.

Potential Health Effects of Radiation

The three primary pathways by which people may be exposed to radiation are (1) direct exposure, (2) inhalation, and (3) ingestion. Exposure from radiation may be from a source outside the body (external exposure) or from radioactive particles that have been taken in by breathing or eating and have become lodged inside the body (internal exposure). Radionuclides that are taken in are not distributed in the same way throughout the body. Radionuclides of strontium, plutonium, and americium concentrate in the skeleton, while radioisotopes of iodine concentrate in the thyroid. Radionuclides such as hydrogen-3 (tritium), carbon-14, or cesium-137, however, will be distributed uniformly throughout the body.

Living tissue in the human body can be damaged by ionizing radiation. The severity of the damage depends upon several factors, among them the amount of exposure (low or high), the duration of the exposure (long-term [*chronic*] or short-term [*acute*]), the type of radiation (alpha, beta, and gamma radiations of various energies), and the sensitivity of the human (or organ) receiving the radiation. The human body has mechanisms that repair damage from exposure to radiation; however, repair processes are not always successful.

Biological effects of exposure to radiation may be either somatic or genetic. *Somatic* effects are limited to the exposed individual. For example, a sufficiently high exposure could cause clouding of the eye lens or a decrease in the number of white blood cells. *Genetic* effects may show up in future generations. Radiation could damage chromosomes, causing them to break or join incorrectly with other chromosomes. Radiation-produced genetic defects and mutations in the offspring of an exposed parent, while not positively identified in humans, have been observed in some animal studies.

Assessing the biological damage from low-level radiation is difficult because other factors can cause the same symptoms as radiation exposure. Moreover, the body is able to repair damage caused by low-level radiation. Epidemiological studies have not demonstrated adverse health effects in individuals exposed to small doses (less than 10 rem) over a period of years. (Note that average natural background radiation in the U.S. is about 0.31 rem/year, and estimated annual dose from activities at the WVDP is about three orders of magnitude lower than this dose.)

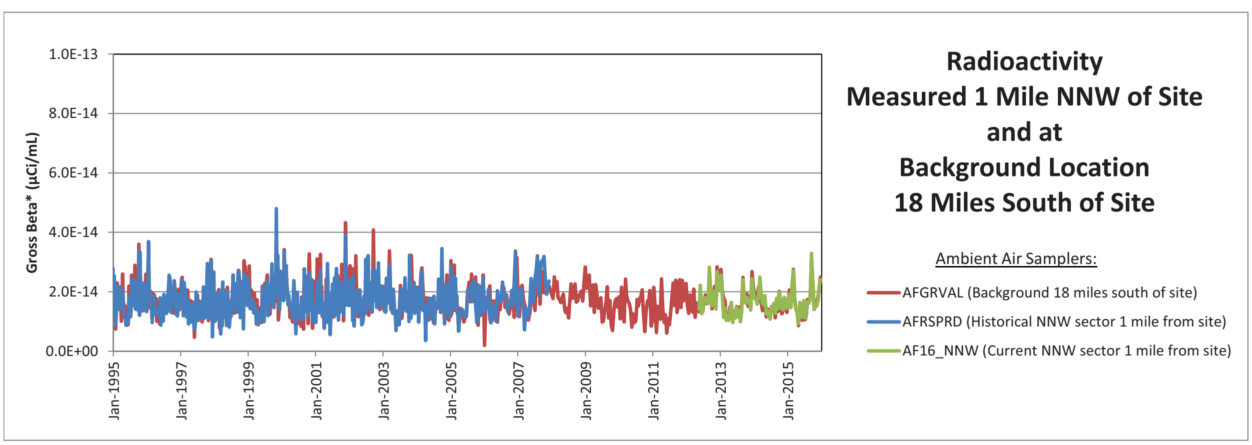
CAP88-PC Computer Modeled Air Dose Estimates Versus Measured Air Dose Estimates

The CAP88-PC model is used regularly for risk evaluation and planning site work activities with the potential to release airborne radioactivity. This model estimates human dose for the ingestion, inhalation, air immersion, and ground surface pathways. Version 4.0 of CAP88-PC (Trinity Engineering Associates, Inc., February 2015) is the most recent version approved by EPA for use in demonstrating NESHAP compliance. Versions 3.0 and 4.0 consider age, gender, and sensitivity of various human organs to radiation; factors not considered in earlier versions. The latest versions also calculate how long radioactive material will remain in a particular organ or system. As a result, dose estimates summarized in the ASER using earlier versions are slightly different than later versions, even if the radioactivity released from the WVDP and the meteorology both remain constant. Any approved version of the code can be used for compliance.

Through CY 2013, airborne radioactive materials released from stacks and diffuse sources on the WVDP property were modeled using CAP88 to demonstrate NESHAP compliance. In 2013 the estimated dose from the air pathway using CAP88 modeling was 0.0032 mrem. The 2013 CAP88 modeled dose estimates were compared with the dose estimated using the 2013 ambient air monitoring data. The 2013 monitoring data resulted in a dose estimate of <0.47 mrem. This dose estimate must be presented as an upper limit of the potential dose from the air pathway (i.e., with a "<") because the 2013 measured average annual concentrations for each ambient air sampler were below the detection limits (therefore considered non-detects). The apparent reduction in the margin of compliance between the measured versus the modeled approach is due to differences in the computational methodologies. EPA reviewed the 2013 comparison of both computational methods and their associated data and granted WVDP final approval to use ambient air monitoring for demonstrating NESHAP compliance at the WVDP. Both dose estimates for 2013 were orders of magnitude lower than the 10 mrem/year NESHAP standard.

The ambient air monitors cannot detect radioactivity down to the low concentrations that can be predicted to reach these areas using a mathematical model. The lowest concentrations the ambient air samplers can detect (i.e. approximately 3E-16 µCi/mL for cesium-137 and strontium-90) are orders of magnitude higher than the model-predicted downwind concentrations from the very low WVDP site emissions (i.e., concentrations of approximately 1.E-20 µCi/mL of cesium-137 and strontium-90 were predicted at the ambient air samplers by the 2013 ASER CAP88 model).

The ambient air monitoring network is currently a more appropriate method for demonstrating NESHAP compliance as the site transitions to more diffuse source emissions. Historical ambient air concentrations surrounding the site have not changed as shown by the graph below.



There is no difference in radioacitivity measured near the site and naturally occuring at the background location in Great Valley 18 miles south of the site.
The potentially Maximally Exposed Off-Site Individual (MEOSI) has most frequently been located NNW of the site (based site-specific meteorological data).
The MEOSI sampler [(AFRSPRD (1991-2007) and AF16_NNW(2012-present)] is located 1 mile downwind of the site in the NNW direction.
*In most cases, gross beta activity is a good overall indicator of an abnormal site-related radioactivity release.

The effect most often associated with exposure to relatively high levels of radiation appears to be an increased risk of cancer. However, scientists have not been able to demonstrate with certainty that exposure to low-level radiation causes an increase in injurious biological effects, nor have they been able to determine if there is a level of radiation exposure below which there are no adverse biological effects.

Data Reporting

In the ASER text, radiological units (e.g., rem, rad, curie) are presented first, followed by the SI equivalent in parentheses. Nonradiological measurements are presented in English units, followed by the metric unit equivalent in parentheses. See Tables UI-1, UI-2, and UI-3 for a summary of unit prefixes, units of measurement, and basic conversion factors used in this ASER.

Where results are very large or very small, scientific notation is used. Numbers greater than 10 are expressed with a positive exponent. To convert the number to its decimal form, the decimal point must be moved to the right by the number of places equal to the exponent. For example, 1.0E+06 would be expressed as 1,000,000 (one million). Numbers smaller than 1 are expressed with a negative exponent. For example, 1.0E-06 would be expressed as 0.000001 (one millionth).

Radiological data are reported as a result plus or minus (±) an associated uncertainty, customarily the 95% confidence interval. The uncertainty is in part due to the random nature of radioactive decay. Generally, the relative uncertainty in a measurement increases as the amount of radioactivity being sampled decreases. For this reason, low-level environmental analyses for radioactivity are especially prone to significant uncertainty in comparison with the result. Radiological data are presented in the following manner:

Example: 1.04±0.54E-09

Where: 1.04 = the result
±0.54 = plus or minus the associated uncertainty
E-09 = times 10 raised to the power -09

Sources of uncertainty may include random components (e.g., radiological counting statistics) or systematic components (e.g., sample collection and handling, measurement sensitivity, or bias). Radiological data in this report include both a result and uncertainty term. The uncertainty term represents only the uncertainty associated with the analytical measurement which for environmental samples is largely due to the random nature of radioactive decay. When such radiological data are used in calculations, such as estimating the total curies released from an air or water effluent point, the other parameter used in the calculation (e.g., air volumes, water volumes), typically do not have an associated uncertainty value available. As such, the uncertainties in this report for such calculated values only reflect the uncertainty associated with the radiological results used in the calculation. The actual (total propagated) uncertainty of such values would be larger if other components of uncertainty were available and included in these estimates.

Radiological results are calculated using both sample counts and background counts. If the background count is greater than the sample count, a negative result term will be reported. The constituent is considered to be detected if the result is larger than the associated uncertainty (i.e., a "positive" detection). Nonradiological data are not reported with an associated uncertainty.

In general, the detection limit is the minimum amount of a constituent that can be detected, or distinguished from background, by an instrument or a measurement technique. If a result is preceded by the symbol "<" (i.e., <5 parts per million [ppm]), the constituent was not measurable below the detection limit (in this example, 5 ppm).

The number of significant digits reported depends on the precision of the measurement technique. Integer counts are reported without rounding. Calculated values are customarily reported to three significant figures. Dose

TABLE UI-1
Unit Prefixes Used in this ASER

Multiplication factor			
Scientific notation	**Decimal form**	**Prefix**	**Symbol**
1.0E+06	1000000	mega	M
1.0E+03	1000	kilo	k
1.0E-02	0.01	centi	c
1.0E-03	0.001	milli	m
1.0E-06	0.000001	micro	µ
1.0E-09	0.000000001	nano	n
1.0E-12	0.000000000001	pico	p

TABLE UI-2
Units of Measure Used in this ASER

Type	Measurement	Symbol	Type	Measurement	Symbol
Length	meter	m	**Dose**	rad (absorbed dose)	rad
	centimeter	cm		rem (dose equivalent)	rem
	kilometer	km		millirem	mrem
	inch	in		sievert	Sv
	foot	ft		millisievert	mSv
	mile	mi		gray	Gy
Volume	gallon	gal	**Exposure**	roentgen	R
	liter	L		milliroentgen	mR
	milliliter	mL		microroentgen	µR
	cubic meter	m^3	**Concentration**	parts per million	ppm
	cubic feet	ft^3		parts per billion	ppb
Area	acre	ac		parts per trillion	ppt
	hectare	ha		milligrams per L (ppm)	mg/L
	square meter	m^2		micrograms per L (ppb)	µg/L
	square foot	ft^2		nanograms per L (ppt)	ng/L
Temperature	degrees Fahrenheit	^oF		milligrams per kg (ppm)	mg/kg
	degrees Celsius	^oC		micrograms per g (ppm)	µg/g
Mass	gram	g		micrograms per mL (ppm)	µg/mL
	kilogram	kg		milliliters per mL	mL/L
	milligram	mg		microcuries per mL	µCi/mL
	microgram	µg		picocuries per L	pCi/L
	nanogram	ng		microcuries per g	µCi/g
	pound	lb		becquerels per L	Bq/L
	tonne (metric ton)	t		nephelometric turbidity units	NTU
	ton, short	T		standard units (pH)	SU
Radioactivity	curie	Ci	**Flow rate**	gallons per day	gpd
	millicurie	mCi		gallons per minute	gpm
	microcurie	µCi		million gallons per day	mgd
	nanocurie	nCi		cubic feet per minute	cfm
	picocurie	pCi		liters per minute	lpm
	becquerel	Bq		meters per second	m/sec

TABLE UI-3
Conversion Factors Used in this ASER

To convert from	to	Multiply by
miles	kilometers	1.609344
feet	meters	0.3048
inches	centimeters	2.54
acres	hectares	0.4046873
pounds	kilograms	0.45359237
gallons	liters	3.785412
curies	becquerels	3.7E+10
rad	gray	0.01
rem	sievert	0.01

estimates are usually reported to two significant figures. All calculations are completed before values are rounded.

Limits Applicable to Environmental Media

Dose Standards. The two dose standards against which releases at the WVDP are assessed are those established by EPA for air emissions and that established by DOE regarding all exposure modes from DOE activities.

Radiological air emissions other than radon from DOE facilities are regulated by EPA under the NESHAP regulation (40 CFR 61, Subpart H), which establishes a standard of 10 mrem/year effective dose equivalent to any member of the public. Compliance with these regulations can be demonstrated by direct ambient air measurement or by modeling. See "CAP88-PC Computer Code" in inset.

DOE Order 458.1 sets the DOE primary standard of 100 mrem/year effective dose equivalent to members of the public considering all exposure modes from DOE activities. (Currently there are no EPA standards establishing limits on the radiation dose to members of the public from liquid effluents except for drinking water.)

For community water supplies, EPA has established a drinking water limit of 4-mrem/year (0.04-mSv/year) (40 CFR Parts 141, National Primary Drinking Water Regulations). However, there are no community drinking water supplies drawn from groundwater downgradient of the site or from surface waters within the Cattaraugus Creek drainage basin downstream of the WVDP. The WVDP on-site drinking water, currently supplied by a deep bedrock groundwater aquifer, is a non-transient, non-community water supply system that is subject to site-specific drinking water monitoring regulated by the NYSDOH. Applicable Maximum Contaminant Limits (MCLs) for the WVDP permitted drinking water system are set by NYS Sanitary Code (10 NYCRR 5-1). Radiological monitoring requirements are established in the CCHD/NYSDOH approved WVDP drinking water monitoring plan.

DOE DCS. A DCS is defined as the concentration of a radionuclide in air or water that, under conditions of continuous exposure by one exposure mode (i.e., ingestion of water, immersion in air, or inhalation) for one year, would result in an EDE of 100 mrem (1 mSv) to a "reference man" (DOE Order 458.1). DCSs for radionuclides measured at the WVDP are listed in Table UI-4. At the WVDP, DCSs are used as a screening tool for evaluating liquid effluents and airborne emissions. (DCSs are not used to estimate dose.)

SPDES Permit Requirements. On July 1, 2011, a modified SPDES permit became effective for the WVDP, and requirements of the CY 2011 SPDES permit are summarized in Appendix B-1. On July 28, 2015 a modification to the permit was issued for relocation of the S09 storm water outfall. The site's SPDES permit defines points where sampling must be conducted, sampling frequency, the type of samples to be collected, nonradiological constituents for which samples must be analyzed, and the limits applicable to these constituents. Results are reported monthly to the NYSDEC in DMRs.

Radionuclides are not regulated under the SPDES permit. However, special requirements in the permit specify that the concentration of radionuclides in the discharge is subject to requirements of DOE Order 458.1, "Radiation Protection of the Public and the Environment," and are reported in the ASER.

Water Quality Classifications, Standards, and Limits for Ambient Water. The objective of the Clean Water Act (CWA) of 1972 is to restore and maintain the integrity of the nation's waters and ensure that, wherever attainable, waters be made useful for fishing and swimming. To achieve this goal, NYS is delegated with authority under Sections 118, 303, and 510 of the CWA to (1) classify and designate the best uses for receiving waters, such as streams and rivers, within its jurisdiction, and (2) establish and assign water quality standards — goals for achieving the designated best uses for these classified waters.

The definitions for best usage classification of New York's jurisdictional waters and the water quality standard goals for these classifications are provided in 6 NYCRR Parts 701–704. Mapping of the Cattaraugus Creek drainage basin and assignment of best usage designations and classification to each receiving water segment within this drainage basin are described in 6 NYCRR Part 838.

According to these regulations, Franks Creek, Quarry Creek, and segments of Buttermilk Creek under the influence of water effluents from the WVDP are identified as Class "C" receiving waters with a minimum designated best usage for fishing with conditions suitable for fish propagation and survival.

Cattaraugus Creek, in the immediate downstream vicinity of the WNYNSC, is identified as a Class "B" receiving water with best designated usages for swimming and fishing. All fresh (nonsaline) groundwaters within New York are assigned a "GA" classification with a designated best usage as a potable water supply source.

Refer to Appendix B for a summary of the water quality standards, guidelines, and maximum contaminant levels (MCLs) assigned to these water classifications for those constituents that are included in the WVDP environmental monitoring program for ambient water.

Potable Water Standards. The CWA establishes water quality goals for fishing and swimming. The NYSDOH and EPA have further classified its jurisdictional waters and established ambient water standards, guidelines, and MCLs or MCL goals to achieve the objectives of the Safe Drinking Water Act. Primary drinking water standards, expressed as MCLs or MCL goals, provide for enforceable health based limits. See Appendix B-1 for a summary of these levels.

Soil and Sediment Concentration Guidelines. Contaminants in soil are potential sources for contamination of groundwater, surface water, ambient air, and plants and animals. Routine soil and sediment sampling is performed every five years.

The NRC and the EPA, in a 2002 memorandum of understanding pertaining to decommissioning and decontamination of contaminated sites, agreed upon concentrations of residual radioactivity in soil that would trigger consultation between the two agencies. Consultation “trigger” levels for radioactive contamination for nuclides applicable to the WVDP in both residential and industrial soil are reported in the ASER every fifth year with the soil and sediment sampling results for that year.

In 2006, the NRC, in a decommissioning guidance document (NUREG-1757, Vol. 2, 2006), provided concentration screening values for common radionuclides in soil that could result in a dose of 25 mrem/year.

In 2009, soil cleanup goals were developed from site-specific data for the “Phase 1 Decommissioning Plan for the WVDP,” Rev. 2, December 2009. These criteria are presented in Table 5-14 of the DP.

Evaluation of Monitoring Data with Respect to Limits

Monitoring data for this report were evaluated against the limits presented in Table UI-4, and in the Appendices. Those locations with results exceeding the limits are listed in Chapter 2, Table 2-4, and in Chapter 4, Table 4-8.

TABLE UI-4
U.S. Department of Energy Derived Concentration Standards (DCSs)[a]
for Inhaled Air or Ingested Water (µCi/mL)

Radionuclide	Half-life (years)[b]	DCSs in Inhaled Air[c]	DCSs in Ingested Water
Gross Alpha[d]	NA	8.1E-14 (as Pu-239/240)	9.8E-08 (as U-232)
Gross Beta[d]	NA	1.0E-10 (as Sr-90)	1.1E-06 (as Sr-90)
Tritium (H-3)	1.23E+01	2.1E-07[e]	1.9E-03
Carbon-14 (C-14)	5.70E+03	6.1E-07[f]	6.2E-05
Potassium-40 (K-40)	1.25E+09	2.6E-10	4.8E-06
Cobalt-60 (Co-60)	5.27E+00	3.6E-10	7.2E-06
Strontium-90 (Sr-90)	2.89E+01	1.0E-10	1.1E-06
Technetium-99 (Tc-99)	2.11E+05	9.2E-10	4.4E-05
Iodine-129 (I-129)	1.57E+07	1.0E-10	3.3E-07
Cesium-137 (Cs-137)	3.00E+01	8.8E-10	3.0E-06
Europium-154 (Eu-154)	8.59E+00	7.5E-11	1.5E-05
Uranium-232 (U-232)	6.89E+01	4.7E-13	9.8E-08
Uranium-233 (U-233)	1.59E+05	1.0E-12	6.6E-07
Uranium-234 (U-234)	2.46E+05	1.1E-12	6.8E-07
Uranium-235 (U-235)	7.04E+08	1.2E-12	7.2E-07
Uranium-236 (U-236)	2.34E+07	1.2E-12	7.2E-07
Uranium-238 (U-238)	4.47E+09	1.3E-12	7.5E-07
Plutonium-238 (Pu-238)	8.77E+01	8.8E-14	1.5E-07
Plutonium-239 (Pu-239)	2.41E+04	8.1E-14	1.4E-07
Plutonium-240 (Pu-240)	6.56E+03	8.1E-14	1.4E-07
Americium-241 (Am-241)	4.32E+02	9.7E-14	1.7E-07

[a] DCSs are defined as the concentration of a radionuclide that, under conditions of continuous exposure for one year. by one exposure mode, would result in an effective dose equivalent of 100 mrem (1mSv).
[b] Nuclear Wallet Cards. April 2005. National Nuclear Data Center. Brookhaven National Laboratory. Upton, New York.
[c] The DCS selection for air utilized the default type lung absorption rates for each nuclide, based on guidance from ICRP-72 for particulate aerosols when no specific chemical information is available.
[d] Because there are no DCSs for gross alpha and gross beta concentrations, the values for the most restrictive alpha and beta emitters at the WVDP (Pu-239/240 for alpha in air, U-232 for alpha in water, and Sr-90 for both air and water gross beta concentrations) are used as a conservative basis for comparison at locations for which there are no radionuclide-specific data, in which case a more appropriate DCS may be applied.
[e] The DCS for tritium represents the water vapor standard, selected from Table 5, DOE-STD-1196-2011.
[f] The DCS for carbon-14 represents the dioxide chemical form, selected from Table 5, DOE-STD-1196-2011.

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GLOSSARY

A

accuracy - The degree of agreement between a measurement and its true value. The accuracy of a data set is assessed by evaluating results from standards or sample spikes containing known quantities of an analyte.

action plan - An action plan addresses assessment findings and root causes that have been identified in an audit or an assessment report. It is intended to define specific actions that the responsible group will undertake to remedy deficiencies. The plan includes a timetable and resource requirements for implementation of the planned activities.

aquifer - A water-bearing unit of permeable rock or soil that will yield water in usable quantities via wells. Confined aquifers are bounded above and below by less permeable layers. Groundwater in a confined aquifer may be under a pressure greater than the atmospheric pressure. Unconfined aquifers are bounded below by less permeable material, but are not bounded above. The pressure on the groundwater at the surface of an unconfined aquifer is equal to that of the atmosphere.

aquitard - A low-permeability geologic unit that can store groundwater and can transmit groundwater at a very slow rate.

as low as reasonably achievable (ALARA) - An approach to radiation protection that advocates controlling or managing exposures (both individual and collective) to the work force and the general public and releases of radioactive material to the environment as low as social, technical, economic, practical, and public policy considerations permit. As used in United States (U.S.) Department of Energy (DOE) Order 458.1, ALARA is not a dose limit but, rather, a process that has as its objective the attainment of dose levels as far below the applicable limits of the order as practicable.

B

background radiation - Natural and man-made radiation such as: cosmic radiation, radiation from naturally radioactive elements, and radiation from commercial sources and medical procedures.

becquerel (Bq) - A unit of radioactivity equal to one nuclear transformation per second.

biweekly - Occurring at a frequency of every two weeks.

C

categorical exclusion (CX) - A proposed action that the DOE has determined does not individually or cumulatively have a significant effect on the human environment. See 10 Code of Federal Regulations (CFR) 1021.410.

Class A, B, and C low-level waste (LLW) - Waste classifications from the Nuclear Regulatory Commission's 10 CFR Part 61 rule. Maximum concentration limits are set for specific isotopes. Class A waste disposal is minimally restricted with respect to the form of the waste. Class B waste must meet more rigorous requirements to ensure physical stability after disposal. Higher radionuclide concentration limits are set for Class C waste (the most radioactive), which also must meet physical stability requirements. Moreover, special measures must be taken at the disposal facility to protect against inadvertent intrusion.

Some LLW, referred to by DOE as "Greater-than-Class-C waste (GTCC)," may not be acceptable for near-surface disposal, and may, for example need to be disposed of in a geologic repository.

compliance findings - Conditions that may not satisfy applicable environmental or safety and health regulations, DOE orders and memoranda, enforcement actions, agreements with regulatory agencies, or permit conditions.

confidence interval - The range of values within which some parameter may be expected to lie with a stated degree of confidence. For example, a value of 10 with an uncertainty of 5 calculated at the 95% confidence level (10±5) indicates there is a 95% probability that the true value of that parameter lies between 5 and 15.

consistency - The condition of showing steady conformity to practices. In the environmental monitoring program, approved procedures are in place so that data collection activities are carried out in a uniform manner to minimize variability.

Core Team - The "core team approach" is a formalized, consensus-based process in which those individuals with decision-making authority, including the DOE, the U.S. Environmental Protection Agency (EPA), and State remedial project managers, work together to reach agreement on key remediation decisions (DOE/EH-413-9911, October 1999). In August 2006, the DOE-West Valley Demonstration Project (DOE-WVDP) requested that the New York State Department of Health (NYSDOH), the U.S. Nuclear Regulatory Commission (NRC), the EPA (region 2), the New York State Department of Environmental Conservation (NYSDEC), and the New York State Energy Research and Development Authority (NYSERDA) participate in a collaborative process (i.e., Core Team) to resolve technical issues associated with the "Draft Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center" (DEIS).

critical receptor - A hypothetical off-site individual who it is estimated would receive the highest radiation dose from a potential air effluent release based on ambient air radioactivity measurements.

cosmic radiation - High-energy subatomic particles from outer space that bombard the earth's atmosphere. Cosmic radiation is part of natural background radiation.

curie (Ci) - A unit of radioactivity equal to 37 billion (3.7 x 10^{10}) nuclear transformations per second.

D

data set - A group of data (e.g., factual information such as measurements or statistics) used as a basis for reasoning, discussion, or calculation.

decay (radioactive) - Disintegration of the nucleus of an unstable nuclide by spontaneous emission of charged particles and/or photons or by spontaneous fission.

derived concentration standard (DCS) - The concentration of a radionuclide in air and water that, under conditions of continuous human exposure for one year by one exposure mode (i.e., ingestion of water, inhalation, or immersion in a gaseous cloud), would result in an effective dose equivalent of 100 millirem (mrem) (1 millisievert [mSv]). See Table UI-4 in the "Useful Information" section of this report.

detection limit or level (DL) - This term may also be expressed as "method detection limit" (MDL). The smallest amount of a substance that can be distinguished in a sample by a given measurement procedure at a given confidence level. (See *lower limit of detection*.)

dispersion (airborne) - The process whereby particulates or gases are spread and diluted in air as they move away from a source.

dispersion (groundwater) - The process whereby solutes are spread or mixed as they are transported by groundwater as it moves through the subsurface.

dosimeter - A portable device for measuring the total accumulated exposure to ionizing radiation.

downgradient - The direction of water flow from a reference point to a selected point of interest at a lower elevation than the reference point. (See *gradient.*)

E

effective dose - (See *effective dose equivalent* under *radiation dose*.)

effluent - Any treated or untreated air emission or liquid discharge to the environment.

effluent monitoring - Sampling or measuring specific liquid or gaseous effluent streams for the presence of pollutants to determine compliance with applicable standards, permit requirements, and administrative controls.

environmental assessment (EA) - An evaluation that provides sufficient evidence and analysis for determining whether an environmental impact statement is required or a finding of no significant impact should be issued. See 10 CFR 1021.

environmental impact statement (EIS) - A detailed statement that includes the environmental impact of the proposed action, any adverse environmental effects that cannot be avoided should the proposal be implemented, and alternatives to the proposed action. Detailed information may be found in Section 10 CFR 1021.

environmental management system (EMS) - The systematic application of business management practices to environmental issues, including defining the organizational structure, planning for activities, identifying responsibilities, and defining practices, procedures, processes, and resources.

environmental monitoring - The collection and analysis of samples or the direct measurement of environmental media. Environmental monitoring consists of two major activities: effluent monitoring and environmental surveillance.

environmental surveillance - The collection and analysis of samples or the direct measurement of air, water, soil, foodstuff, and biota in the environs of a facility of interest to determine compliance with applicable standards and to detect trends and environmental pollutant transport.

exposure - The subjection of a target (usually living tissue) to radiation.

F

finding - A DOE compliance term. A finding is a statement of fact concerning a condition in the Environmental, Safety, and Health program that was investigated during an appraisal. Findings include best management practice findings, compliance findings, and noteworthy practices. A finding may be a simple statement of proficiency or a description of deficiency (i.e., a variance from procedures or criteria). (See also *self-assessment*.)

fission - The act or process of splitting into parts. A nuclear reaction in which an atomic nucleus splits into fragments (i.e., fission products, usually fragments of comparable mass) with the evolution of approximately 100 million to several hundred million electron volts of energy.

G

gamma isotopic (also *gamma scan*) - An analytical method by which the quantity of several gamma ray-emitting radioactive isotopes may be determined simultaneously. Typical nuclear fuel cycle isotopes determined by this method include, but are not limited to, cobalt-60, zirconium-95, ruthenium-106, silver-110m, antimony-125, cesium-134, cesium-137, and europium-154. Naturally occurring isotopes for which samples may be analyzed are beryllium-7, potassium-40, radium-224, and radium-226.

gradient - Change in value of one variable with respect to another variable, such as a vertical change over a horizontal distance.

groundwater - Subsurface water in the pore spaces and fractures of soil and bedrock units.

H

half-life - The time in which half the atoms of a radionuclide disintegrate into another nuclear form. The half-life may vary from a fraction of a second to billions of years.

hazardous waste - A waste or combination of wastes that because of quantity, concentration, or physical, chemical, or infectious characteristics may: a) cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness; or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

high-level radioactive waste (HLW) - The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and solid waste derived from the liquid, that contains a combination of transuranic waste and fission products in concentrations sufficient to require permanent isolation. (See also *transuranic waste*.)

hydraulic conductivity - The ratio of flow velocity to driving force for viscous flow under saturated conditions of a specified liquid in a porous medium; the ratio describing the rate at which water can move through a permeable medium.

I

integrated safety management system (ISMS) - A process that describes the programs, policies, and procedures used at the WVDP to ensure the establishment of a safe workplace for the employees, the public, and the environment. The guiding principles of ISMS are line management responsibility for safety; clear roles and responsibilities; competence commensurate with responsibilities; balanced priorities; identification of safety standards and requirements; hazard controls; and operations authorization.

interim status - The status of any currently existing facility that becomes subject to the requirement to have a Resource Conservation and Recovery Act (RCRA) permit because of a new statutory or regulatory amendment to RCRA.

ion - An atom or group of atoms with an electric charge.

ion exchange - The reversible exchange of ions contained in solution with other ions that are part of the ion-exchange material.

ISO (International Organization for Standardization) - An international network of nongovernmental standards institutes that forms a bridge between the public and private sectors, and is the largest standards organization in the world. ISO enables a consensus to be reached on solutions that meet both the requirements of business and the broader needs of society.

***ISO 14001:2004* -** A standard for an EMS, which requires an organization to:

- Determine the organization's impact on the environment and relevant regulations to the operations of the business;
- Create a plan to control the organization's processes to minimize the environmental impact;
- Monitor the effectiveness of the system at meeting objectives, as well as legal and other; and
- Continually analyze the results and improve the organization's systems.

isotope - Different forms of the same chemical element that are distinguished by having the same number of protons but a different number of neutrons in the nucleus. An element can have many isotopes. For example, the three isotopes of hydrogen are protium, deuterium, and tritium, with one, two, and three neutrons in the nucleus, respectively.

K

knickpoint - A term in geomorphology to describe a location in a river or channel where there is a sharp change in channel slope resulting from differential rates of erosion.

L

land disposal restrictions (LDR) - Regulations promulgated by the EPA (and by NYSDEC in New York State) governing the land disposal of hazardous wastes. The wastes must be treated using the best demonstrated available technology or must meet certain treatment standards before being disposed.

lower limit of detection (LLD) - The lowest limit of a given parameter that an instrument is capable of detecting. A measurement of analytical sensitivity.

low-level radioactive waste (LLW or LLRW) - Radioactive waste not classified as high-level radioactive waste, transuranic waste, spent fuel, or uranium mill tailings. (See *Class A, B, C, and GTCC low-level waste*.)

M

maximally exposed individual (MEI) - Hypothetical on-site (occupational) or off-site (nonoccupational) individual who, because of realistically assumed proximity, activities, and living habits, would receive the highest radiation dose, taking into account all pathways, from a given event, process, or facility.

maximally exposed off-site individual (MEOSI) - Member of the general off-site public at a known residence who would receive the highest dose from an effluent release.

mean - The average value of a series of measurements.

metric ton - (See *ton, metric*.)

millirem (mrem) - A unit of radiation dose equivalent that is equal to one one-thousandth of a rem. An individual member of the public can receive up to 100 mrem per year according to DOE standards. This limit does not include the roughly 310 mrem, on average, that people in the U.S. receive annually from natural background radiation.

minimum detectable concentration (MDC) or **method detection limit (MDL) -** Depending on the sample medium, the smallest amount or concentration of a radioactive or nonradioactive analyte that can be reliably detected using a specific analytical method. Calculations of the minimum detectable concentrations are based on the lower limit of detection.

mixed waste (MW) - A waste that is both radioactive and RCRA hazardous.

N

n-Dodecane/tributyl phosphate - An organic solution composed of 30% tributyl phosphate (TBP) dissolved in n-dodecane used to first separate the uranium and plutonium from the fission products in dissolved nuclear fuel and then to separate the uranium from the plutonium.

neutron - An electrically neutral subatomic particle in the baryon family with a mass 1,839 times that of an electron, stable when bound in an atomic nucleus, and having a mean lifetime of just under 15 minutes as a free particle.

notice of violation (NOV) - Generally, an official notification from a regulatory agency of noncompliance with permit requirements. (An example would be a letter of notice from a regional water engineer in response to an instance of significant noncompliance with a State Pollutant Discharge Elimination System [SPDES] permit.)

nucleus - The positively-charged central region of an atom, made up of protons and neutrons and containing almost all of the mass of the atom.

O

outfall - The discharge end of a drain or pipe that carries wastewater or other liquid effluents into a ditch, pond, or river.

P

parameter - Any of a set of physical properties whose values determine the characteristics or behavior of something (e.g., temperature, pressure, density of air). In relation to environmental monitoring, a monitoring parameter is a constituent of interest. Statistically, the term “parameter” is a calculated quantity, such as a mean or variance, that describes a statistical population.

particulates - Solid particles and liquid droplets small enough to become airborne.

person-rem - The sum of the individual radiation dose equivalents received by members of a certain group or population. It may be calculated by multiplying the average dose per person by the number of persons exposed. For example, a thousand people each exposed to one millirem would have a collective dose of one person-rem.

plume - The distribution of a pollutant in air or water after being released from a source.

practical quantitation limits (PQLs) - The PQL is the minimum concentration of an analyte that can be measured within specified limits of precision during routine laboratory operations (NYSDEC, 1991).

precision - The degree of reproducibility of a measurement under a given set of conditions. Precision in a data set is assessed by evaluating results from duplicate field or analytical samples.

proton - A stable, positively-charged subatomic particle in the baryon family with a mass 1,836 times that of an electron.

pseudo-monitoring point - A theoretical monitoring location rather than an actual physical location; a calculation based on analytical test results of samples obtained from other associated, tributary, monitored locations. (Point 116 at the WVDP is classified as a “pseudo” monitoring point because samples are not physically collected at that location. Rather, using analytical results from samples collected from “real” upstream outfall locations, compliance with the total dissolved solids limit in the WVDP’s SPDES permit is calculated for this theoretical point.)

Q

quality factor (QF) - The extent of tissue damage caused by different types of radiation of the same energy. The greater the damage, the higher the quality factor. More specifically, the factor by which absorbed doses are multiplied to obtain a quantity that indicates the degree of biological damage produced by ionizing radiation. (See radiation dose.) The factor is dependent upon radiation type (alpha, beta, gamma, or x-ray) and exposure (internal or external).

R

rad - Radiation absorbed dose. One hundred ergs of energy absorbed per gram of solid material.

radiation - The process of emitting energy in the form of rays or particles that are thrown off by disintegrating atoms. The rays or particles emitted may consist of alpha, beta, or gamma radiation.

alpha radiation - The least penetrating type of radiation. Alpha radiation (similar to a helium nucleus) can be stopped by a sheet of paper or the outer dead layer of skin.

beta radiation - Electrons emitted from a nucleus during fission and nuclear decay. Beta radiation can be stopped by an inch of wood or a thin sheet of aluminum.

gamma radiation - A form of electromagnetic, high-energy radiation emitted from a nucleus. Gamma rays are essentially the same as x-rays and require heavy shielding such as lead, concrete, or steel to be effectively attenuated.

internal radiation - Radiation originating from a source within the body as a result of the inhalation, ingestion, or implantation of natural or man-made radionuclides in body tissues.

radiation dose:

absorbed dose - The amount of energy absorbed per unit mass in any kind of matter from any kind of ionizing radiation. Absorbed dose is measured in rads or grays.

collective dose equivalent - The sum of the dose equivalents for all the individuals comprising a defined population. The per capita dose equivalent is the quotient of the collective dose equivalent divided by the population. The unit of collective dose equivalent is person-rem or person-sievert.

collective effective dose equivalent - The sum of the effective dose equivalents for the individuals comprising a defined population. Units of measurement are person-rem or person-sievert. The per capita effective dose equivalent is obtained by dividing the collective dose equivalent by the population. Units of measurement are rem or sievert.

committed dose equivalent - A measure of internal radiation. The predicted total dose equivalent to a tissue or organ over a 50-year period after a known intake of a radionuclide into the body. It does not include contributions from sources of external penetrating radiation. Committed dose equivalent is measured in rem or sievert.

committed effective dose equivalent - The sum of the committed dose equivalents to various tissues in the body, each multiplied by the appropriate weighting factor. Committed effective dose equivalent is measured in rem or sievert.

total effective dose equivalent - The summation of the products of the dose equivalent received by specified tissues of the body and the appropriate weighting factors. It includes the dose from radiation sources internal and/or external to the body. The effective dose equivalent is expressed in units of rem or seivert.

radioactivity - A property possessed by some elements (such as uranium) whereby alpha, beta, or gamma rays are spontaneously emitted.

radioisotope - A radioactive isotope of a specified element. Carbon-14 is a radioisotope of carbon. Tritium is a radioisotope of hydrogen. (See *isotope*.)

radionuclide - A radioactive nuclide. Radionuclides are variations (isotopes) of elements. They have the same number of protons and electrons but different numbers of neutrons, resulting in different atomic masses. There are hundreds of known nuclides, both man-made and naturally occurring.

reference man - A hypothetical aggregation of human physical and physiological characteristics arrived at by international consensus. These characteristics may be used by researchers and public health workers to standardize results of experiments and to relate biological insult to a common base.

rem - An acronym for Roentgen Equivalent Man. A unit of radiation exposure that indicates the potential effect of radiation on human cells.

remote-handled waste - At the WVDP, waste that has an external surface dose rate that exceeds 100 millirem per hour or a high level of alpha and/or beta surface contamination and, therefore, must be handled in such a manner that it does not come into physical contact with workers.

roentgen - A unit of exposure to ionizing radiation. It is that quantity of gamma or x-rays required to produce ions carrying one electrostatic unit of electrical charge in one cubic centimeter of dry air under standard conditions. The unit is named after Wilhelm Roentgen, German scientist who discovered x-rays in 1895.

S

self-assessment - Appraisals of work at the WVDP by individuals, groups, or organizations responsible for overseeing and/or performing the work. Self-assessments are intended to provide an internal review of performance to determine that specific functional areas are in programmatic and site-specific compliance with applicable DOE directives, WVDP procedures, and regulations.

***finding* -** A direct and significant violation of applicable DOE, regulatory, or other procedural or programmatic requirements. A finding requires documented corrective action.

***observation* -** A condition that, while not a direct and significant violation of applicable DOE, regulatory, or other procedural or programmatic requirements, could result in a finding if not corrected. An observation may require documented corrective action.

***good practice* -** A statement of proficiency or confirmed excellence worthy of documenting.

sievert - A unit of dose equivalent from the International System of Units (Systeme Internationale). Equal to one joule per kilogram.

solid waste management unit (SWMU) - Any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility at which solid wastes have been routinely and systematically released or created. (See also *super solid waste management unit*.)

spent fuel - Nuclear fuel that has been used in a nuclear reactor; this fuel contains uranium, activation products, fission products, and plutonium.

spill - A spill or release is defined as "any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or otherwise disposing of substances from the ordinary containers employed in the normal course of storage, transfer, processing, or use," outside of the intended procedural action.

stakeholder - A person or group that has an investment, share, or interest in something. At the WVDP stakeholders include Project management, scientists, other employees, politicians, regulatory agencies, local and national interest groups, and members of the general public.

standard deviation - An indication of the dispersion of a set of results around their average.

super solid waste management unit (SSWMU) - Individual solid waste management units that have been grouped and ranked into larger units – super solid waste management units – because some individual units are contiguous or so close together as to make monitoring of separate units impractical. This terminology is unique to the WVDP, and is not an official regulatory term. (See also *solid waste management unit*.)

surface water - Water that is exposed to the atmospheric conditions of temperature, pressure, and chemical composition at the surface of the earth.

surveillance - The act of monitoring or observing a process or activity to verify conformance with specified requirements.

T

thermoluminescent dosimeter (TLD) - A device that luminesces upon heating after being exposed to radiation. The amount of light emitted is proportional to the amount of radiation to which the luminescent material has been exposed.

ton, metric (also *tonne*) **-** A unit of mass equal to 1,000 kilograms. (See also Table UI-2, "Units of Measure Used in This ASER.")

ton (*short ton*) **-** A unit of weight equal to 2,000 pounds or 907.1847 kilograms. (See also Table UI-2, "Units of Measure Used in This ASER.)

transuranic (TRU) waste - Waste containing transuranic elements, that is, those elements with an atomic number greater than 92, including neptunium, plutonium, americium, and curium.

U

universal wastes - Wastes subject to special management provisions that are intended to ease the management burden and facilitate recycling of such materials. Four types of waste are currently covered under the universal waste regulations: hazardous waste batteries, hazardous waste pesticides that are either recalled or collected in waste pesticide collection programs, hazardous waste thermostats, and hazardous waste lamps.

upgradient - Referring to the flow of water or air, “upgradient” is analogous to upstream. Upgradient is a point that is “before” an area of study and that is used as a baseline for comparison with downstream or downgradient data. (See *gradient* and *downgradient*.)

__V__

vitrification - A waste treatment process that encapsulates or immobilizes radioactive wastes in a glassy matrix to prevent them from reacting in disposal sites. Vitrification involves adding chemicals, glass formers, and waste to a heated vessel and melting the mixture into a glass that is then poured into a canister.

__W__

watershed - The area contained within a drainage divide above a specified point on a stream or river.

water table - The upper surface in a body of groundwater; the surface in an unconfined aquifer or confining bed at which the pore water pressure is equal to atmospheric pressure.

well point - A small-diameter well that is hammer-driven rather than placed into a pre-drilled borehole.

__X__

x-ray - Penetrating electromagnetic radiations having wave lengths shorter than those of visible light. They are usually produced by bombarding a metallic target with fast electrons in a high vacuum. In nuclear reactions it is customary to refer to photons originating in the nucleus as gamma rays and those originating in the extranuclear part of the atom as x-rays. These rays are sometimes called Roentgen rays after their discoverer, W.C. Roentgen.

ACRONYMS AND ABBREVIATIONS

Note: For abbreviations of units of measure, see Table UI-2, "Units of Measure Used in This ASER," in the "Useful Information" section.

A

ACM - Asbestos-Containing Material
AEA - Atomic Energy Act
ALARA - As Low As Reasonably Achievable
alpha-BHC - alpha-hexachlorocyclohexane
ASER - Annual Site Environmental Report
ASME - American Society of Mechanical Engineers
AST - Aboveground Storage Tank

B

BCG - Biota Concentration Guide
BOD_5 - Biological Oxygen Demand (5-day)
BOSF - Balance of Site Facilities
Bq - Becquerels

C

CAA - Clean Air Act
CBS - Chemical Bulk Storage
CCHD - Cattaraugus County Health Department
CD - Compact Disk
CDDL - Construction and Demolition Debris Landfill
CEDE - Committed Effective Dose Equivalent
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
CFMT - Concentrator Feed Makeup Tank
CFR - Code of Federal Regulations
CHBWV - CH2M HILL BWXT West Valley, LLC
CMS - Corrective Measures Study
CSAP - Characterization Sampling and Analysis Plan
CSPF - Container Sorting and Packaging Facility
CSRF - Contact Size-Reduction Facility
CSS - Cement Solidification System
CWA - Clean Water Act
CX - Categorical Exclusion
CY - Calendar Year

D

D&D - Decontamination and Decommissioning
DCG - Derived Concentration Guide
DCS - Derived Concentration Standard
DEIS - Draft Environmental Impact Statement
DMR - Discharge Monitoring Report
DO - Dissolved Oxygen
DOE - (U.S.) Department of Energy
DOE-HQ - Department of Energy, Headquarters Office
DOE-WVDP - Department of Energy, West Valley Demonstration Project (title as of June 2006)
DP - Decommissioning Plan

E

EA - Environmental Assessment
ECL - (New York State) Environmental Conservation Law
ECS - Environmental Compliance Summary
EDE - Effective Dose Equivalent
EIS - Environmental Impact Statement
ELAP - Environmental Laboratory Approval Program
EMS - Environmental Management System
EO - Executive Order
EPA - (U.S.) Environmental Protection Agency
EPCRA - Emergency Planning and Community Right-to-Know Act
EPEAT - Electronic Product Environmental Assessment Tool
ERO - Emergency Response Organization
ES - Environmental Services (within Regulatory Strategy Group)
ESRB - Executive Safety Review Board

F

FEIS - Final Environmental Impact Statement
FFCA - Federal Facilities Compliance Act
FONSI - Finding of No Significant Impact

FR - Federal Register
FRS - Fuel Receiving and Storage
FSSP - Final Status Survey Plan
FY - Fiscal Year

G

GHG - Greenhouse Gas
GMP - Groundwater Monitoring Program
GSL - (Site-Specific) Groundwater Screening Levels
GTCC - Greater Than Class C

H

ha - Hectare
HEPA - High Efficiency Particulate Air (filter)
HEV - Head End Ventilation
HLW - High-Level (radioactive) Waste
HP/BBS - Human Performance/Behavior-Based Safety
HQ - Headquarters
HVAC - Heating, Ventilation, and Air Conditioning
HWSL - Hazardous Waste Storage Locker

I

IAEA - International Atomic Energy Agency
IAP - Integrated Assessment Program
ICRP - International Commission on Radiological Protection
IM - Interim Measure
INEEL - Idaho National Engineering and Environmental Laboratory (1997 to 2005) now known as Idaho National Laboratory
ISMS - Integrated Safety Management System
ISO - International Organization for Standardization
ISP - Independent Scientific Panel
IWP - Industrial Work Permit

K

KRS - Kent Recessional Sequence
KT - Kent Till

L

LAS - Linear Alkylate Sulfonate
LLW - Low-Level (radioactive) Waste
LLW2 - Low-Level Waste Treatment Building
LLWTF - Low-Level Waste Treatment Facility (SSWMU #1)
LOI - Lines of Inquiry
LPS - Liquid Pretreatment System
LPRC - Low Profile Rail Cart
LSA - Lag Storage Addition
LTS - Lavery Till Sand
LWC - Liquid Waste Cell
LWTS - Liquid Waste Treatment System

M

MAPEP - Mixed Analyte Performance Evaluation Program
MCL - Maximum Contaminant Level
MEOSI - Maximally Exposed Off-Site Individual
MFHT - Melter Feed Hold Tank
MGD - Million Gallons per Day
MLLW - Mixed Low Level Waste
MOU - Memorandum of Understanding
MPPB - Main Plant Process Building

N

NA - Not Applicable
NCRP - National Council on Radiation Protection and Measurements
NDA - Nuclear Regulatory Commission (NRC)-Licensed Disposal Area
NEPA - National Environmental Policy Act
NESHAP - National Emission Standards for Hazardous Air Pollutants
NFS - Nuclear Fuel Services, Inc.
NH_3 - Ammonia
NOI - Notice of Intent
NO_2-N - Nitrite (as N)
NO_3-N - Nitrate (as N)
NO_x - Nitrogen Oxides
NPGMP - North Plateau Groundwater Monitoring Plan
NPGRS - North Plateau Groundwater Recovery System
NPOC - Nonpurgeable Organic Carbon
NQA-1 - Nuclear Quality Assurance, Level 1
NRC - (U.S.) Nuclear Regulatory Commission
NUREG - (U.S.) NRC Regulation
NYCRR - New York State Official Compilation of Codes, Rules, and Regulations
NYS - New York State
NYSDEC - New York State Department of Environmental Conservation
NYSDOH - New York State Department of Health
NYSDOL - New York State Department of Labor
NYSERDA - New York State Energy Research and Development Authority

O

OAD - Office of Atomic Development (historical)
OSTI - Office of Scientific and Technical Information
OVE - Outdoor Ventilation Enclosure

P

PA - Performance Assessment
PBS - Petroleum Bulk Storage
PCB - Polychlorinated Biphenyl
PEA - Programmatic Environmental Assessment
PEIS - Programmatic Environmental Impact Statement
PNL - Pacific Northwest Laboratory
POC - Principal Organic Contaminant
PPA - Probabilistic Performance Assessment
PPM - Parts Per Million
PQL - Practical Quantitation Limit
PTW - Permeable Treatment Wall
PTWPMP - Permeable Treatment Wall Performance Monitoring Plan
PVS - Permanent Ventilation System
PVU - Portable Ventilation Unit

Q

QA - Quality Assurance
QC - Quality Control

R

RAO - Remedial Action Objectives
RCRA - Resource Conservation and Recovery Act
REM - Roentgen Equivalent Man
RFI - RCRA Facility Investigation
RHWF - Remote-Handled Waste Facility
ROD - Record of Decision
RVS - Replacement Ventilation System
RVU - Replacement Ventilation Unit

S

S&G - Sand and Gravel Unit
SARA - Superfund Amendments and Reauthorization Act
SDA - (New York) State-Licensed Disposal Area
SEC - Safety and Ecology Corporation
SEQR - (New York) State Environmental Quality Review Act
SI - Systeme Internationale (International System of Units)
SME - Subject Matter Expert
SOC - Specific Organic Chemicals (NYSDOH). Also referred to as Synthetic Organic Chemicals by EPA.
SO_x - Sulfur Oxides
SPDES - (New York) State Pollutant Discharge Elimination System
SSP - Site Sustainability Plan
SSPP - Strategic Sustainability Performance Plan
SSWMU - Super Solid Waste Management Unit
STP - Site Treatment Plan
STS - Supernatant Treatment System
SU - Standard Unit
Sv - Sievert
SVOC - Semivolatile Organic Compound
SWMU - Solid Waste Management Unit
SWPPP - Storm Water Pollution Prevention Plan
SWS - Slackwater Sequence

T

T&VDS - Tank and Vault Drying System
TBP - Tributyl Phosphate
TBU - Thick-Bedded Unit
TDS - Total Dissolved Solids
TER - Technical Evaluation Report
TKN - Total Kjeldahl Nitrogen
TLD - Thermoluminescent Dosimeter
TOGS - Technical and Operational Guidance Series
TOX - Total Organic Halides
TRU - Transuranic
TSS - Total Suspended Solids

U

U.S. - United States
UDF - Unit Dose Factor
ULT - Unweathered Lavery Till
UOD - Ultimate Oxygen Demand
URS - URS - Energy & Construction Division (historical)
USACE - U.S. Army Corps of Engineers
USC - United States Code
UST - Underground Storage Tank

V

VCT - Vertical Cask Transporter
VIT - Vitrification
VOC - Volatile Organic Compound
VPP - Voluntary Protection Program
VSC - Vertical Storage Cask

W

WET - Whole Effluent Toxicity
WIR - Waste Incidental to Reprocessing
WLT - Weathered Lavery Till
WMA - Waste Management Area
WNYNSC - Western New York Nuclear Service Center
WTF - Waste Tank Farm
WVDP - West Valley Demonstration Project
WVES - West Valley Environmental Services LLC (historical)
WVNS - West Valley Nuclear Services (historical)
WVNSCO - West Valley Nuclear Services Company (historical)
WWTF - Wastewater Treatment Facility

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APPENDIX A

2015 Environmental Monitoring Program

Environmental Monitoring Program Drivers and Sampling Rationale

The index and tables on the following pages describe the WVDP routine environmental monitoring program for 2015. This program met or exceeded the requirements of DOE Order 458.1, "Radiation Protection of the Public and the Environment," and DOE-HDBK-1216-2015, "DOE Handbook, Environmental Radiological Effluent Monitoring and Environmental Surveillance" (March 2015). Specific methods and monitoring program elements were based on DOE/EP-0096, "A Guide for Effluent Radiological Measurements at DOE Installations," and DOE/EP-0023, "A Guide for Environmental Radiological Surveillance at U.S. Department of Energy Installations." Additional monitoring was mandated by air and water discharge permits (under the NESHAP regulations in 40 CFR 61, Subpart H, and the SPDES, respectively). Specific groundwater monitoring is required by the RCRA §3008(h) Administrative Order on Consent.

Permits, agreements, and/or programs may require formal reports of monitoring results. Radiological air emissions from the WVDP are reported annually in the NESHAP report to EPA. Nonradiological releases in water effluent and storm water drainage points covered under the SPDES permit are reported monthly to NYSDEC in a DMR. Groundwater monitoring results are reported quarterly to NYSDEC. Annual results from the monitoring program, as a whole, are evaluated and discussed in this ASER, which is prepared as directed in DOE Order 231.1B, "Environment, Safety, and Health Reporting," and associated guidance.

Table A-1 summarizes programmatic drivers and guidance applicable to each environmental medium measured or sampled as part of the WVDP Environmental Monitoring Program.

Sampling Schedule

Sampling locations are assigned a specific identifier, the location code, which is used to schedule sampling, track samples, and trace analytical results. Table A-2 provides the details of the sampling schedule for each location monitored in 2015. Routine sampling locations are shown on Figures A-2 through A-15. Table headings in the sampling program described in Table A-2 are as follows:

- **Sample Location Code**. This code describes the physical location where the sample is collected. The code consists of seven or eight characters: The first character identifies the sample medium as Air, Water, Soil/sediment, Biological, or Direct measurement. The second character specifies oN-site or oFf-site. The remaining characters describe the specific location (e.g., AFGRVAL is Air oFf-site at GReat VALley). Distances noted at sampling locations are as measured in a straight line from the ventilation stack of the MPPB on site. Groundwater and storm water sampling points (e.g., WNW0408, WNNDATR, WNSO04) are often abbreviated in figures or data tables (i.e., "408," "NDATR," "S04").

- **Sampling Type/Medium**. Describes the collection method and the physical characteristics of the medium or sample.

- **Collection Frequency/Total Annual Samples.** Indicates how often the samples are collected or retrieved and the total number of each type of sample processed in one year.

- **Measurements/Analyses**. Notes the type of measurement taken from the sampling medium and/or the constituents of interest, and (in some instances) the type of analysis conducted.

Index of Environmental Monitoring Program Sample Points

Sample Location	Description of Monitoring Point	Location shown on Figure
Air Effluent		
ANSTACK	Main Plant Process Building	Figure A-6
ANSTSTK	Supernatant Treatment System	Figure A-6
ANCSRFK (inactive)	Contact Size-Reduction Facility	Figure A-6
ANCSPFK (inactive)	Container Sorting and Packaging Facility	Figure A-6
ANVITSK	Vitrification Heating, Ventilation, and Air Conditioning	Figure A-6
ANRHWFK	Remote-Handled Waste Facility	Figure A-6
ANRVEU1	Main Plant Replacement Ventilation Unit 1	Figure A-6
OVEs/PVUs[a]	Outdoor Ventilated Enclosures/Portable Ventilation Units	Figure A-6
Liquid Effluent and On-Site Water		
WNSP001	Lagoon 3 Weir Point	Figure A-2
WNSP01B[a] (inactive)	Internal Process Monitoring Point	not shown
WNSP116	Pseudo-Monitoring Point Outfall 116	Figure A-2
WNSP007 (inactive)	Sanitary Waste Discharge	Figure A-2
WNURRAW[a]	Augmentation Water (collected in utility room)	not shown
WNSP006	Facility Main Drainage, Franks Creek at Security Fence	Figure A-2
Storm Water Outfalls		
GROUP 1		
S04 (WNSO04)	North Swamp Drainage (WNSW74A)	Figure A-3
GROUP 2		
S06 (WNSO06)	Northeast Swamp Drainage (WNSWAMP)	Figure A-3
S33 (WNSO33)	LAG Storage Drainage	Figure A-3
GROUP 3		
S09 (WNSO09)	Smartditch®	Figure A-3
S12 (WNSO12)	South Facility Drainage (WNSP005)	Figure A-3
GROUP 4		
S34 (WNSO34)	Rail Spur Culvert	Figure A-3
GROUP 5		
S14 (WNSO14)	NDA Service Road Drainage North	Figure A-3
S17 (WNSO17)	NDA Service Road Drainage South	Figure A-3
S28 (WNSO28)	Drum Cell West Road	Figure A-3
GROUP 6		
S36 (WNSO36)	Live-Fire Range Wetland Drainage	Figure A-4
S37 (WNSO37)	Pump House Roadway	Figure A-4
S38 (WNSO38)	Lake Two Roadway North	Figure A-4
S39 (WNSO39)	Lake Two Roadway South	Figure A-4
S41 (WNSO41)	Lake One Roadway	Figure A-4
S42 (WNSO42)	Pre-Railroad Spur Wetland Area (Near WFBCBKG)	Figure A-4
S43 (WNSO43)	Live-Fire Range Drainage East	Figure A-4

[a] *Location not shown on map.*

Index of Environmental Monitoring Program Sample Points *(continued)*

Sample Location	Description of Monitoring Point	Location shown on Figure
Storm Water Outfalls *(continued)*		
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GROUP 8		
S27 (WNSO27)	Drum Cell Drainage West	Figure A-3
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Storm Water Precipitation pH Measurement Location		
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On-Site Surface Water		
WNSWAMP	Northeast Swamp Drainage Point	Figure A-2
WNSW74A	North Swamp Drainage Point	Figure A-2
WNSP005	South Facility Drainage	Figure A-2
WNFRC67	Franks Creek East	Figure A-2
WNERB53	Erdman Brook	Figure A-2
WNNDADR	Disposal Area Drainage	Figure A-2
Off-Site Surface Water		
WFBCBKG	Buttermilk Creek Near Fox Valley, Background	Figure A-5
WFFELBR	Cattaraugus Creek at Felton Bridge	Figure A-5
WFBCTCB	Buttermilk Creek at Thomas Corners	Figure A-5
Soil and Sediment		
On-Site Soil/Sediment		
SNSW74A	Soil/Sediment at North Swamp Drainage Point	Figure A-2
SNSWAMP	Soil/Sediment at Northeast Swamp Drainage Point	Figure A-2
SNSP006	Soil/Sediment at Facility Main Drainage	Figure A-2
Off-Site Soil (collected at historical off-site air sampler locations)		
SFFXVRD	Surface Soil South-Southeast at Fox Valley	Figure A-5
SFRT240	Surface Soil Northeast on Route 240	Figure A-5
SFRSPRD	Surface Soil Northwest on Rock Springs Road	Figure A-5
SFGRVAL	Surface Soil South at Great Valley, Background	Figure A-14
Off-Site Sediment		
SFCCSED	Cattaraugus Creek at Felton Bridge, Sediment	Figure A-5
SFSDSED	Cattaraugus Creek at Springville Dam, Sediment	Figure A-5
SFTCSED	Buttermilk Creek at Thomas Corners, Sediment	Figure A-5
SFBCSED	Buttermilk Creek at Fox Valley Road, Background Sediment	Figure A-5

Index of Environmental Monitoring Program Sample Points *(continued)*

Sample Location	Description of Monitoring Point	Location shown on Figure
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SSWMU #2	Miscellaneous Small Units Wells	Figure A-9
SSWMU #3	Liquid Waste Treatment System Wells	Figure A-9
SSWMU #4	HLW Storage and Processing Tank Wells	Figure A-9
SSWMU #5	Maintenance Shop Leach Field Wells	Figure A-9
SSWMU #6	LLW Storage Area Wells	Figure A-9
SSWMU #7	Chemical Process Cell - Waste Storage Area Wells	Figure A-9
SSWMU #8	CDDL Wells	Figure A-9
SSWMU #9	NDA Unit Wells and NDATR	Figure A-10
SSWMU #10	IRTS Drum Cell Wells	Figure A-10
SSWMU #11	SDA Unit Wells	Figure A-10
RHWF	RHWF Wells	Figure A-9
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WNDWELL2	Drinking Water Well #2	Figure A-8
WNDRAW1/2	Raw, Untreated Groundwater (sampled from utility room)	Figure A-8
WNDFIN	Chlorinated, Filtered Groundwater (sampled from utility room)	Figure A-8
WNEHMKE	Bedrock Well South of Main Plant	Figure A-8
WWCOURT	Bedrock Well South of Annex	Figure A-8
WNCT272	Bedrock Well Southeast of Warehouse	Figure A-8
Potable Water Distribution System		
WNDNK06	Guardhouse Bathroom Sink	Figure A-8
WNDNK10	Utility Room Bathroom Sink	Figure A-8
WNDNK13	Vit Hill Mens Room Sink	Figure A-8
WNDNK15	Annex Ladies Room Sink	Figure A-8
WNDNK23	TSB Men’s Room Sink	Figure A-8
WNDNURSE	Nurse’s Office Sink	Figure A-8
WNDNKMP	Main Plant Shower	Figure A-8
WNDNKRH	RHWF Sink	Figure A-8

Index of Environmental Monitoring Program Sample Points *(concluded)*

Sample Location	Description of Monitoring Point	Location shown on Figure
Off-Site Ambient Air		
AF01_N	Bond Road	Figure A-7
AF02_NNE	Route 240	Figure A-7
AF03_NE	Route 240	Figure A-7
AF04_ENE	Route 240	Figure A-7
AF05_E	Heinz Road	Figure A-7
AF06_ESE	Buttermilk Road	Figure A-7
AF07_SE	Fox Valley Road	Figure A-7
AF08_SSE	Fox Valley Road	Figure A-7
AF09_S	Rock Springs Road	Figure A-7
AF10_SSW	Dutch Hill Road	Figure A-7
AF11_SW	Dutch Hill Road	Figure A-7
AF12_WSW	Dutch Hill Road	Figure A-7
AF13_W	Dutch Hill Road	Figure A-7
AF14_WNW	Boberg Road	Figure A-7
AF15_NW	Rock Springs Road	Figure A-7
AF16_NNW	Rock Springs Road, historical MEOSI location	Figure A-7
AF16HNNW	Co-located with AF16_NNW, High Volume Sampler	Figure A-7
AFGRVAL	Great Valley Sampler, Background	Figure A-14
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BFMBLSY	Milk, West-Northwest	Figure A-11
BFMSCHT	Milk, South	Figure A-11
BFMCTLS	Milk, Background	Figure A-14
BFDNEAR	Venison, Near-Site	Figure A-11
BFDCTRL	Venison, Background	Figure A-14
BFVNEAR[a]	Produce, Near-Site	Figure A-11
BFVCTRL[a]	Produce, Background	Figure A-14
BFFCATC	Fish, Cattaraugus Creek, Downstream	Figure A-11
BFFCATD	Fish from Cattaraugus Creek, Downstream of Springville Dam	Figure A-11
BFFCTRL	Fish from Cattaraugus Creek, Background	Figure A-14
Direct Measurement Dosimetry (Figures A-12 through A-14)		
DNTLD Series	On-Site/Near-Site Direct Radiation	Figure A-12
DFTLD Series	Off-Site Direct Radiation	Figure A-13
DFTLD23	Background Direct Radiation (more than 5 km from the WVDP)	Figure A-14

[a] Produce samples (corn, apples, and beans) are identified specifically as follows:
Near site: corn = BFVNEAC; apples = BFVNEAA, BFVNEAAF; beans = BFVNEAB
Background: corn = BFVCTRC; apples = BFVCRA; beans = BFVCTRB.

TABLE A-1
WVDP Environmental Program Drivers and Sampling Rationale

Programmatic Drivers	*Sampling Rationale*
On-Site Air Emissions	
40 CFR 61, Subpart H (radiological air emissions); DOE Order 458.1, Change 3	DOE-HDBK-1216-2015, Chapter 4.0 (airborne radiological effluent monitoring and sampling); DOE/EP-0096, Section 3.3 (criteria for effluent measurements)
Ambient Air	
DOE Order 458.1, Change 3	DOE-HDBK-1216-2015, Section 6.7.2 (environmental surveillance, air measurements, sampling locations); DOE/EP-0023, Section 4.2.3 (air sampling locations and measurement techniques)
On-Site Liquid Effluents and Storm Water	
New York State SPDES Permit No. NY 0000973 (nonradiological; specified points only), DOE Order 458.1, Change 3 (radiological)	DOE-HDBK-1216-2015, Section 3.4.4 (liquid effluent monitoring, sampling locations); New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certification for nonpotable water
Surface Water	
DOE Order 458.1, Change 3	DOE-HDBK-1216-2015, Section 6.10.1 (environmental surveillance, water sampling locations); NYSDOH ELAP certification for nonpotable water
Potable (Drinking) Water	
DOE Order 458.1, Change 3	DOE-HDBK-1216-2015, Section 6.10 (environmental surveillance, water sampling); NYSDOH ELAP certification for potable water
On-Site Groundwater	
RCRA §3008(h) Order on Consent (nonradiological); DOE Order 458.1, Change 3 (radiological)	DOE-HDBK-1216-2015, Section 6.10 (environmental surveillance, water sampling); NYSDOH ELAP certification for nonpotable water
Soil and Sediment	
DOE Order 458.1, Change 3	DOE-HDBK-1216-2015, Sections 6.9 (environmental surveillance, basis for sampling soil) and 6.12 (basis for sampling sediment)
Biological	
DOE Order 458.1, Change 3	DOE-HDBK-1216-2015, Sections 6.8 (environmental surveillance, sampling of terrestrial foodstuffs) and 6.11 (basis for sampling aquatic foodstuffs)
Direct Radiation	
DOE Order 458.1, Change 3	DOE-HDBK-1216-2015, Section 6.5 (environmental surveillance, external exposure monitoring); DOE/EP-0023, Section 4.6 (external radiation)

TABLE A-2
2015 Environmental Monitoring Program

<table>
<tr><th>Sample Location Code</th><th>Sampling Type/ Medium</th><th>Collection Frequency/ Total Annual Samples</th><th>Measurements/Analyses</th></tr>
<tr><td colspan="4">On-Site Air Emissions</td></tr>
<tr><td rowspan="5">ANSTACK[a]
MPPB ventilation exhaust stack

ANSTSTK[a]
STS ventilation exhaust

ANCSRFK[a,c] (inactive)
Contact size-reduction facility exhaust

ANCSPFK[a] (inactive)
Container sorting and packaging facility exhaust

ANVITSK[a]
VIT heating, ventilation, and air conditioning exhaust

ANRHWFK[a]
RHWF exhaust

ANRVEU1[a,d]
MPPB replacement ventilation emission unit exhaust</td><td>Continuous on-line air particulate monitors</td><td>Continuous measurement of fixed filter; replaced biweekly; held as backup</td><td>Real-time monitoring - CAM</td></tr>
<tr><td>Continuous off-line air particulate filters</td><td>Biweekly; 26 each location</td><td>Gross alpha/beta, gamma isotopic[b] upon collection, flow</td></tr>
<tr><td>Composite of biweekly particulate filters</td><td>Semiannually; 2 each location</td><td>Sr-90, U-232, U-233/234, U-235/236, U-238, total U, Pu-238, Pu-239/240, Am-241, gamma isotopic, flow</td></tr>
<tr><td>Continuous off-line desiccant columns for collection of water vapor</td><td>Biweekly; 26 each at ANSTACK and ANSTSTK only</td><td>H-3, flow</td></tr>
<tr><td>Continuous off-line charcoal cartridges</td><td>Cartridges collected biweekly and composited into 2 semiannual samples at each location</td><td>I-129</td></tr>
<tr><td rowspan="2">OVEs/PVUs[a]
Outdoor ventilated enclosures/portable ventilation units</td><td>Continuous off-line air particulate filter</td><td>Collected as required by project</td><td>Gross alpha/beta, gamma isotopic[b] upon collection, flow</td></tr>
<tr><td>Composite of filters</td><td>Semiannually</td><td>Sr-90, U-232, U-233/234, U-235/236, U-238, total U, Pu-238, Pu-239/240, Am-241, gamma isotopic, flow</td></tr>
</table>

[a] Required by 40 CFR 61, Subpart H. Results reported in the Annual NESHAP Report and evaluated in the ASER.
[b] Gamma isotopic analysis done only if gross alpha/beta activity rises significantly.
[c] Operation of the contact size-reduction stack was discontinued in July 2005. No activites were conducted in the facility in 2015. Building will be ventilated by PVU during pre-demolition activitiesin 2016
[d] The MPPB replacement ventilation emission unit, went online in August 2015.

TABLE A-2 (*continued*)
2015 Environmental Monitoring Program

Sample Location Code	*Sampling Type/ Medium*	*Collection Frequency/ Total Annual Samples*	*Measurements/Analyses*
On-Site Liquid Effluents			
WNSP001[a] Lagoon 3 discharge weir	Continuous	Daily during discharge. Lagoon 3 is discharged 3 to 8 times per year, averaging 6 to 7 days per discharge; 18–56 days per year	Daily flow, hold for flow-weighted composite
	Grab	Twice during discharge; 6–16 per year	Gross alpha/beta, H-3, Sr-90, gamma isotopic
	Flow-weighted composite of daily samples for each discharge	3 to 8 per year	Gross alpha/beta, H-3, C-14, Sr-90, Tc-99, I-129, gamma isotopic, U-232, U-233/234, U-235/236, U-238, total U, Pu-238, Pu-239/240, Am-241
	Grab	Twice during discharge; 6–16 per year	Settleable solids, TDS, Dissolved Oxygen (DO)
	24-hour composite	Twice during discharge; 6–16 per year	5-day Biological Oxygen Demand (BOD_5), Total Suspended Solids (TSS), Ammonia (as NH_3), TKN (as N), total Fe
	Grab	Once during discharge; 3–8 per year	Total Hg (method 1631), pH, total recoverable Co, Se, V, total residual chlorine, oil & grease, surfactant (as LAS)
	24-hour composite	Once during discharge; 3–8 per year	Total Al, total recoverable As, dissolved sulfide, NO_3-N, NO_2-N, SO_4
	24-hour composite	Quarterly; 4 per year, every five years[b]	Whole Effluent Toxicity (WET) Testing
	Grab	Semiannually; 2 per year	Cyanide amenable to chlorination, Heptachlor
	24-hour composite	Semiannually; 2 per year	Bromide, B, total Mn, Ni, total recoverable Cu, Cr, Pb, Ti, Zn
	Grab	Annually; 1 per year	Total recoverable Cr+6, Dichlorodifluoromethane, trichlorofluoromethane, 3,3-dichlorobenzidine, tributyl phosphate, xylene, hexachlorobenzene, 2-butanone, alpha-BHC, chloroform
	24-hour composite	Annually; 1 per year	Total Ba, Sb, total recoverable Cd
	Calculated from BOD_5 and TKN	Twice during discharge; 6–16 per year	Ultimate Oxygen Demand (UOD)
WNSP01B[a,c] Internal process monitoring point	Continuous	Recorded when operating	Total flow, elapsed flow time
	Grab liquid	Twice per month when operating; 0–24 per year	Total Hg (method 1631)
WNSP116[a] Pseudo-monitoring point outfall 116	Calculated	Twice per lagoon discharge; 6–16 per year	TDS

[a] Required by SPDES Permit #NY0000973. Results reported in the SPDES DMR and evaluated in the ASER.
[b] WET testing was performed quarterly for the first year in 2012, and will be repeated again in 2017.
[c] WNSP01B is no longer operated.

TABLE A-2 *(continued)*
2015 Environmental Monitoring Program

Sample Location Code	*Sampling Type/ Medium*	*Collection Frequency/ Total Annual Samples*	*Measurements/Analyses*
On-Site Liquid Effluents			
WNSP007[a,b] (inactive) Sanitary waste discharge	24-hour composite liquid	Monthly, when discharging	Gross alpha/beta, H-3
	Composite of monthly samples	Annually, if discharged during the year	Sr-90, gamma isotopic
	Grab	2 per month; when discharging	pH, settleable solids, TDS, DO, oil & grease
	24-hour composite	2 per month; when discharging	TSS, BOD_5, ammonia (as NH_3), total Fe
	Grab	Monthly, when discharging	Total residual chlorine, total Hg (method 1631)
	24-hour composite	Monthly, when discharging	TKN (as N), NO_2-N
	24-hour composite	2 per month; when discharging	Flow rate (gpm)
	Calculated from BOD_5 and TKN	Monthly, when discharging	UOD
	24-hour composite	Quarterly; 4 per year , once every 5 years[c]	WET Testing
	Grab	Annually, if discharged during the year	Chloroform
WNURRAW[a] Augmentation water from the reservoirs	Grab	Three per lagoon discharge: pre-discharge, near beginning, at end, 9-24 per year	TDS, flow rate
WNSP006 Franks Creek at the security fence	Timed continuous composite	Biweekly, 26 per year	Gross alpha/beta, H-3
	Composite of biweekly samples	Monthly; 12 per year	Sr-90 and gamma isotopic
	Composite of biweekly samples	Quarterly; 4 per year	C-14, Tc-99, I-129, U-232, U-233/234, U-235/236, U-238, total U, Pu-238, Pu-239/240, Am-241
	Grab	Three per lagoon discharge: pre-discharge, near beginning, at end, 9-24 per year	TDS, flow rate
Storm Water Outfalls			
Group 1[a] **S04 (WNSO04)**	First flush grab	Semiannually; 2 per year	pH, oil & grease, BOD_5, TSS, TDS, total P, Al, Fe, total recoverable Cu, Pb, Zn, Cd, Cr, Cr+6, Se, V, TKN (as N), ammonia (as NH_3), NO_3-N, NO_2-N, total nitrogen (as N)
	Flow-weighted composite	Semiannually; 2 per year	Maximum flow, total flow, plus all of the above constituents except for pH and oil & grease
Group 2[a] **WNSO06 (S06)** **WNSO33 (S33)**	First flush grab	Semiannually; 2 per year	pH, oil & grease, BOD_5, TSS, TDS, total P, Al, Fe, total recoverable Cu, Pb, Zn, surfactant (as LAS)
	Flow-weighted composite	Semiannually; 2 per year	Maximum flow, total flow, plus all of the above constituents except for pH and oil & grease

[a] Required by SPDES Permit #NY0000973. Results are reported in the SPDES DMR and evaluated in the ASER.
[b] The waste treatment facility was shutdown in November 2014. WNSP007 is not sampled if there is no discharge.
[c] WET testing was performed quarterly for the first year in 2012, and will be repeated again in 2017.

TABLE A-2 (*continued*)
2015 Environmental Monitoring Program

Sample Location Code	*Sampling Type/ Medium*	*Collection Frequency/ Total Annual Samples*	*Measurements/Analyses*
Storm Water Outfalls			
Group 3[a] **WNSO09 (S09)** **WNSO12 (S12)**	First flush grab	Semiannually; 2 per year	pH, oil & grease, BOD_5, TSS, TDS, total P, Al, Fe, Hg (method 1631), total recoverable Cu, Pb, Zn, TKN (as N), ammonia (as NH_3), NO_3-N, NO_2-N, alpha-BHC, total nitrogen (as N)
	Flow-weighted composite	Semiannually; 2 per year	Maximum flow, total flow, plus all of the above constituents (except for pH, oil & grease, and Hg [method 1631])
Group 4[a] **WNSO34 (S34)**	First flush grab	Semiannually; 2 per year	pH, oil & grease, BOD_5, TSS, TDS, total P, Al, Fe, total recoverable Cu, Pb, Zn, surfactant (as LAS)
	Flow-weighted composite	Semiannually; 2 per year	Maximum flow, total flow, plus all of the above constituents except for pH and oil & grease
Group 5[a] **WNSO14 (S14)** **WNSO17 (S17)** **WNSO28 (S28)**	First flush grab	Semiannually; 2 per year[b]	pH, oil & grease, BOD_5, TSS, TDS, total P, Al, Fe, total recoverable Cu, Pb, Zn, V, TKN (as N), ammonia (as NH_3), NO_3-N, NO_2-N, surfactant (as LAS), sulfide, settleable solids, total nitrogen (as N)
	Flow-weighted composite	Semiannually; 2 per year[b]	Maximum flow, total flow, plus all of the above constituents except for pH and oil & grease
Group 6[a] **WNSO36 (S36)** **WNSO37 (S37)** **WNSO38 (S38)** **WNSO39 (S39)** **WNSO41 (S41)** **WNSO42 (S42)** **WNSO43 (S43)**	First flush grab	Semiannually; 2 per year[b]	pH, oil & grease, BOD_5, TSS, TDS, total P, Al, Fe, total recoverable Cu, Pb, Zn, V, TKN (as N), ammonia (as NH_3), NO_3-N, NO_2-N, surfactant (as LAS), sulfide, settleable solids, total nitrogen (as N)
	S43 only, grab	Semiannually; 2 per year	Total recoverable Pb
	Flow-weighted composite	Semiannually; 2 per year[b]	Maximum flow, total flow, plus all of the above constituents except for pH and oil & grease
Group 7[a] **WNSO20 (S20)**	First flush grab	Semiannually; 2 per year	pH, oil & grease, BOD_5, TSS, TDS, total P, Al, Fe, total recoverable Cu, Pb, Zn, TKN (as N), ammonia (as NH_3), NO_3-N, NO_2-N, surfactant (as LAS), sulfide, total nitrogen (as N)
	Flow-weighted composite	Semiannually; 2 per year	Maximum flow, total flow, plus all of the above constituents except for pH and oil & grease

[a] Required by SPDES Permit # NY0000973. Results reported in the monthly SPDES DMR and evaluated in the ASER.
[b] For groups containing more than two outfalls, outfalls should be sampled in a rotational sequence until all outfalls in that group have been sampled.

TABLE A-2 (*continued*)
2015 Environmental Monitoring Program

Sample Location Code	*Sampling Type/ Medium*	*Collection Frequency/ Total Annual Samples*	*Measurements/Analyses*
Storm Water Outfalls *(continued)*			
Group 8[a] **WNSO27 (S27)** **WNSO35 (S35)**	First flush grab	Semiannually; 2 per year	pH, oil & grease, BOD_5, TSS, TDS, total P, Al, Fe, total recoverable Cu, Pb, Zn, TKN (as N), ammonia (as NH_3), NO_3-N, NO_2-N, surfactant (as LAS), total nitrogen (as N)
	Flow-weighted composite	Semiannually; 2 per year	Maximum flow, total flow, plus all of the above constituents except for pH and oil & grease
WNSWR01[a] Site rain gauge	Field measurement of precipitation	1 each storm water sampling event	inches of precipitation, pH
On-Site Surface Water			
WNSWAMP Northeast swamp drainage **WNSW74A** North swamp drainage	Timed continuous composite liquid	Biweekly; 26 per year	Gross alpha/beta, H-3, pH, flow (flow at WNSWAMP only)
	Composite of biweekly samples	Monthly; 12 per year	Sr-90 and gamma isotopic
	Composite of biweekly samples	Semiannually; 2 per year	C-14, I-129, U-232, U-233/234, U-235/236, U-238, total U, Pu-238, Pu-239/240, Am-241
WNSP005 Facility yard drainage **WNFRC67** Franks Creek east of SDA **WNERB53** Erdman Brook north of disposal areas	Grab liquid	Quarterly; 4 per year (**WNFRC67** and **WNERB53** collected at same time as **WNNDADR**)	Gross alpha/beta, H-3, pH
	Composite of quarterly samples	Semiannually; 2 per year	Sr-90 and gamma isotopic
WNNDADR Drainage between NDA and SDA	Timed continuous composite liquid	Biweekly; 26 per year	Hold for composite
	Composite of biweekly samples	Monthly; 12 per year	Gross alpha/beta, H-3, gamma isotopic
	Composite of biweekly samples	Semiannually; 2 per year	Sr-90 and I-129

[a] Required by SPDES Permit # NY0000973. Results reported in the monthly SPDES DMR and evaluated in the ASER.

TABLE A-2 (*continued*)
2015 Environmental Monitoring Program

Sample Location Code	*Sampling Type/ Medium*	*Collection Frequency/ Total Annual Samples*	*Measurements/Analyses*
On-Site Potable (Drinking) Water: Groundwater Supply			
WNDWELL1 and WNDWELL2 Raw water at wellheads	Grab liquid	As needed[d]	Total coliform and E. coli
WNDRAW1, WNDRAW2 Utility room raw water (unfiltered, unchlorinated)	Grab liquid	Monthly; 12 per year	Gross alpha/beta, H-3
		Annually; 1 per year	I-129 and gamma isotopic
WNDFIN Utility room chlorinated potable water (storage tank)	Grab liquid	Daily; 365 per year	Residual chlorine
		Quarterly; up to 4 per year[e]	POCs[e] , SOCs[e] , MTBE[e], vinyl chloride[e]
		Annually; 1 per year (2nd week in August)	Na, NO_3-N, NO_2-N[f]
		Once every 3 years	Ag, As, Ba, Be, Cd, Cr, Hg, Ni, Sb, Se, Tl, cyanide (as free), fluoride
WNDNKMP Main plant shower	Grab liquid	Annually; 1 per year	Gross alpha/beta, H-3
WNDNKRH RHWF drinking water	Grab liquid	Annually; 1 per year	Total haloacetic acids and total trihalomethanes
Distribution System Sinks: WNDNK06, 10, 13, 15, 23, WNDNKRH and WNDNURSE [a, b, c]	Grab liquid [b,c]	Quarterly[b] ; 4 per year	Total coliform, E. coli, residual chlorine[b]
		Once every three years[c]	Cu and Pb
On-Site Potable (Drinking) Water: Source Water Protection Monitoring for Groundwater Supply			
Bedrock monitoring wells: **WNEHMKE (EHMKE)** South of MPPB **WWCOURT (WWCOURT)** South of Annex **WNCT272 (60CT272)** Southeast of warehouse	Grab liquid	Biweekly; 24 per year	Gross alpha/beta, pH and conductivity

[a] Distribution system sinks include: Guard house (WNDNK06), Utility room (WNDNK10), Vit Hill men's room (WNDNK13), Annex ladies' room (WNDNK15), TSB men's room (WNDNK23), RHWF (WNDNKRH) and Nurse's office (WNDNURSE).

[b] One sample is collected by CCHD for bacteriolofical sampling from one of four sinks in the distribution system (WNDNK06, WNDNK23, WNDNKRH or WNDNURSE) on a rotational basis each quarter.

[c] Pb and Cu are analyzed for at five sinks (WNDFIN, WNDNK06, WNDNK10, WNDNK13 and WNDNK15) every three years. They were last sampled for Pb and Cu in 2014.

[d] Samples are collected at the wellheads only if bacteriological parameters are detected in the distribution system.

[e] Quarterly POCs and Specific Organic Chemicals (SOCs) sampling began in 2014. Based on the first three quarters of data, monitoring waivers were received from CCDH that expire 1/1/2021 for POCs and 12/31/2017 for SOCs.

[f] Only an initial sample for NO_2-N is required, unless it is detected at > 50% of the MCL. This initial sample was collected in 2015.

TABLE A-2 (*continued*)
2015 Environmental Monitoring Program

Sample Location Code	*Sampling Type/ Medium*	*Collection Frequency/ Total Annual Samples*	*Measurements/Analyses*
On-Site Groundwater			
LLW2: SSWMU #1 (wells 103, 104, 105, 106, 107, 108, 110, 111, 116, 8604, 8605) **Miscellaneous small units:** SSWMU #2 (wells 204, 205, 206) **LWTS:** SSWMU #3 (wells 301, 302) **HLW and processing tank:** SSWMU #4 (wells 401, 402, 403, 405, 406, 408, 409) **Maintenance shop leach field:** SSWMU #5 (wells 501, 502) **LLW storage area:** SSWMU #6 (wells 602A, 604, 605, 8607, 8609) **Chemical process cell waste storage area:** SSWMU #7 (wells 704, 706, 707) **CDDL:** SSWMU #8 (wells 801, 802, 803, 804, 8603, 8612) **NDA:** SSWMU #9 (wells 901, 902, 903, 906, 908, 908R, 909, 910R, 8610, 8611, trench NDATR) **IRTS drum cell**: SSWMU #10 (wells 1005, 1006, 1008B, 1008C) **RHWF** (not in a SSWMU): (wells 1301, 1302, 1303, 1304)	Grab liquid	Quarterly during the fiscal year (generally[a]); 4 per year	Gross alpha/beta, H-3. Select locations for radioisotopic analyses, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), or metals
	Direct field measurement	Twice each sampling event; 8 per year for wells sampled quarterly	Conductivity, pH

[a] Sampling frequency and analyses vary from point to point.

TABLE A-2 *(continued)*
2015 Environmental Monitoring Program

Sample Location Code	*Sampling Type/ Medium*	*Collection Frequency/ Total Annual Samples*	*Measurements/Analyses*
On-Site Groundwater			
MPPB downgradient wells (installed in 2010: MP-01, MP-02, MP-03, MP-04)	Grab liquid	Quarterly during the fiscal year (generally[a]); 4 per year	Gross alpha/beta, H-3, Radioisotopic analyses, VOCs, SVOCs, metals, and turbidity
	Direct field measurement	Twice each sampling event; 8 per year for wells sampled quarterly	Conductivity, pH
North plateau seeps (not in a SSWMU): (points GSEEP, SP04, SP06, SP11, SP12)	Grab liquid	Semiannually (quarterly at GSEEP); 2 (or 4) per year	Gross alpha/beta, H-3 (also VOCs at GSEEP and SP12)
	Direct field measurement of sampled water	Semiannually at SP12 (quarterly at GSEEP); 2 (or 4) per year	pH, conductivity
PTWPMP wells: (58 PTW platform wells at stations 1-12, installed in 2010 [i.e. PTW-S1A] and 21 pre-existing full network wells [i.e. WP02, MW-5])	Grab liquid	Quarterly (annually at full network wells); 4 (or 1) per year at each location	Strontim-90
	Grab liquid	Annually; 1 per year at each location	Geochemical parameters: Na, K, Ca, Mg, carbonate, bicarbonate, SO_4, Cl
	Direct field measurement	Quarterly (annually at full network wells); 4 (or 1) per year at each location	Conductivity, pH, temperature, oxidation-reduction potential, dissolved oxygen, and turbidity
NPGMP Wells: (25 north plateau wells)	Grab liquid	Quarterly; 4 per year at each location	Gross beta
Miscellaneous monitoring locations (not in a SSWMU): Well points WP-A, WP-C, WP-H	Grab liquid	Annually; 1 per year	Gross alpha/beta, H-3
	Direct field measurement of sampled water	Annually; 1 per year	pH, conductivity
Surface water elevation points: (SE007, SE008, SE009, SE011)	Direct field measurement	Quarterly; 4 per year at each location	Water level
SDA (SSWMU #11)	Groundwater wells in SSWMU #11 are sampled by NYSERDA under a separate program. For information, see the NYSERDA website at www.nyserda.ny.gov.		
On-Site Soil/Sediment			
SN on-site soil series: **SNSW74A** (near WNSW74A), **SNSWAMP** (near WNSWAMP), and **SNSP006** (near WNSP006)	Surface plug composite soil/sediment	1 each location every five years (sampled in 2012, will next be sampled in 2017)	Gross alpha/beta, gamma isotopic, Sr-90, U-232, U-233/234, U-235/236, U-238, total U, Pu-238, Pu-239/240, Am-241
Off-Site Soil			
SF off-site soil series (collected at historical air sampling location[s]); **SFFXVRD, SFRT240, SFRSPRD, SFGRVAL**	Surface plug composite soil	1 each location every five years (sampled in 2012, will next be sampled in 2017)	Gross alpha/beta, Sr-90, gamma isotopic, Pu-238, Pu-239/240, Am-241. At nearest site (**SFRSPRD**) and background (**SFGRVAL**), also U-232, U-233/234, U-235/236, U-238, and total U

[a] Sampling frequency and analyses vary from point to point.

TABLE A-2 *(continued)*
2015 Environmental Monitoring Program

Sample Location Code	*Sampling Type/ Medium*	*Collection Frequency/ Total Annual Samples*	*Measurements/Analyses*
Off-Site Sediment			
SFCCSED Cattaraugus Creek at Felton Bridge **SFSDSED** Cattaraugus Creek at Springville Dam **SFTCSED** Buttermilk Creek at Thomas Corners Road **SFBCSED** Buttermilk Creek at Fox Valley Road (background)	Grab stream sediment	1 each location every five years (sampled in 2012, will next be sampled in 2017)	Gross alpha/beta, gamma isotopic, Sr-90, U-232, U-233/234, U-235/236, U-238, total U, Pu-238, Pu-239/240, Am-241
Off-Site Surface Water			
WFBCBKG Buttermilk Creek near Fox Valley (background)	Timed continuous composite liquid	Biweekly; 26 per year	Hold for composite
	Composite of biweekly samples	Monthly; 12 per year	Gross alpha/beta, H-3
	Composite of biweekly samples	Semiannually; 2 per year	C-14, Sr-90, Tc-99, I-129, U-232, U-233/234, U-235/236, U-238, total U, Pu-238, Pu-239/240, Am-241, gamma isotopic
WFFELBR Cattaraugus Creek at Felton Bridge (downstream of confluence with Buttermilk Creek); nearest point of public access to waters receiving WVDP effluents	Timed continuous composite liquid	Biweekly; 26 per year	Gross alpha/beta, H-3, pH, flow
	Flow-weighted composite of biweekly samples	Monthly; 12 per year	Gross alpha/beta, H-3, Sr-90, and gamma isotopic
WFBCTCB Buttermilk Creek at Thomas Corners Road, downstream of WVDP and upstream of confluence with Cattaraugus Creek	Timed continuous composite liquid	Biweekly; 26 per year	Hold for composite
	Composite of biweekly samples	Monthly; 12 per year	Gross alpha/beta, H-3
	Composite of biweekly samples	Semiannually; 2 per year	Sr-90, gamma isotopic

TABLE A-2 *(continued)*
2015 Environmental Monitoring Program

Sample Location Code	*Sampling Type/ Medium*	*Collection Frequency/ Total Annual Samples*	*Measurements/Analyses*
Off-Site Ambient Air			
AF01_N North at Bond Road **AF02_NNE** North-northeast at Rt. 240 **AF03_NE** Northeast at Rt. 240 **AF04_ENE** East-northeast at Rt. 240	Glass fiber filters for air particulates	Biweekly; 26 per year	Gross alpha/beta screening, flow; Hold for composite
AF05_E East at Heinz Road **AF06_ESE** East-southeast at Buttermilk Road **AF07_SE** Southeast at Fox Valley Road **AF08_SSE** South-southeast at Fox Valley Road	Charcoal cartridge for iodine	Monthly; 12 per year	I-129 screening, flow; Hold for composite
AF09_S South at Rock Springs Road **AF10_SSW** South-southwest at Dutch Hill Road **AF11_SW** Southwest at Dutch Hill Road **AF12_WSW** West-southwest at Dutch Hill Road	Composite of biweekly glass fiber filters	Quarterly; 4 per year	Sr-90, Cs-137, U-232, Pu-238, Pu-239/240, Am-241, flow
AF13_W West at Dutch Hill Road **AF14_WNW** West-northwest at Boberg Road **AF15_NW** Northwest at Rock Springs Road **AF16_NNW** North-northwest at Rock Springs Road (Low volume sampler at historical MEOSI location)	Composite of monthly charcoal	Quarterly; 4 per year	I-129, flow

TABLE A-2 *(continued)*
2015 Environmental Monitoring Program

Sample Location Code	*Sampling Type/ Medium*	*Collection Frequency/ Total Annual Samples*	*Measurements/Analyses*
Off-Site Ambient Air			
AF16HNNW North-northwest at Rock Springs Road (High volume sampler at historical MEOSI location)	Glass fiber filters for air particulates	Biweekly; 26 per year	Gross alpha/beta screening, flow; Hold for composite
	Composite of biweekly glass fiber filters	Quarterly; 4 per year	Sr-90, Cs-137, U-232, Pu-238, Pu-239/240, Am-241, flow
AFGRVAL 29 km south at Great Valley (background)	Glass fiber filter for air particulates	Biweekly; 26 per year	Gross alpha/beta screening, flow; Hold for composite
	Charcoal cartridge for iodine	Monthly; 12 per year	I-129 screening, flow; Hold for composite
	Composite of monthly charcoal	Quarterly; 4 per year	I-129, flow
	Composite of biweekly glass fiber filters	Quarterly; 4 per year	Sr-90, gamma isotopic, U-232, U-233/234, U-235/236, U-238, total U, Pu-238, Pu-239/240, Am-241, flow
Off-Site Biological			
BFMFLDMN Dairy farm 5.1 km southeast of WVDP	Grab milk sample	Annual; 1 per year	Sr-90, I-129, gamma isotopic
BFMCTLS Control location 22 km south (background) **BFMBLSY** Dairy farm 5.5 km west-northwest **BFMSCHT** Dairy farm 4.9 km south	Grab milk sample	Each location and background, once every five years (sampled in 2012, will next be sampled in 2017)	Sr-90, I-129, gamma isotopic
BFDNEAR Deer in the vicinity of the WVDP **BFDCTRL** Control deer 16 km or more from the WVDP	Individual collection of venison samples, usually from deer killed in collisions with vehicles	Six deer collected annually during hunting season (3 near-site, 3 background)	Gamma isotopic and Sr-90 in edible portions of meat, % moisture, H-3 in free moisture
BFVNEAR Apples, beans, and corn from locations near the WVDP **BFVCTRL** Control apples, beans, and corn from locations far from the WVDP	Grab biological	Each food crop and background, once every five years at time of harvest (sampled in 2012, will next be sampled in 2017)	Gamma isotopic and Sr-90 in edible portions, % moisture, H-3 in free moisture

TABLE A-2 *(concluded)*
2015 Environmental Monitoring Program

Sample Location Code	*Sampling Type/ Medium*	*Collection Frequency/ Total Annual Samples*	*Measurements/Analyses*
Off-Site Biological			
BFFCATC Fish from Cattaraugus Creek downstream of its confluence with Buttermilk Creek **BFFCATD** Fish from Cattaraugus Creek downstream of the Springville Dam **BFFCTRL** Control fish sample from nearby stream not affected by WVDP (7 km or more upstream of site effluent point); background	Individual collection of fish	Once every 5 years; 10 fish from each location (sampled in 2012, will next be sampled in 2017)	Gamma isotopic and Sr-90 in edible portions, % moisture
Off-Site Direct Radiation			
DFTLD Series: Off-site environmental thermoluminescent dosimeters (TLDs): **#1 through #16**, at each of 16 compass sectors at nearest accessible perimeter point **#20:** 1,500 m northwest (downwind receptor) **#23:** 29 km south, Great Valley (background)	Integrating TLD	Semiannually; 2 per year at each location	Gamma radiation exposure
On-Site/ Near-Site Direct Radiation			
DNTLD Series: On-site TLDs **#33**: Corner of the SDA **#24, #28, #44**[a] : Security fence around the WVDP **#32, #34**[b] **, #35, #36**: Drum Cell road and Drum Cell south fence **#38, #40**: Near operational areas on-site **#43**: SDA west perimeter fence	Integrating TLD	Semiannually; 2 per year at each location	Gamma radiation exposure

[a] TLD #44 was added on the Rock Springs Road security fence in 2014, to monitor the HLW canister storage pad.
[b] TLD #34, located southeast if the drum cell, was discontinued in March 2015.

Summary of Monitoring Program Changes in 2015

Description of Changes

There were no major changes to the overall environmental monitoring program in 2015. Minor changes to the environmental monitoring program are described below.

Emission Unit 1, providing replacement ventilation for a portion of the MPPB, began routine operations in August 2015. HEPA filtered air from the two parallel units is discharged, monitored and sampled at a single point, ANRVEU1, shown on Figure A-6. The effluent stack for the size-reduction facility in LSA #4 (CSRF) did not operate in 2015 and was therefore not sampled.

Operation of the wastewater treatment facility was discontinued in October 2014. Consequently, sampling of the sanitary waste discharge at WNSP007 under the SPDES program was discontinued in November 2014 and no samples from WNSP007 were collected during 2015.

The biweekly collection frequency at WNSP006 and WFFELBR during Lagoon 3 discharge periods was standardized in 2015.

Semi-annual sampling of water quality parameters at WFBCTCB was discontinued in 2015.

TLD #44 was deployed along Rock Springs Road at the end of CY 2014. TLD #34, located south of the Drum Cell, was discontinued in March 2015. Both TLDs were monitored during the first sampling round of 2015.

The environmental monitoring program requires the collection of soils, aquatic sediments, milk (from multiple locations), apples, beans, corn, beans, corn, and fish every five years. These environmental matrices (with the exception of milk which is still done at one location every year) were sampled in 2012 and will not be sampled again until 2017.

FIGURE A-1
West Valley Demonstration Project Base Map

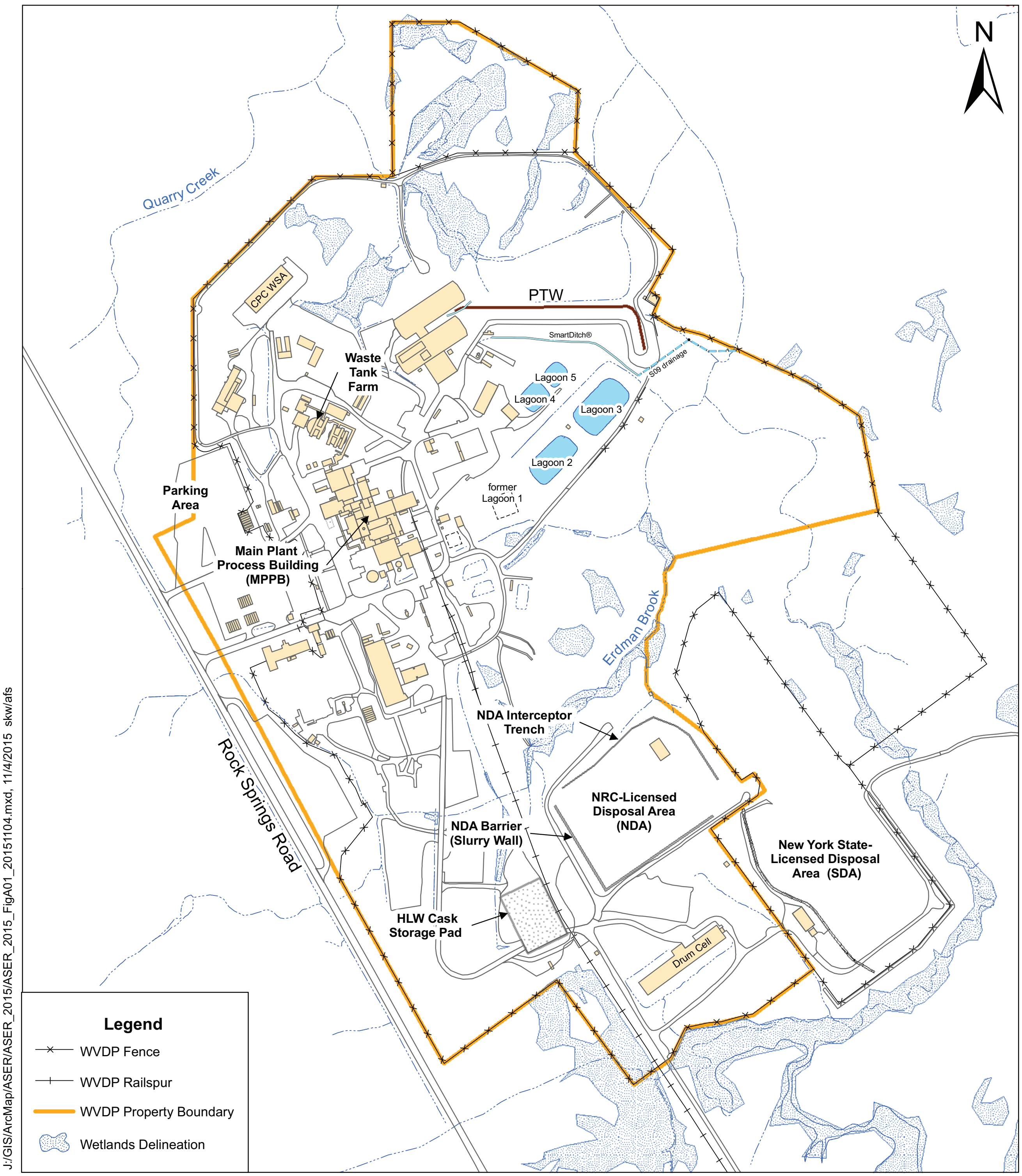


FIGURE A-2
On-Site Liquid Effluent, Surface Water and Soil/Sediment Sampling Locations

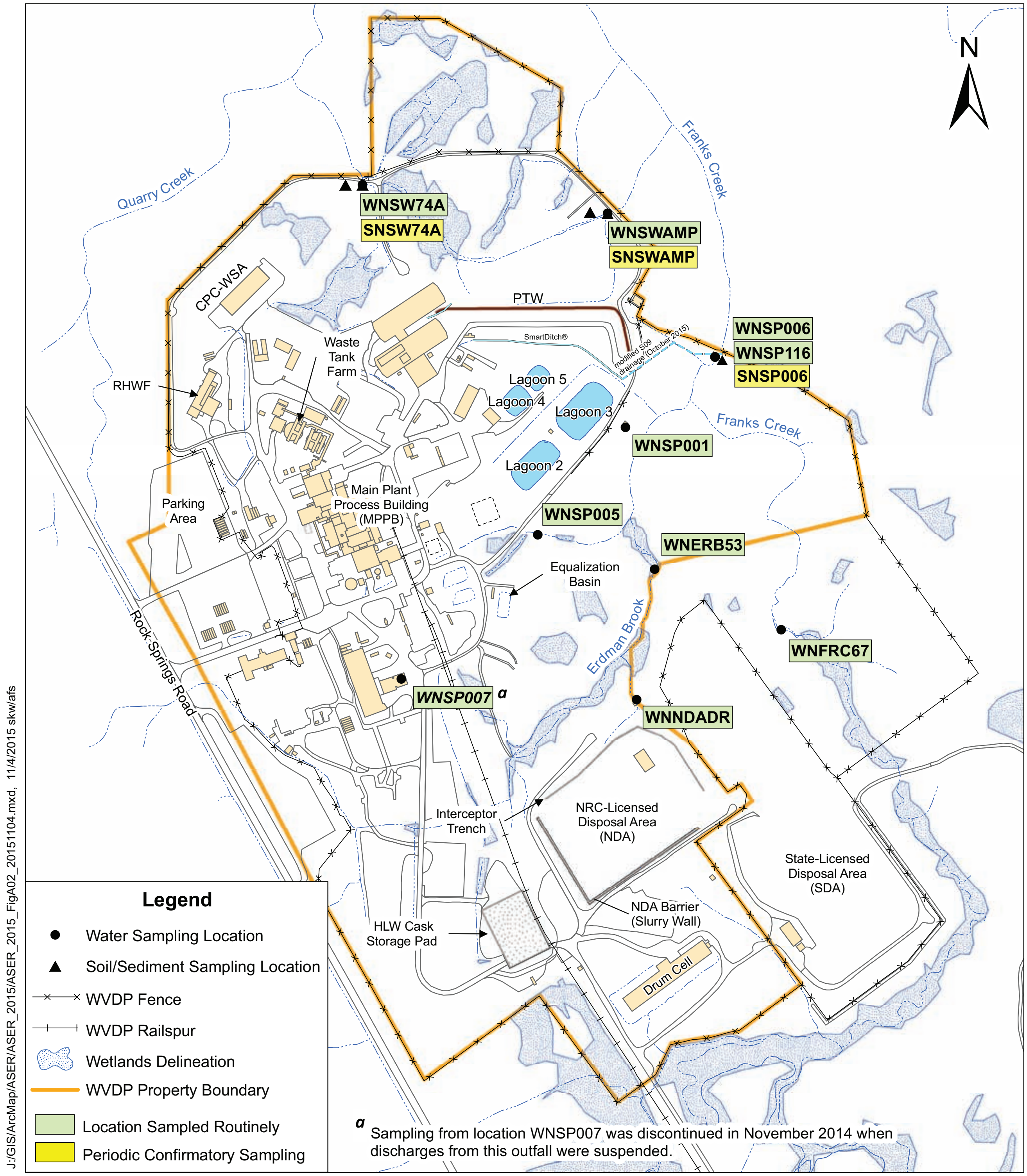


FIGURE A-3
On-Site Storm Water Outfalls

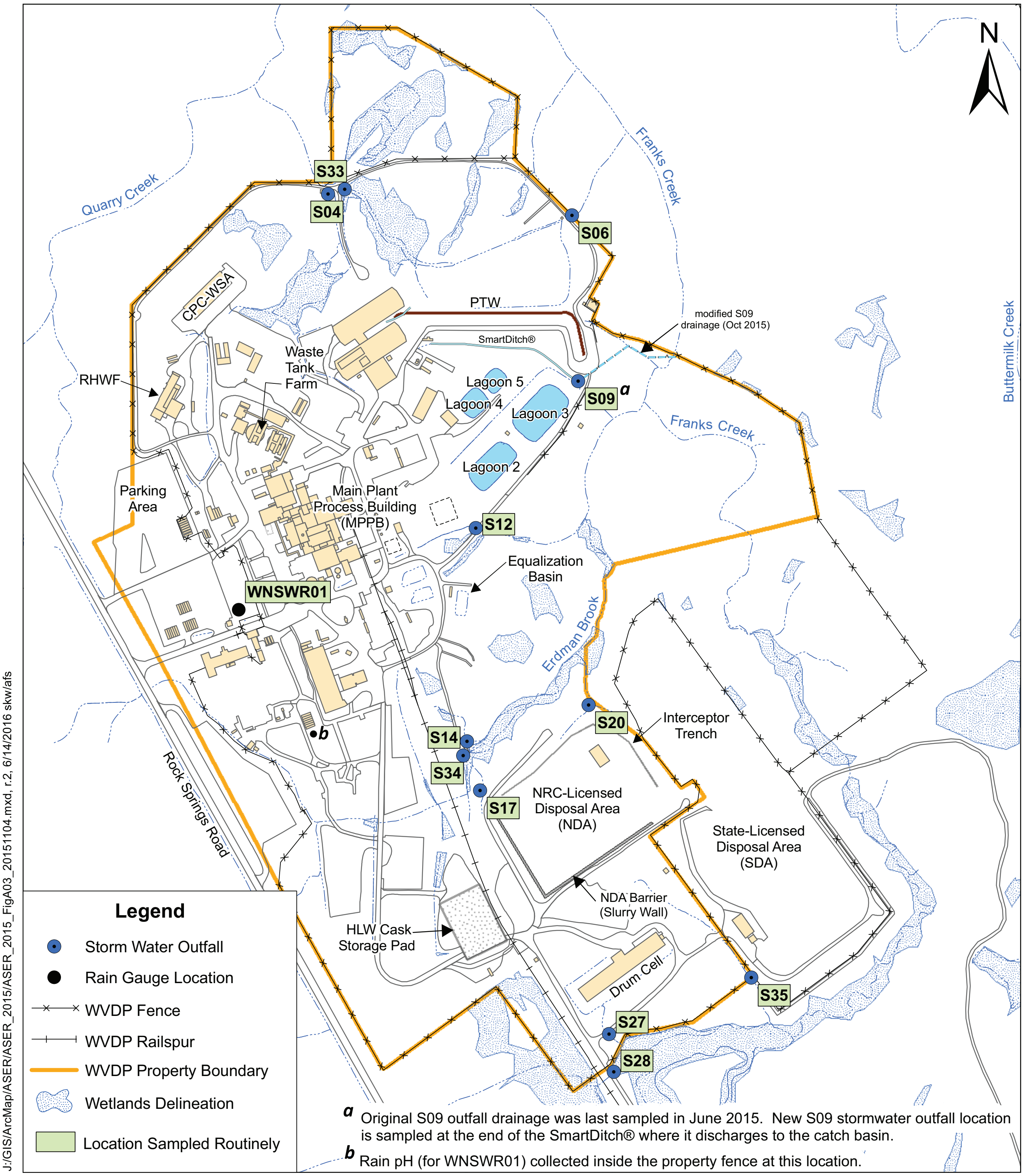


FIGURE A-4
Rail Spur Storm Water Outfalls

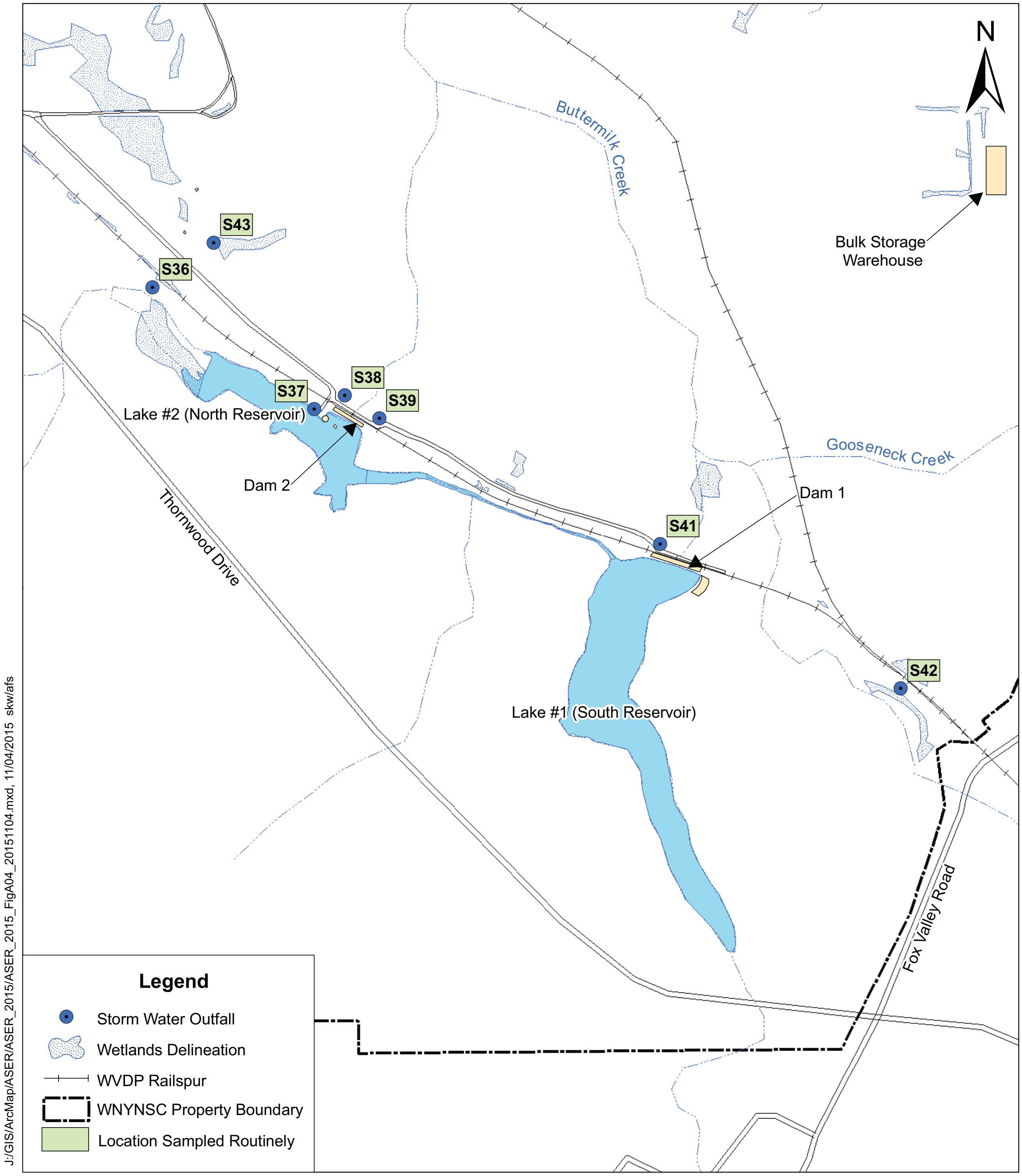


FIGURE A-5
Off-Site Surface Water and Soil/Sediment Sampling Locations

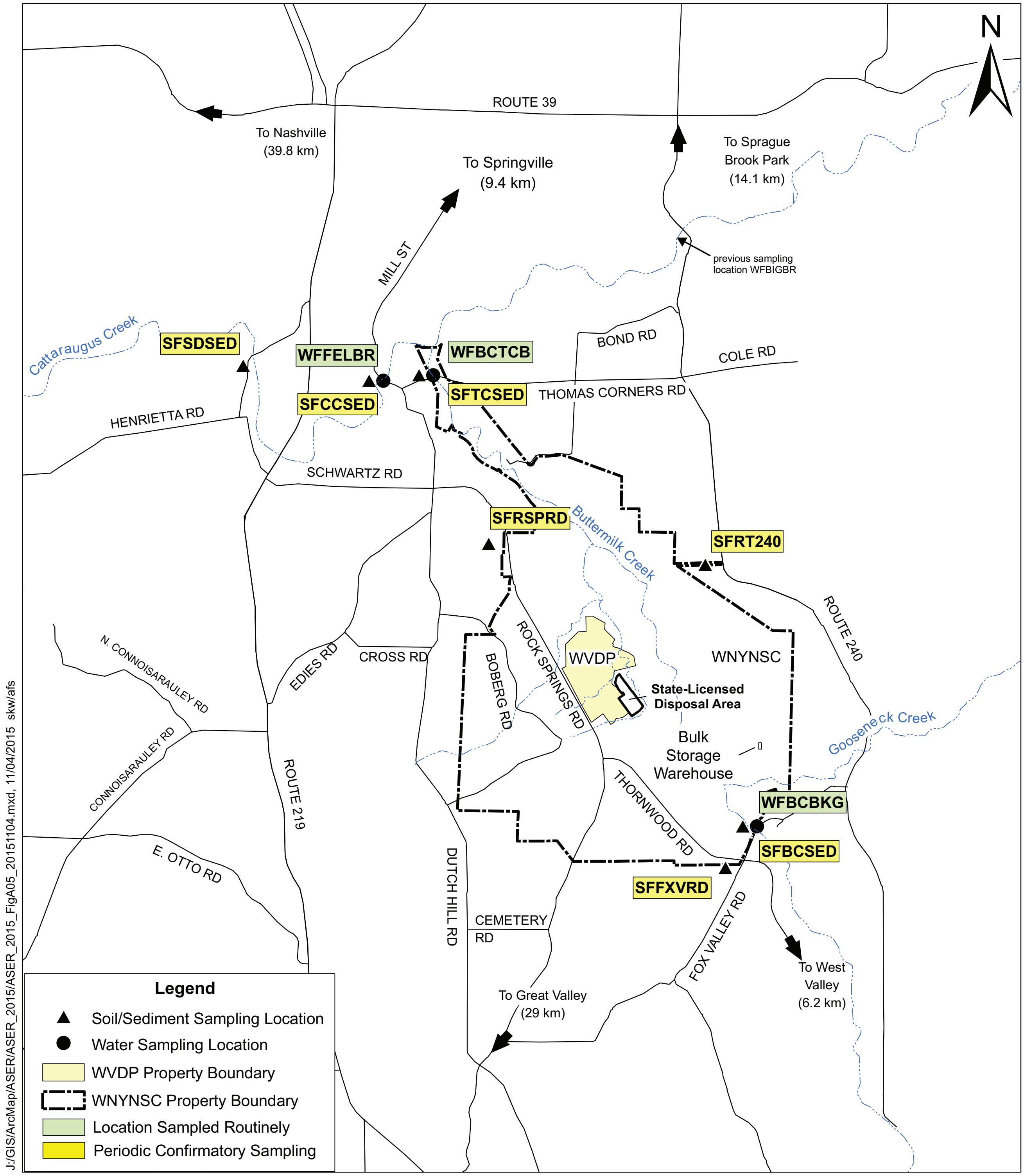
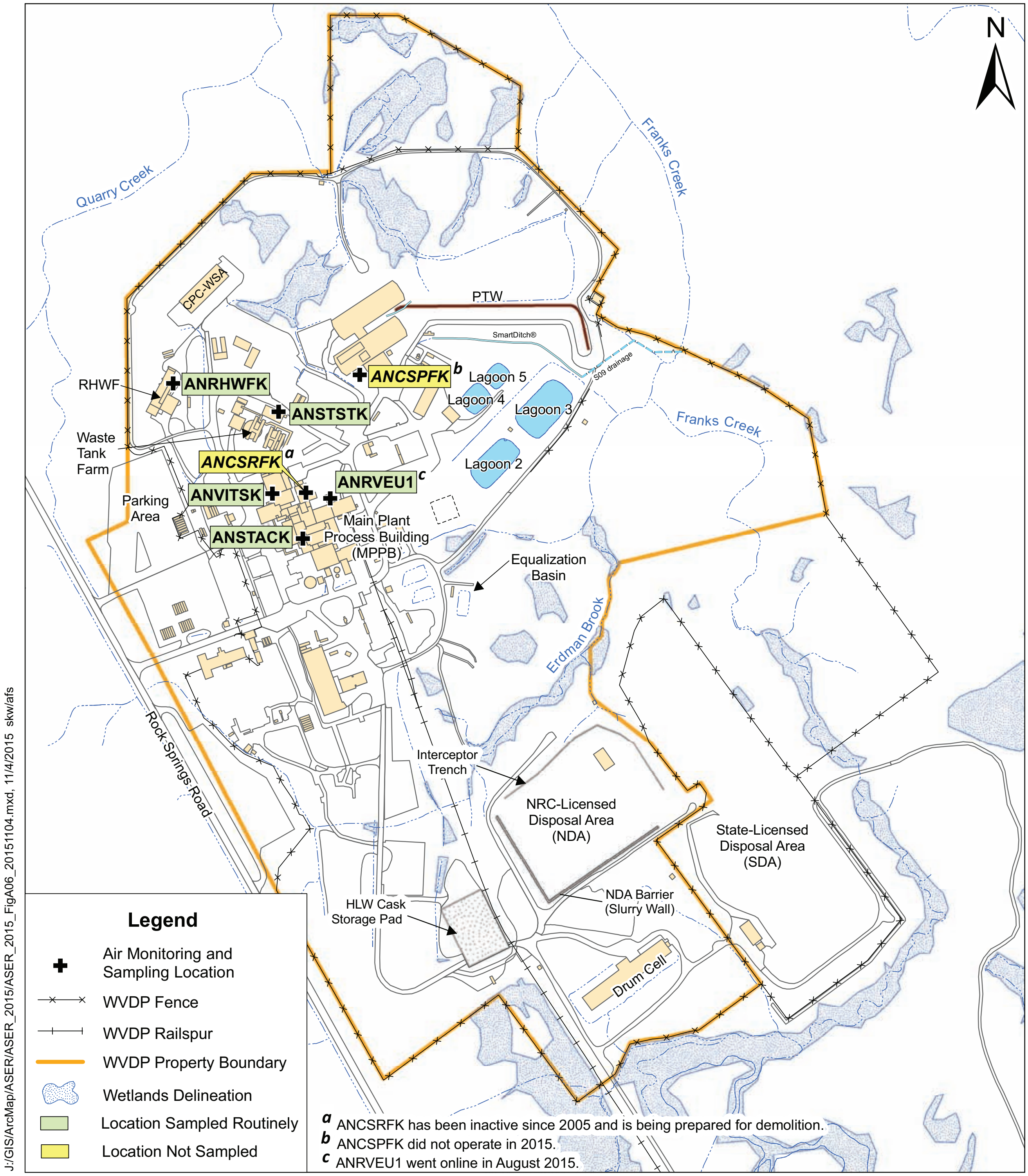


FIGURE A-6
On-Site Air Monitoring and Sampling Locations



[a] ANCSRFK has been inactive since 2005 and is being prepared for demolition.
[b] ANCSPFK did not operate in 2015.
[c] ANRVEU1 went online in August 2015.

FIGURE A-7
Off-Site Ambient Air Monitoring and Sampling Locations

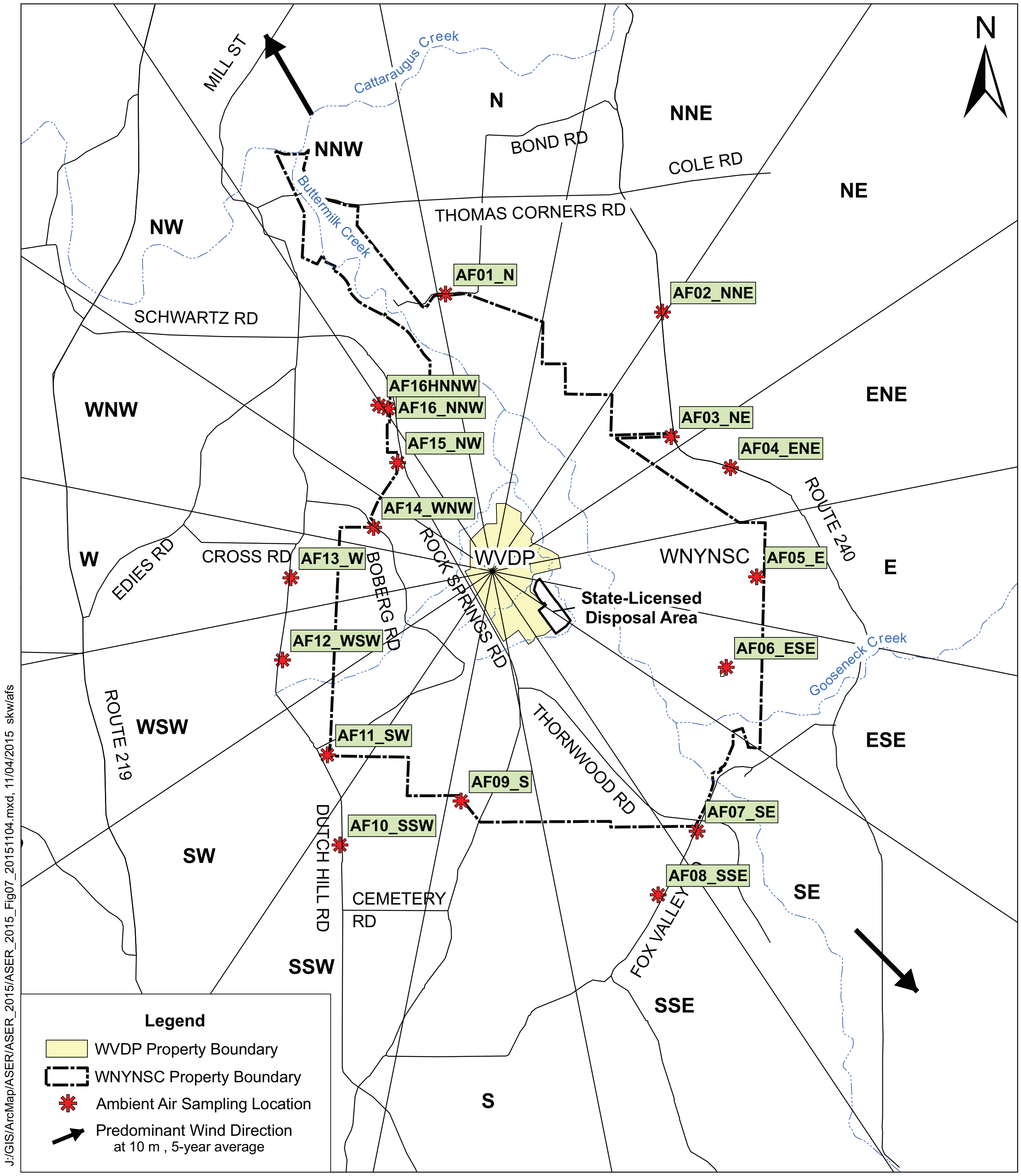


FIGURE A-8
Drinking Water Supply Wells and Source Water Protection Monitoring Network

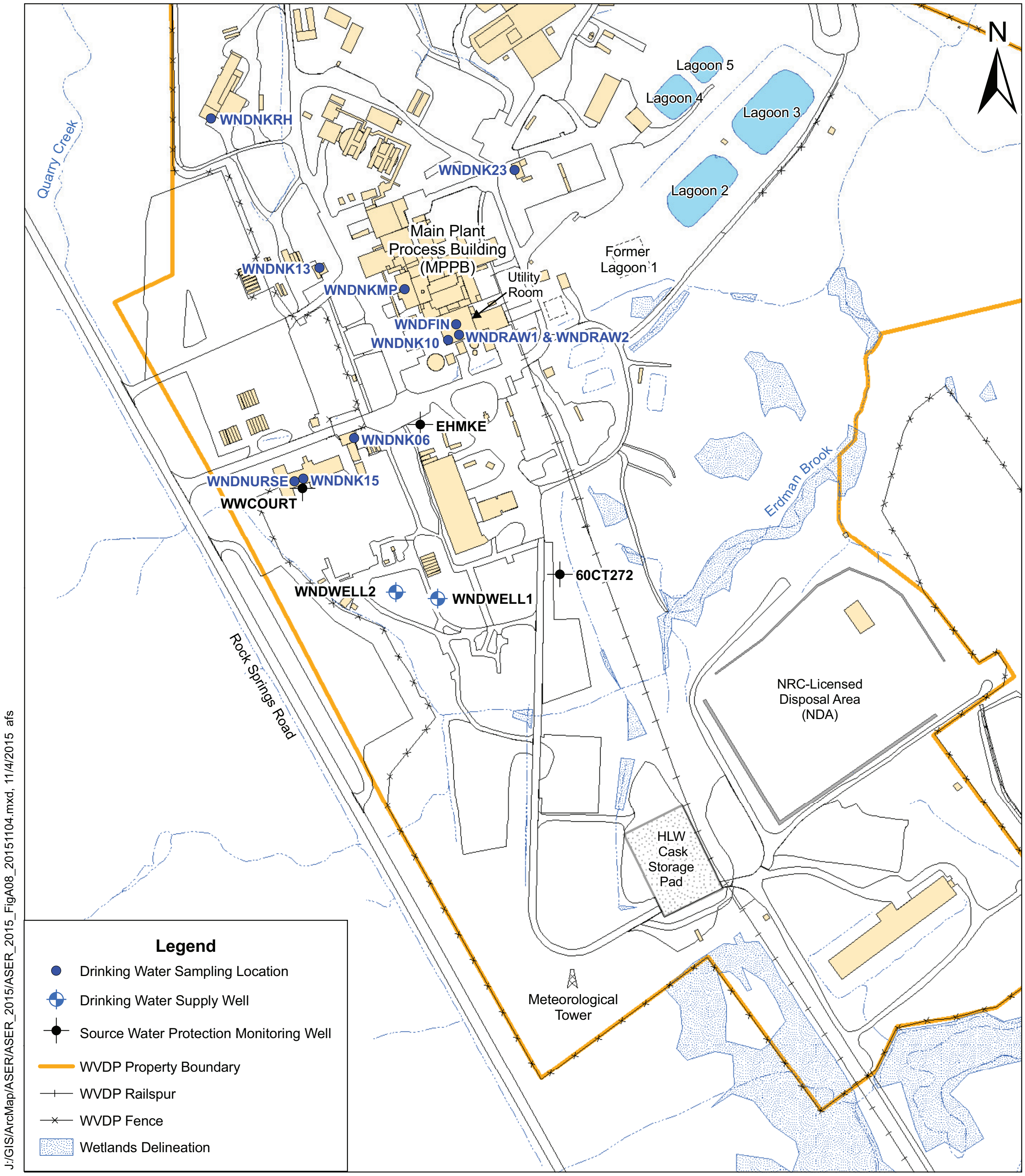


FIGURE A-9
North Plateau Groundwater Monitoring Network

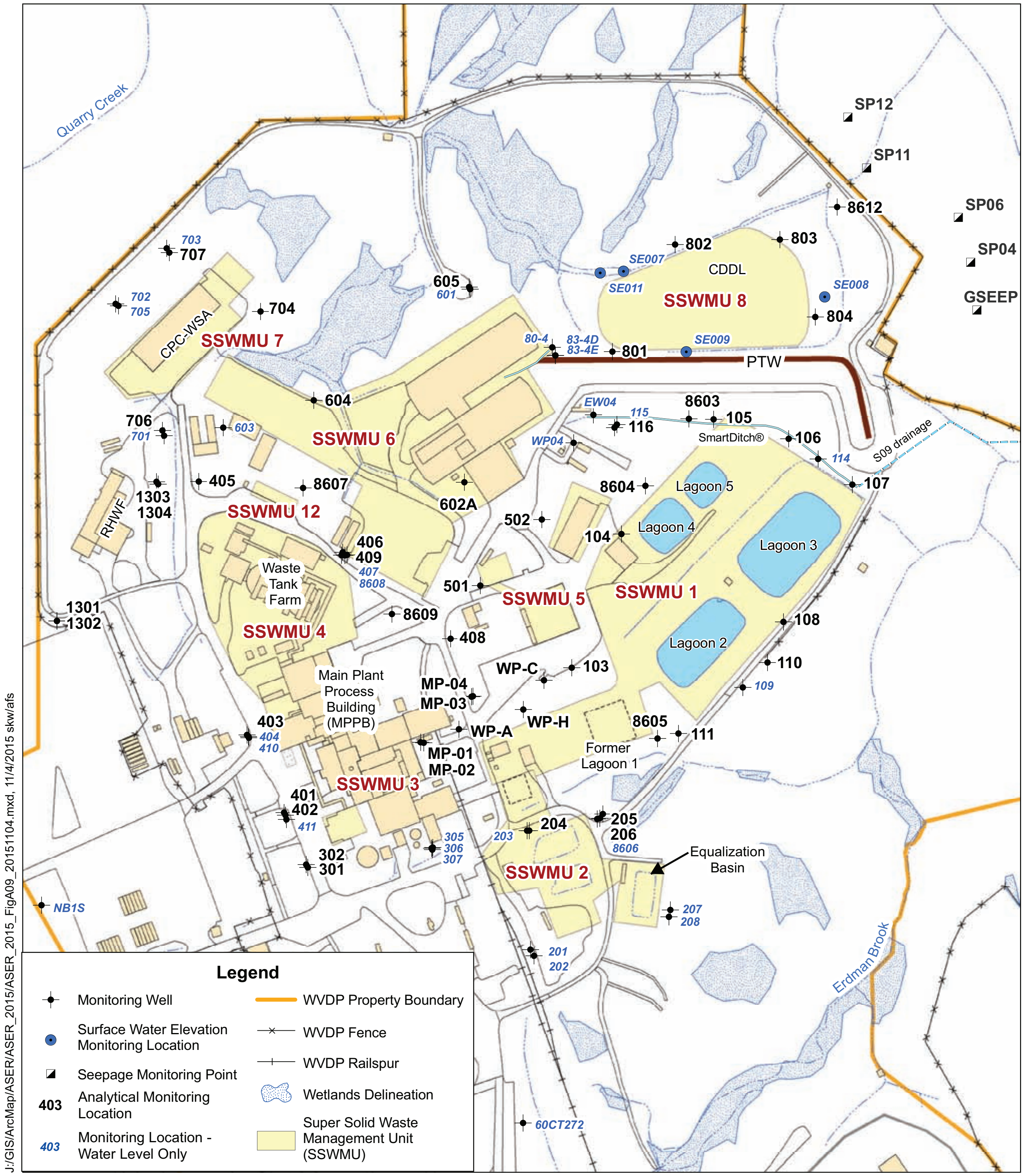
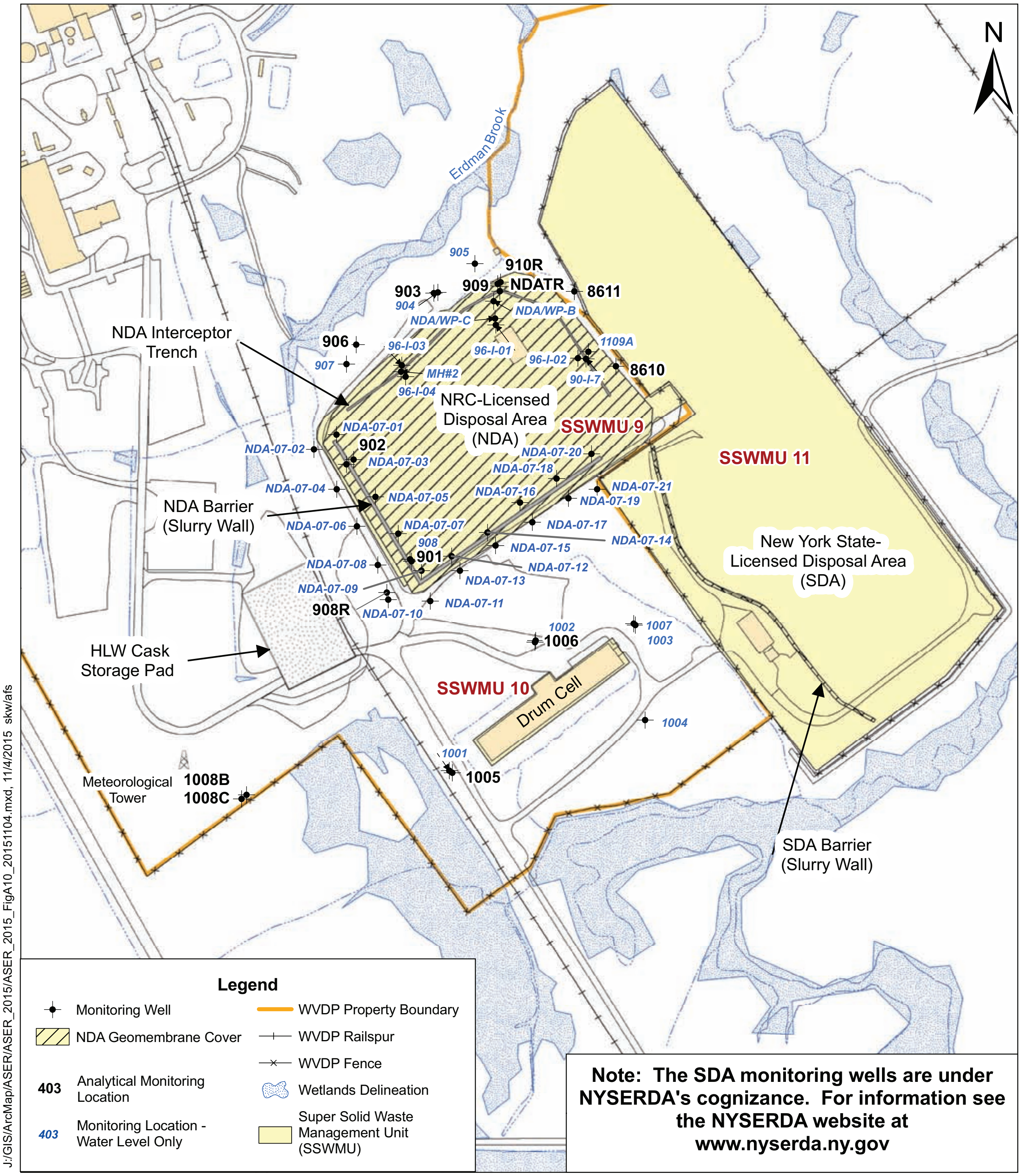


FIGURE A-10
South Plateau Groundwater Monitoring Network



Note: The SDA monitoring wells are under NYSERDA's cognizance. For information see the NYSERDA website at www.nyserda.ny.gov

FIGURE A-11
Biological Sampling Locations

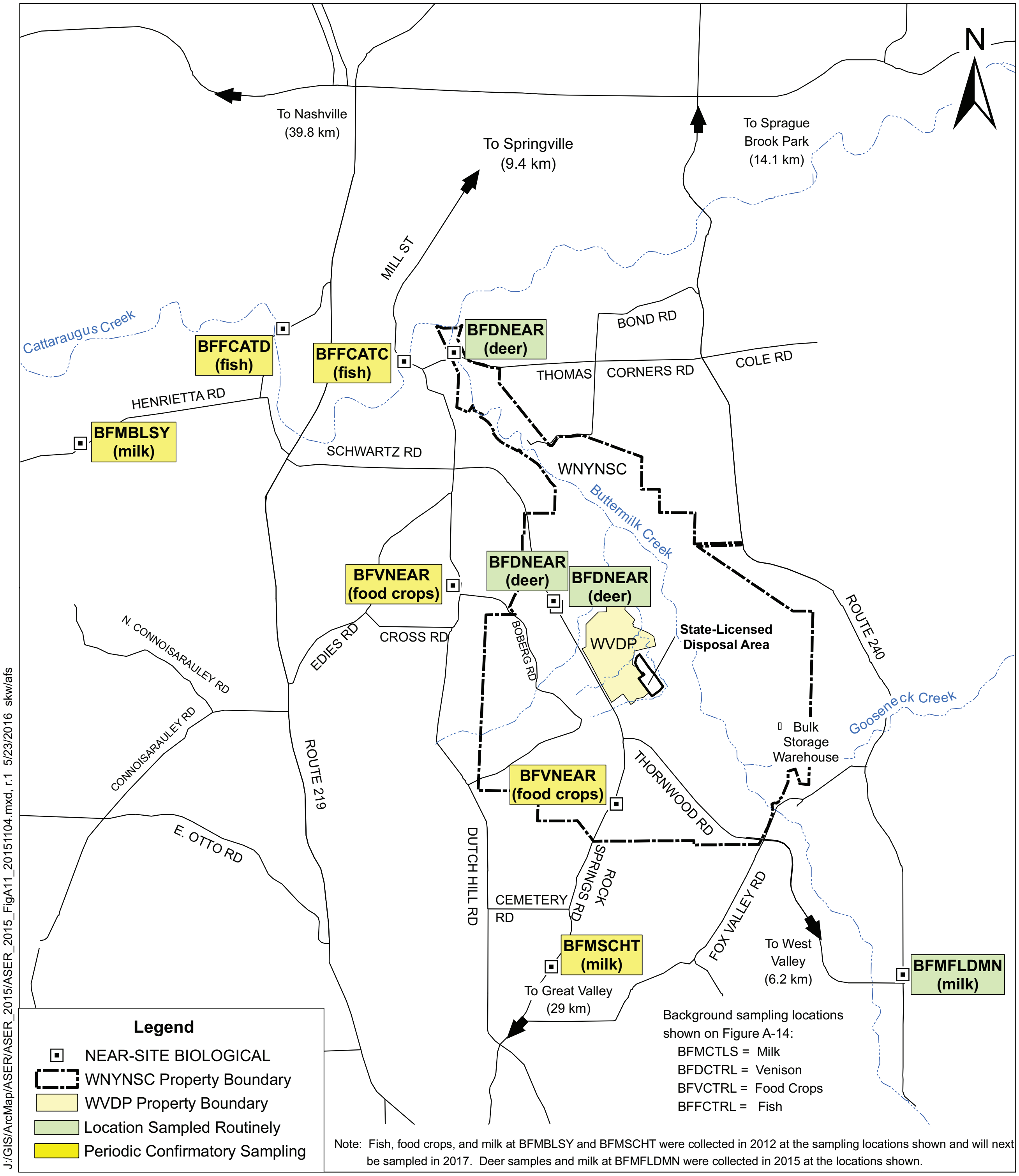


FIGURE A-12
Location of On-Site / Near-Site Thermoluminescent Dosimeters (TLDs)

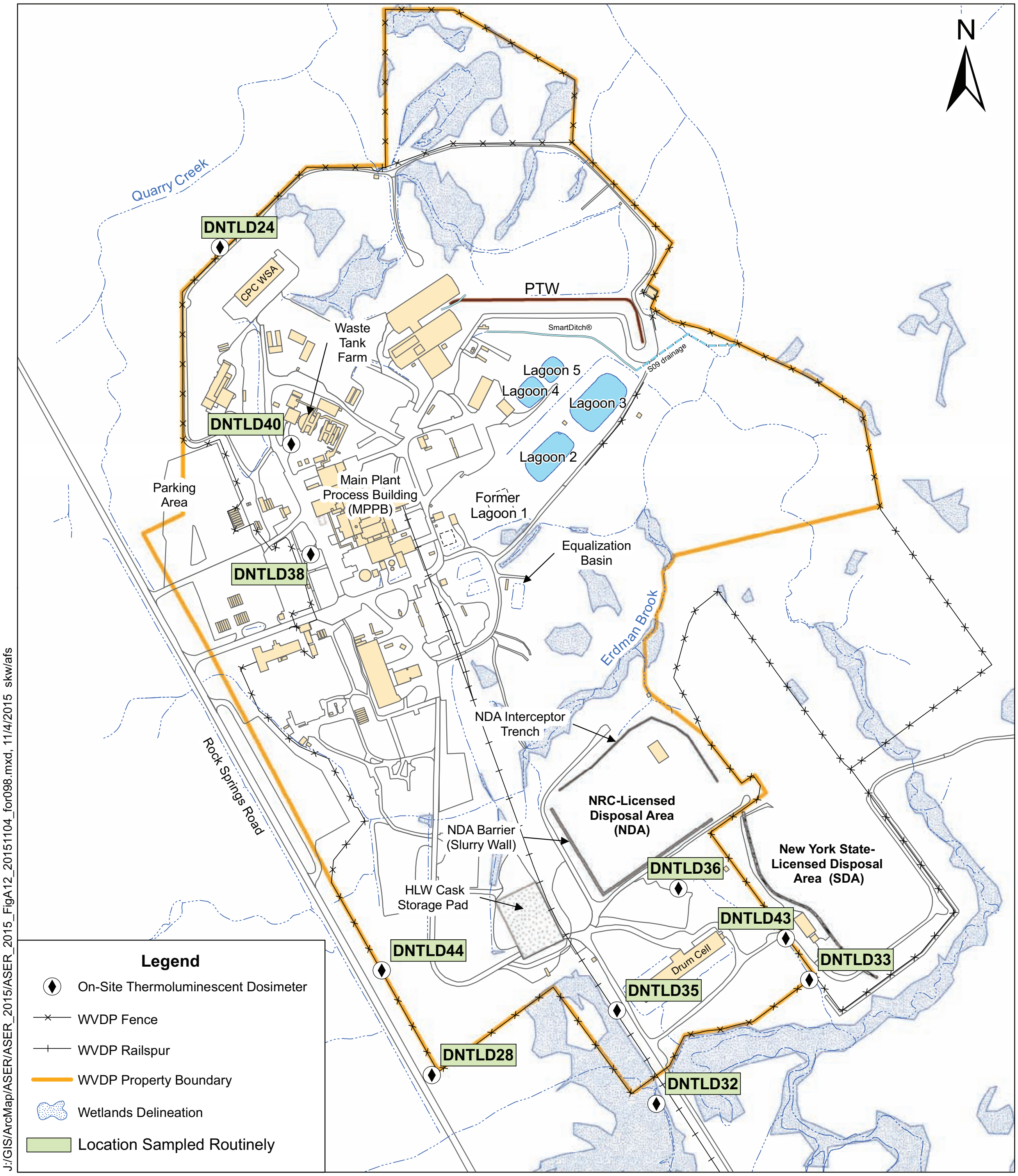


FIGURE A-13
Location of Off-Site Thermoluminescent Dosimeters (TLDs) Within 5 Kilometers of the WVDP

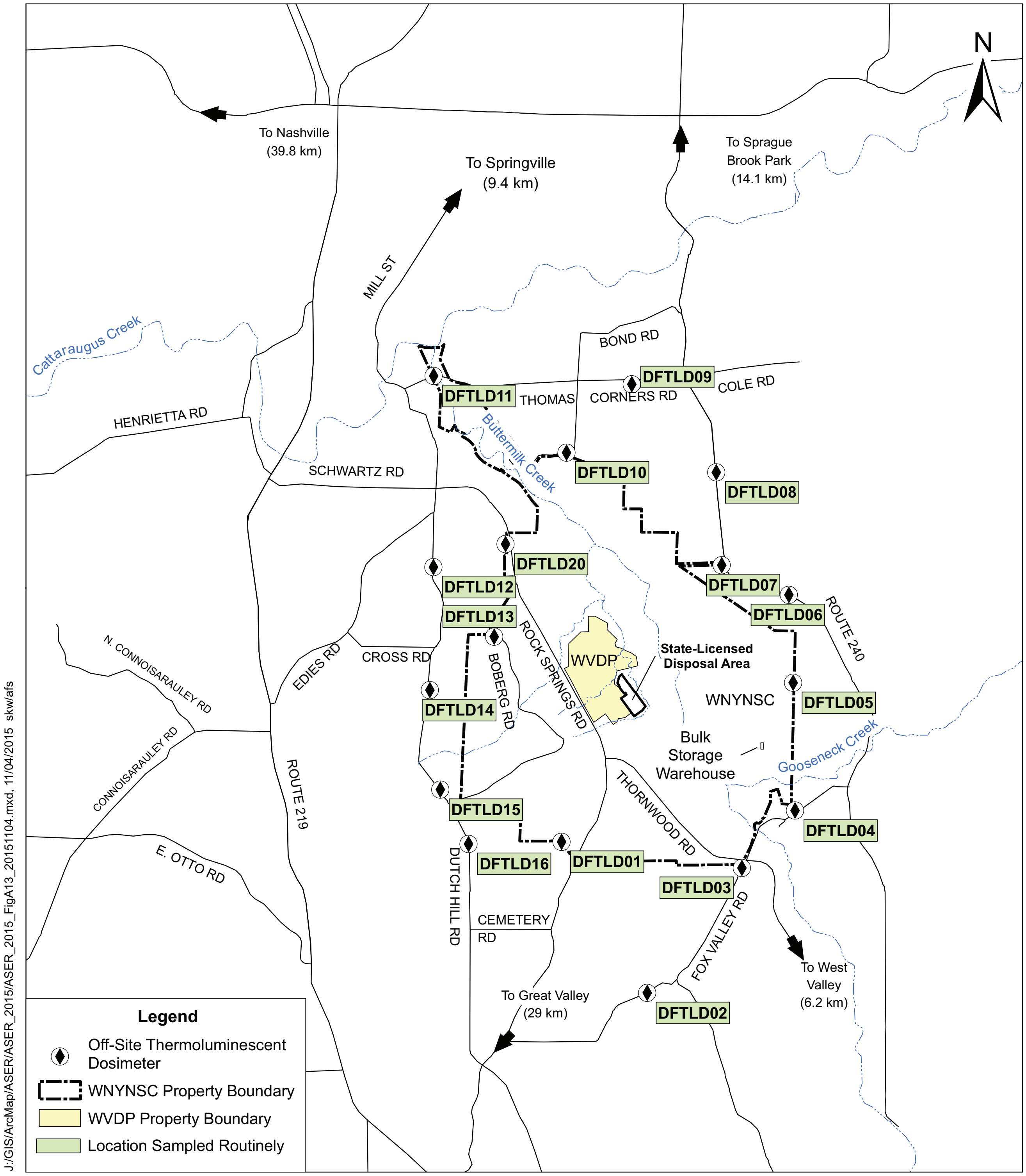


FIGURE A-14
Environmental Sampling Locations More Than 5 Kilometers From the WVDP

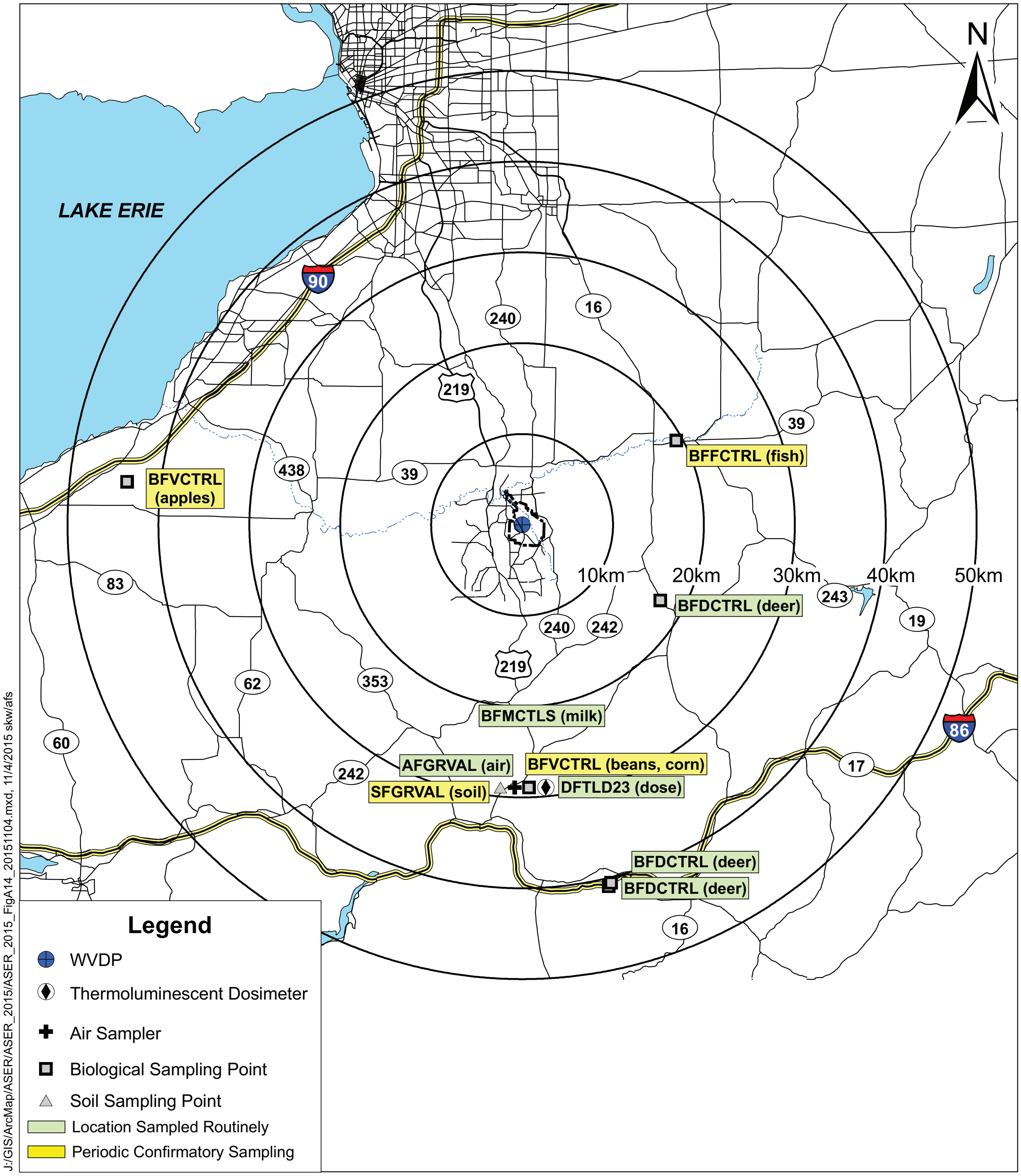
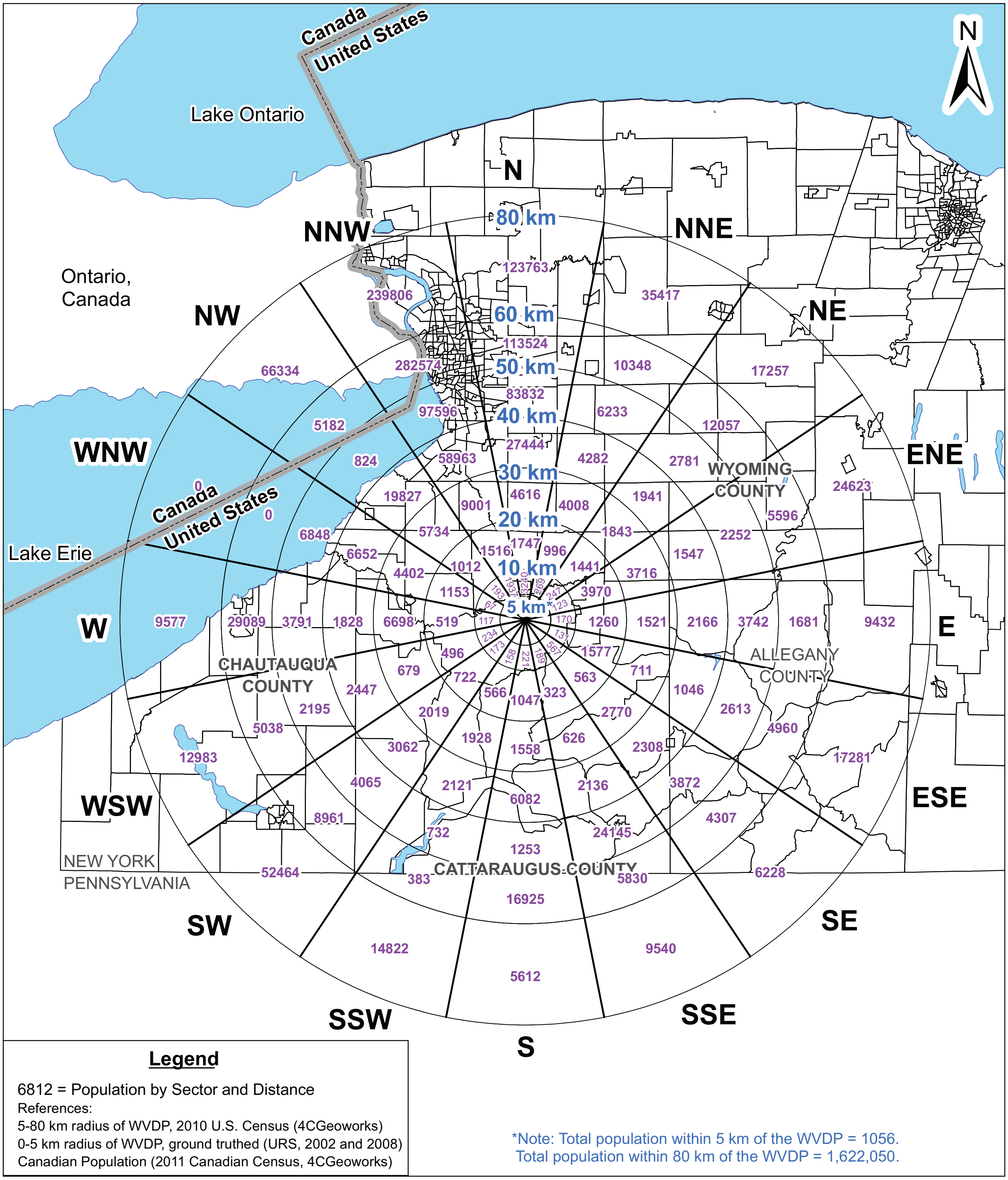


FIGURE A-15
Population by Sector Within 80 Kilometers of the WVDP



Legend

6812 = Population by Sector and Distance

References:

5-80 km radius of WVDP, 2010 U.S. Census (4CGeoworks)

0-5 km radius of WVDP, ground truthed (URS, 2002 and 2008)

Canadian Population (2011 Canadian Census, 4CGeoworks)

*Note: Total population within 5 km of the WVDP = 1056.
Total population within 80 km of the WVDP = 1,622,050.

J:/GIS/ArcMap/ASER/ASER_2015/ASER_2015_FigA15_20151104.mxd, 11/4/2015 skw/afs

APPENDIX B-1

Summary of Water Limits, Guidelines, and Standards

TABLE B-1A
West Valley Demonstration Project
State Pollutant Discharge Elimination System (SPDES) Sampling Program

Outfall 001	*Parameter*	*Effluent Limit*	*Sample Frequency*
001; Process and Storm Wastewater	Flow	Monitor - MGD	2/batch
	Aluminum	4.0 mg/L	1/batch
	Ammonia as (NH_3)	2.1 mg/L	2/batch
	pH	6.5–8.5 SU	1/batch
	Dissolved Oxygen (DO)	3.0 mg/L (minimum)	2/batch
	Oil and grease	15.0 mg/L	1/batch
	Solids, total suspended	45 mg/L	2/batch
	Solids, Settleable	0.3 ml/L	2/batch
	Solids, Total dissolved	Monitor	2/batch
	BOD_5	10.0 mg/L	2/batch
	TKN (as N)	Monitor	2/batch
	Nitrate (as N)	Monitor	1/batch
	Nitrite (as N)	0.1 mg/L	1/batch
	Ultimate oxygen demand (UOD)	22.0 mg/L	2/batch
	Chlorine, total residual	0.1 mg/L	1/batch
	Arsenic, total recoverable	0.15 mg/L	1/batch
	Cadmium, total recoverable	0.002 mg/L	1/year
	Iron, total	Monitor	2/batch
	Chromium, total recoverable	0.11 mg/L	2/year
	Chromium, hexavalent, total recoverable	0.011 mg/L	1/year
	Copper, total recoverable	0.014 mg/L	2/year
	Cyanide, amenable to chlorination	0.005 mg/L	2/year
	Manganese, total	2.0 mg/L	2/year
	Lead, total recoverable	0.006 mg/L	2/year
	Nickel, total	0.079 mg/L	2/year
	Selenium, total recoverable	0.004 mg/L	1/batch
	Sulfate	Monitor	1/batch
	Sulfide, dissolved	0.4 mg/L	1/batch
	Cobalt, total recoverable	0.005 mg/L	1/batch
	Vanadium, total recoverable	0.014 mg/L	1/batch
	Zinc, total recoverable	0.13 mg/L	2/year
	Dichlorodifluoromethane	0.01 mg/L	1/year
	Trichlorofluoromethane	0.01 mg/L	1/year
	3,3-Dichlorobenzidine	0.01 mg/L	1/year
	Tributylphosphate	0.1 mg/L	1/year
	Heptachlor	0.01 µg/L	2/year
	Surfactant (as LAS)	0.04 mg/L	1/batch
	Xylene	0.05 mg/L	1/year
	2-butanone	0.5 mg/L	1/year
	Hexachlorobenzene	0.2 µg/L	1/year
	Mercury, total	50 ng/L	1/batch
	Alpha - BHC	0.01 µg/L	1/year

TABLE B-1A (*continued*)
West Valley Demonstration Project
State Pollutant Discharge Elimination System (SPDES) Sampling Program

Outfall 001	*Parameter*	*Action Levels*	*Sample Frequency*
001; Process and Storm Wastewater	Antimony	1.0 mg/L	1/year
	Barium	0.5 mg/L	1/year
	Boron	2.0 mg/L	2/year
	Bromide	5.0 mg/L	2/year
	Chloroform	0.3 mg/L	1/year
	Titanium	0.65 mg/L	2/year
	Whole Effluent Toxicity (WET) Testing[a]		
	Parameter	*Action Levels*	*Sample Frequency*
	WET - Acute Invertebrate	0.3 TUa	Quarterly
	WET - Acute Vertebrate	0.3 TUa	Quarterly
	WET - Chronic Invertebrate	1.0 TUc	Quarterly
	WET - Chronic Vertebrate	1.0 TUc	Quarterly

Outfall 007	*Parameter*	*Effluent Limit*	*Sample Frequency*
007; Sanitary and Utility Wastewater	pH	6.5–8.5 SU	2/month
	Dissolved oxygen (DO)	3.0 mg/L (minimum)	2/month
	Flow	Monitor - MGD	1/month
	Oil and Grease	15.0 mg/L	2/month
	Solids, total suspended	45 mg/L	2/month
	Solids, settleable	0.3 ml/L	2/month
	Solids, total dissolved	Monitor	2/month
	BOD_5	10.0 mg/L	2/month
	Ammonia (as NH_3)	2.1 mg/L	2/month
	TKN (as N)	Monitor	Monthly
	Nitrite (as N)	0.1 mg/L	Monthly
	Ultimate oxygen demand (UOD)	22.0 mg/L	Monthly
	Iron, total	Monitor	2/month
	Chlorine, total residual	0.1 mg/L	Monthly
	Mercury, total	50 ng/L	Monthly
	Chloroform	0.20 mg/L	1/year
	Whole Effluent Toxicity (WET) Testing[a]		
	Parameter	*Action Levels*	*Sample Frequency*
	WET - Acute Invertebrate	0.3 TUa	Quarterly
	WET - Acute Vertebrate	0.3 TUa	Quarterly
	WET - Chronic Invertebrate	1.0 Tuc	Quarterly
	WET - Chronic Vertebrate	1.0 TUc	Quarterly

Outfall 01B	*Parameter*	*Effluent Limit*	*Sample Frequency*
01B[b]; Mercury Pre-Treatment Process	Flow	Monitor - GPD	Weekly
	Mercury, total	50 ng/L	2/batch

Sum of Outfalls	*Parameter*	*Effluent Limit*	*Sample Frequency*
001 and 007	Iron, total	1.0 mg/L	Monthly

[a] WET testing is only required every five years. WET testing was performed in 2012 and will be performed again in 2017.
[b] WNSP01B and WNSP007 are no longer in operation.

TABLE B-1A (*concluded*)
West Valley Demonstration Project
State Pollutant Discharge Elimination System (SPDES) Sampling Program

Monitoring Point	*Parameter*	*Effluent Limit*	*Sample Frequency*
116	Solids, total dissolved	500 mg/L	2/discharge event

Monitoring Point	*Parameter*	*Compliance Limit*	*Sample Frequency*
Stormwater Outfalls (All)	Oil & grease	<15 mg/L	1/event
Outfall S43	Lead, total recoverable	0.006 mg/L	1/event

TABLE B-1B

New York State Water Quality Standards and Guidelines[a]

Parameter	Units	Class A	Class B	Class C	Class D	Class GA
Gross Alpha[b]	pCi/L (µCi/mL)	15 (1.5E-08)	--	--	--	15 (1.5E-08)
Gross Beta[c]	pCi/L (µCi/mL)	1,000 (1E-06)	--	--	--	1,000 (1E-06)
Tritium (H-3)	pCi/L (µCi/mL)	20,000 (2E-05)	--	--	--	--
Strontium-90	pCi/L (µCi/mL)	8 (8E-09)	--	--	--	--
Alpha BHC	mg/L	0.000002	0.000002	0.000002	0.000002	0.00001
Aluminum, Ionic	mg/L	0.10	0.10	0.10	--	--
Aluminum, Total	mg/L	--	--	--	--	--
Ammonia, Total as N	mg/L	0.09–2.1	0.09–2.1	0.09–2.1	0.67–29	2.0
Antimony, Total	mg/L	0.003	--	--	--	0.003
Arsenic, Dissolved	mg/L	0.050	0.15	0.15	0.34	--
Arsenic, Total	mg/L	0.050	--	--	--	0.025
Barium, Total	mg/L	1.0	--	--	--	1.0
Beryllium, Total	mg/L	0.003	[d]	[d]	--	0.003
Boron, Total	mg/L	10	10	10	--	1.0
Bromide	mg/L	2.0	--	--	--	2.0
Cadmium, Dissolved[e]	mg/L	--	--	--	--	--
Cadmium, Total	mg/L	0.005	--	--	--	0.005
Calcium, Total	mg/L	--	--	--	--	--
Chloride	mg/L	250	--	--	--	250
Chromium, Dissolved[e]	mg/L	--	--	--	--	--
Chromium, Total	mg/L	0.05	--	--	--	0.05
Cobalt, Total[f]	mg/L	0.005	0.005	0.005	0.11	--
Conductivity	µmhos/cm@25°C	--	--	--	--	--
Copper, Dissolved[e]	mg/L	--	--	--	--	--
Copper, Total	mg/L	0.20	--	--	--	0.20
Cyanide	mg/L	0.0052	0.0052	0.0052	0.022	0.200
Dissolved Oxygen (minimum)	mg/L	4.0	4.0	4.0	3.0	--
Fluoride[e]	mg/L	--	--	--	--	1.5
Hardness	mg/L	--	--	--	--	--
Iron and Manganese (sum)	mg/L	--	--	--	--	0.50
Iron, Total	mg/L	0.30	0.30	0.30	0.30	0.30

-- No applicable guideline or reference standard available.

Note: All water quality and metals standards are presented in mg/L (ppm) to provide consistency in comparisons.

[a] Source: 6 NYCRR Part 702 - 704; The most stringent applicable pathway (e.g.,wildlife, aquatic, human health) values are reported.

[b] Gross alpha standard excludes radon and uranium, however WVDP results include uranium.

[c] Gross beta standard excludes strontium-90 and alpha emitters, however WVDP results include these isotopes.

[d] Beryllium standard for classes "B" and "C" are based on stream hardness values.

[e] Standards for these constituents vary according to stream location hardness values.

[f] Standards for cobalt, thallium, and vanadium are applicable to the acid soluble fraction.

[g] Applies to the sum of those organic substances which have individual human health water source standards listed at 0.10 mg/L or less in 6 NYCRR Part 703.5.

TABLE B-1B *(concluded)*

New York State Water Quality Standards and Guidelines[a]

Parameter	*Units*	*Class A*	*Class B*	*Class C*	*Class D*	*Class GA*
Lead, Dissolved[e]	mg/L	--	--	--	--	--
Lead, Total	mg/L	0.050	--	--	--	0.025
Magnesium, Total	mg/L	35	--	--	--	35
Manganese, Total	mg/L	0.30	--	--	--	0.30
Mercury, Dissolved	mg/L	0.0000007	0.0000007	0.0000007	0.0000007	--
Mercury, Total	mg/L	0.0007	--	--	--	0.0007
Nickel, Dissolved[e]	mg/L	--	--	--	--	--
Nickel, Total	mg/L	0.10	--	--	--	0.10
Nitrate-N	mg/L	10	--	--	--	10
Nitrate + Nitrite	mg/L	10	--	--	--	10
Nitrite-N	mg/L	0.10	0.10	0.10	--	1.0
NPOC[g]	mg/L	0.10	--	--	--	--
Oil & Grease	mg/L	No residue nor visible oil film nor globules of grease.				
pH	SU	6.5–8.5	6.5–8.5	6.5–8.5	6.0–9.5	6.5–8.5
Potassium, Total	mg/L	--	--	--	--	--
Selenium, Dissolved	mg/L	0.0046	0.0046	0.0046	--	--
Selenium, Total	mg/L	0.01	--	--	--	0.01
Silver, Total	mg/L	0.05	--	--	--	0.05
Sodium, Total	mg/L	--	--	--	--	20
Solids, Total Dissolved	mg/L	500	500	500	--	500
Solids, Total Suspended	mg/L	None that will cause deposition or impair waters for best usage.				
Sulfate	mg/L	250	--	--	--	250
Sulfide (undissociated form)	mg/L	0.002	0.002	0.002	--	0.050
Surfactants (as LAS)	mg/L	0.04	0.04	0.04	--	--
Thallium, Total[f]	mg/L	0.0005	0.008	0.008	0.020	0.0005
Titanium, Total	mg/L	--	--	--	--	--
TOX (total organic halides)[g]	mg/L	0.10	--	--	--	--
Vanadium, Total[f]	mg/L	0.014	0.014	0.014	0.19	--
Zinc, Dissolved[e]	mg/L	--	--	--	--	--
Zinc, Total	mg/L	2.0	--	--	--	2.0

-- No applicable guideline or reference standard available.

Note: All water quality and metals standards are presented in mg/L (ppm) to provide consistency in comparisons.

[a] Source: 6 NYCRR Part 702 - 704; The most stringent applicable pathway (e.g.,wildlife, aquatic, human health) values are reported.

[b] Gross alpha standard excludes radon and uranium, however WVDP results include uranium.

[c] Gross beta standard excludes strontium-90 and alpha emitters, however WVDP results include these isotopes.

[d] Beryllium standard for classes "B" and "C" are based on stream hardness values.

[e] Standards for these constituents vary according to stream location hardness values.

[f] Standards for cobalt, thallium, and vanadium are applicable to the acid soluble fraction.

[g] Applies to the sum of those organic substances which have individual human health water source standards listed at 0.10 mg/L or less in 6 NYCRR Part 703.5.

TABLE B-1C
New York State Department of Health Potable Water MCLs
for a Groundwater Supply

Parameter	*Units*	*NYSDOH MCL* [a]
Inorganic Chemicals (IOCs)		
Metals		
Antimony, Total	mg/L	0.006
Arsenic, Total	mg/L	0.010
Barium, Total	mg/L	2.00
Beryllium, Total	mg/L	0.004
Cadmium, Total	mg/L	0.005
Chromium, Total	mg/L	0.10
Copper, Total	mg/L	1.3[b]
Lead, Total	mg/L	0.015[b]
Mercury, Total	mg/L	0.002
Nickel, Total	mg/L	--
Selenium, Total	mg/L	0.05
Silver, Total	mg/L	0.1
Thallium, Total	mg/L	0.002
Other Inorganic Chemicals		
Cyanide (as free cyanide)	mg/L	0.2
Fluoride	mg/L	2.2
Nitrate-N	mg/L	10
Sodium	mg/L	20 / 270 [c]
Organic Chemicals		
POC (Principle Organic Contaminant)	mg/L	0.005
SOC (Specific Organic Chemicals)		
Alachlor	mg/L	0.002
Aldicarb	mg/L	0.003
Aldicarb sulfone	mg/L	0.002
Aldicarb sulfoxide	mg/L	0.004
Atrazine	mg/L	0.003
Carbofuran	mg/L	0.04
Chlordane	mg/L	0.002
Dibromochloropropane(DBCP)	mg/L	0.0002
2,4-D	mg/L	0.05
Dinoseb	mg/L	0.007
Endrin	mg/L	0.002
Ethylene dibromide(EDB)	mg/L	0.00005
Heptachlor	mg/L	0.0004
Heptachlor epoxide	mg/L	0.0002
Hexachlorobenzene	mg/L	0.001
Lindane	mg/L	0.0002

-- No applicable guideline or reference standard available.
MCL - Maximum Contamination Level
[a] MCL - Listed is NYSDOH 10 NYCRR Part 5, Subpart 5-1, Section 5-1.52.
[b] Value shown for copper and lead are the 90th percentile Action Levels.
[c] Although there is no designated limit for sodium, recommended limits are provided for people on severely and moderately sodium restricted diets.

TABLE B-1C *(concluded)*
New York State Department of Health Potable Water MCLs
for a Groundwater Supply

Parameter	*Units*	*NYSDOH MCL* [a]	
Organic Chemicals (continued)			
SOC (Specific Organic Chemicals) ***continued***			
Methoxychlor	mg/L	0.04	
Methyl-tertiary-butyl-ether(MTBE)	mg/L	0.010	
Pentachlorophenol	mg/L	0.001	
Polychlorinated biphenyls(PCBs)	mg/L	0.0005	
Simazine	mg/L	0.004	
Toxaphene	mg/L	0.003	
2,4,5-TP (Silvex)	mg/L	0.01	
2,3,7,8-TCDD (dioxin)	mg/L	0.00000003	
Vinyl chloride	mg/L	0.002	
Parameter	*Units*	*Standard*	
Disinfectant and Disinfection Byproducts			
Free Residual Chlorine	mg/L	0.2 to 4.0	
Haloacetic Acids-Five (5)	mg/L	0.06	
Total Trihalomethanes	mg/L	0.08	
Microbiological Contamination			
E. Coli	NA	no positive samples	
Total Coliform	NA	no positive samples	
SPECIAL WVDP MONITORING: Radiological Parameters			
Parameter	*Units*	*Guidance*	*Groundwater Background* [b]
Gross Alpha	µCi/mL	1.5E-08[c]	7.61E-09
Gross Beta	mrem/year	4[c]	-
Gross Beta (screening level)	µCi/mL	1.5E-08[d]	1.56E-08
Tritium	µCi/mL	2.0E-05[e]	1.78E-07
Cesium-137	µCi/mL	2.0E-07[e]	ND
Iodine-129	µCi/mL	1.0E-09[e]	ND

-- No applicable guideline or reference standard available.
ND - Non-detect
MCL - Maximum Contamination Level

[a] MCL - Listed is NYSDOH 10 NYCRR Part 5, Subpart 5-1, Section 5-1.52.
[b] Background concentrations for groundwater (provided in Table D-1A) are used for screening gross alpha, gross beta and tritium in the groundwater supply and source water protection plan wells.
[c] NYSDOH 10 NYCRR Part 5, Subpart 5-1, Public Water System Table 7 Radiological MCL (applicable to community water systems).
[d] NYSDOH 10 NYCRR Part 5, Subpart 5-1, Public Water System Table 12 Radiological Monitoring Requirements (screening level applicable to community water supply near nuclear facilities).
[e] Standard used for screening radionulides are from the EPA Safe Drinking Water Act Implemention Guidance for Radionuclides (40 CFR Part 141 Subpart F §141.66), applicable to community water systems.

TABLE B-1D
Department of Energy (DOE)
Derived Concentration Standards (DCSs)[a] in Ingested Water

Radionuclide	*Units*	*Concentration in Ingested Water*
Gross Alpha (as U-232)[b]	µCi/mL	9.8E-08
Gross Beta (as Sr-90)[b]	µCi/mL	1.1E-06
Tritium (H-3)	µCi/mL	1.9E-03
Carbon-14 (C-14)	µCi/mL	6.2E-05
Potassium-40 (K-40)	µCi/mL	4.8E-06
Cobalt-60 (Co-60)	µCi/mL	7.2E-06
Strontium-90 (Sr-90)	µCi/mL	1.1E-06
Technetium-99 (Tc-99)	µCi/mL	4.4E-05
Iodine-129 (I-129)	µCi/mL	3.3E-07
Cesium-137 (Cs-137)	µCi/mL	3.0E-06
Europium-154 (Eu-154)	µCi/mL	1.5E-05
Uranium-232 (U-232)	µCi/mL	9.8E-08
Uranium-233 (U-233)	µCi/mL	6.6E-07
Uranium-234 (U-234)	µCi/mL	6.8E-07
Uranium-235 (U-235)	µCi/mL	7.2E-07
Uranium-236 (U-236)	µCi/mL	7.2E-07
Uranium-238 (U-238)	µCi/mL	7.5E-07
Plutonium-238 (Pu-238)	µCi/mL	1.5E-07
Plutonium-239 (Pu-239)	µCi/mL	1.4E-07
Plutonium-240 (Pu-240)	µCi/mL	1.4E-07
Americium-241 (Am-241)	µCi/mL	1.7E-07

[a] DCS: Derived Concentation Standard. DCSs are established in DOE-STD-1196-2011 and are defined as the concentration of a radionuclide that, under conditions of continuous exposure for one year by one exposure mode, would result in an effective dose equivalent of 100 mrem (1mSv).

[b] Because there are no DCSs for gross alpha and gross beta concentrations, the DCSs for the most restrictive alpha and beta emitters in water at the WVDP, uranium-232 and strontium-90 (9.8E-08 and 1.1E-06 uCi/mL, respectively) are used as a conservative basis for comparison at locations for which there are no radionuclide-specific data, in which case a more appropriate DCS may be applied.

APPENDIX B-2

Process Effluent Data

TABLE B-2A
Comparison of 2015 Lagoon 3 (WNSP001) Liquid Effluent Radioactivity Concentrations With U.S. DOE-Derived Conentration Standards (DCSs)

Isotope [a]	*Discharge Activity* [b]		*Average Concentration*	*DCS* [d]	*Ratio of Average Concentration to DCS*
	(Ci)	*(Becquerels)* [c]	*(µCi/mL)*	*(µCi/mL)*	
Gross Alpha	6.15±0.62E-04	2.27±0.23E+07	3.13±0.32E-08	NA[e]	NA
Gross Beta	9.45±0.09E-03	3.50±0.03E+08	4.81±0.04E-07	NA[e]	NA
H-3	1.56±0.15E-02	5.76±0.56E+08	7.93±0.77E-07	1.9E-03	0.0004
C-14	-2.00±3.24E-04	-0.74±1.20E+07	-1.02±1.65E-08	6.2E-05	<0.0003
K-40	4.32±4.81E-04	1.60±1.78E+07	2.20±2.45E-08	NA[f]	NA
Co-60	3.74±3.15E-05	1.38±1.17E+06	1.91±1.61E-09	7.2E-06	0.0003
Sr-90	3.18±0.07E-03	1.18±0.03E+08	1.62±0.04E-07	1.1E-06	0.1474
Tc-99	2.63±0.31E-04	9.74±1.13E+06	1.34±0.16E-08	4.4E-05	0.0003
I-129	5.61±1.63E-05	2.07±0.60E+06	2.86±0.83E-09	3.3E-07	0.0087
Cs-137	9.43±0.79E-04	3.49±0.29E+07	4.81±0.40E-08	3.0E-06	0.0160
U-232[g]	1.23±0.07E-04	4.54±0.24E+06	6.25±0.34E-09	9.8E-08	0.0638
U-233/234[g]	1.01±0.07E-04	3.73±0.25E+06	5.14±0.34E-09	6.6E-07[h]	0.0078
U-235/236[g]	4.57±1.46E-06	1.69±0.54E+05	2.33±0.74E-10	7.2E-07	0.0003
U-238[g]	8.37±0.60E-05	3.10±0.22E+06	4.26±0.31E-09	7.5E-07	0.0057
Pu-238	1.72±0.76E-06	6.35±2.80E+04	8.74±3.86E-11	1.5E-07	0.0006
Pu-239/240	1.99±0.79E-06	7.35±2.94E+04	1.01±0.40E-10	1.4E-07	0.0007
Am-241	3.27±1.14E-06	1.21±0.42E+05	1.67±0.58E-10	1.7E-07	0.0010
Sum of Ratios					**0.25**

NA - Not applicable.
[a] Half-lives are listed in Table UI-4.
[b] Total volume released: 1.96E+10 milliliters (mL) (5.19E+06 gal).
[c] 1 curie (Ci) = 3.7E+10 becquerels (Bq): 1Bq = 2.7E-11 Ci; 1 microcurie (µCi) =1E-06 Ci.
[d] DCSs are used as reference values for the application of best available technology per DOE Order 458.1.
[e] DCSs do not exist for indicator parameters gross alpha and gross beta.
[f] The DCS is not applied to potassium-40 (K-40) activity because of its natural origin.
[g] Total uranium (g) = 2.47±0.04E+02; Average uranium (µg/mL) = 1.26±0.02E-02.
[h] The DCS for U-233 is used for this comparison.

TABLE B-2B
2015 SPDES Results for Outfall 001 (WNSP001): Water Quality

Permit Limit	Ammonia (as NH_3) (mg/L)		BOD $_5$ day (mg/L)		Discharge Rate (MGD)		Chlorine, Total Redisual (mg/L)	
	2.1 mg/L daily maximum		10.0 mg/L daily maximum		Monitor		0.1 mg/L daily maximum	
Month	Avg	Max	Avg	Max	Avg	Max	Avg	Max
January [a]	--	--	--	--	--	--	--	--
February [a]	--	--	--	--	--	--	--	--
March	0.38	0.43	<2.1	2.2	0.220	0.247	0.04	0.04
April [a]	--	--	--	--	--	--	--	--
May [a]	--	--	--	--	--	--	--	--
June	<0.015	0.021	2.3	2.5	0.194	0.245	0.02	0.02
July [a]	--	--	--	--	--	--	--	--
August [a]	--	--	--	--	--	--	--	--
September [a]	--	--	--	--	--	--	--	--
October	0.024	0.038	<2.4	2.8	0.227	0.309	0.09	0.09
November [a]	--	--	--	--	--	--	--	--
December [a]	--	--	--	--	--	--	--	--

Permit Limit	Dissolved Oxygen (mg/L)		Nitrogen, total Kjeldahl (as N) (mg/L)		Nitrate (as N) (mg/L)		Nitrite (as N) (mg/L)	
	3.0 mg/L minimum		Monitor		Monitor		0.1 mg/L daily maximum	
Month	Min	Max	Avg	Max	Avg	Max	Avg	Max
January [a]	--	--	--	--	--	--	--	--
February [a]	--	--	--	--	--	--	--	--
March	13	15	1.2	1.3	0.11	0.11	<0.02	<0.02
April [a]	--	--	--	--	--	--	--	--
May [a]	--	--	--	--	--	--	--	--
June	7.4	11	1.0	1.2	<0.02	<0.02	0.02	0.02
July [a]	--	--	--	--	--	--	--	--
August [a]	--	--	--	--	--	--	--	--
September [a]	--	--	--	--	--	--	--	--
October	8.5	11.5	1.0	1.1	<0.02	<0.02	<0.02	<0.02
November [a]	--	--	--	--	--	--	--	--
December [a]	--	--	--	--	--	--	--	--

Note: No results exceeded the permit limits.
MGD - Million gallons per day.
[a] There was no discharge from outfall 001 during this month in 2015.

TABLE B-2B *(continued)*
2015 SPDES Results for Outfall 001 (WNSP001); Water Quality

Permit Limit	***Oil & Grease (mg/L)***		***pH (standard units)***		***Solids, Settleable (mL/L)***		***Solids, Total Dissolved (mg/L)***	
	15.0 mg/L daily maximum		***6.5 to 8.5***		***0.3 mL/L daily maximum***		***Monitor***	
Month	***Avg***	***Max***	***Min***	***Max***	***Avg***	***Max***	***Avg***	***Max***
January [a]	--	--	--	--	--	--	--	--
February [a]	--	--	--	--	--	--	--	--
March	<1.4	<1.4	7.6	7.6	<0.1	<0.1	972	984
April [a]	--	--	--	--	--	--	--	--
May [a]	--	--	--	--	--	--	--	--
June	<1.4	<1.4	7.2	7.2	<0.1	<0.1	696	734
July [a]	--	--	--	--	--	--	--	--
August [a]	--	--	--	--	--	--	--	--
September [a]	--	--	--	--	--	--	--	--
October	<1.4	<1.4	7.5	7.5	<0.1	<0.1	721	722
November [a]	--	--	--	--	--	--	--	--
December [a]	--	--	--	--	--	--	--	--

Permit Limit	***Solids, Total Suspended (mg/L)***		***Sulfate (as S) (mg/L)***		***Sulfide, (as S) Dissolved (mg/L)***		***Surfactant (as LAS) (mg/L)***	
	45 mg/L daily maximum		***Monitor***		***0.4 mg/L daily maximum***		***0.04 mg/L***	
Month	***Avg***	***Max***	***Avg***	***Max***	***Avg***	***Max***	***Avg***	***Max***
January [a]	--	--	--	--	--	--	--	--
February [a]	--	--	--	--	--	--	--	--
March	< 4.0	< 4.0	82	82	<0.05	<0.05	0.018	0.018
April [a]	--	--	--	--	--	--	--	--
May [a]	--	--	--	--	--	--	--	--
June	5.8	6.0	87	87	<0.05	<0.05	0.02	0.02
July [a]	--	--	--	--	--	--	--	--
August [a]	--	--	--	--	--	--	--	--
September [a]	--	--	--	--	--	--	--	--
October	< 4.0	4.0	72	72	<0.05	<0.05	0.04	0.04
November [a]	--	--	--	--	--	--	--	--
December [a]	--	--	--	--	--	--	--	--

Note: No results exceeded the permit limits.
LAS - linear alkylate sulfonate.
[a] There was no discharge from outfall 001 during this month in 2015.

Table B-2B *(concluded)*
2015 SPDES Results for Outfall 001 (WNSP001): Water Quality

Permit Limit	***Ultimate Oxygen Demand (UOD) (mg/L)***	
	22.0 mg/L daily maximum	
Month	***Avg***	***Max***
January [a]	--	--
February [a]	--	--
March	< 8.41	9.24
April [a]	--	--
May [a]	--	--
June	8.06	9.23
July [a]	--	--
August [a]	--	--
September [a]	--	--
October	8.22	8.40
November [a]	--	--
December [a]	--	--

Note: No results exceeded the permit limits.
[a] There was no discharge from outfall 001 during this month in 2015.

TABLE B-2C
2015 SPDES Results for Outfall 001 (WNSP001): Metals

Permit Limit	Aluminum, Total (mg/L)		Arsenic, Total Recoverable (mg/L)		Cobalt, Total Recoverable (mg/L)		Iron, Total (mg/L)	
	4.0 mg/L daily maximum		0.15 mg/L daily maximum		0.005 mg/L daily maximum		Monitor	
Month	Avg	Max	Avg	Max	Avg	Max	Avg	Max
January [a]	--	--	--	--	--	--	--	--
February [a]	--	--	--	--	--	--	--	--
March	0.10	0.10	0.0016	0.0016	<0.0006	<0.0006	0.649	0.871
April [a]	--	--	--	--	--	--	--	--
May [a]	--	--	--	--	--	--	--	--
June	0.18	0.18	0.00097	0.00097	<0.0006	<0.0006	0.792	1.12
July [a]	--	--	--	--	--	--	--	--
August [a]	--	--	--	--	--	--	--	--
September [a]	--	--	--	--	--	--	--	--
October	0.17	0.17	0.0018	0.0018	<0.0006	<0.0006	0.208	0.212
November [a]	--	--	--	--	--	--	--	--
December [a]	--	--	--	--	--	--	--	--

Permit Limit	Mercury, Total (ng/L)		Selenium, Total Recoverable (mg/L)		Vanadium, Total Recoverable (mg/L)	
	50 ng/L maximum		0.004 mg/L daily maximum		0.014 mg/L daily maximum	
Month	Avg	Max	Avg	Max	Avg	Max
January [a]	--	--	--	--	--	--
February [a]	--	--	--	--	--	--
March	5.5	5.5	< 0.0004	<0.0004	<0.0015	<0.0015
April [a]	--	--	--	--	--	--
May [a]	--	--	--	--	--	--
June	1.3	1.3	< 0.0004	<0.0004	<0.0015	<0.0015
July [a]	--	--	--	--	--	--
August [a]	--	--	--	--	--	--
September [a]	--	--	--	--	--	--
October	3.0	3.0	< 0.0004	<0.0004	<0.0015	<0.0015
November [a]	--	--	--	--	--	--
December [a]	--	--	--	--	--	--

Note: No results exceeded the permit limits.
[a] There was no discharge from outfall 001 during this month in 2015.

TABLE B-2D
2015 SPDES Results for Sum of Outfalls 001 and 007[a] : Water Quality

Permit Limit	*Iron Total Net Effluent Limitation*	
	1.0 mg/L daily maximum	
Month	*Avg*	*Max*
January [b]	--	--
February [b]	--	--
March	0.65	0.65
April [b]	--	--
May [b]	--	--
June	0.79	0.79
July [b]	--	--
August [b]	--	--
September [b]	--	--
October	0.21	0.21
November [b]	--	--
December [b]	--	--

Note: No results exceeded the permit limits.
[a] SPDES discharge from 007 was discontinued in November 2014.
[b] There were no discharges from either outfall 001 or 007 during these months. Therefore, a calculated total iron is not required.

TABLE B-2E
2015 SPDES Results for Sum of Outfalls 001, 007[a] and 116: Water Quality

Permit Limit	*Total Dissolved Solids (mg/L)*	
	500 mg/L daily maximum	
Month	*Avg*	*Max*
January [b]	--	--
February [b]	--	--
March	266	307
April [b]	--	--
May [b]	--	--
June	337	357
July [b]	--	--
August [b]	--	--
September [b]	--	--
October	314	382
November [b]	--	--
December [b]	--	--

Note: No results exceeded the permit limits.
[a] SPDES discharge from 007 was discontinued in November 2014.
[b] There was no discharge from outfall 001 or 007 during this month in 2015. Therefore, a calculated TDS at 116 is not required.

TABLE B-2F
2015 Annual and Semiannual SPDES Results for Outfall 001:
Metals, Water Quality and Organic Compounds

Permit Limit Parameters	*Permit Limit*	*Monitoring Frequency*	*Sample Date*	*Maximum Measured*
2-Butanone	0.5 mg/L daily maximum	Annual	March 2015	<0.002
3,3-Dichlorobenzidine	0.01 mg/L daily maximum	Annual	March 2015	<0.0008
Alpha-BHC	0.01 ug/L daily maximum	Annual	March 2015	<0.006
Cadmium, Total Recoverable	0.002 mg/L daily maximum	Annual	March 2015	<0.00007
Chromium VI, Total Recoverable	0.011 mg/L daily maximum	Annual	March 2015	<0.0050
Chromium, Total Recoverable	0.11 mg/L daily maximum	Semiannual	March 2015 October 2015	0.00065 0.00053
Copper, Total Recoverable	0.014mg/L daily maximum	Semiannual	March 2015 October 2015	0.0041 0.0033
Cyanide, Amenable to chlorination	0.005 mg/L daily maximum	Semiannual	March 2015 October 2015	<0.005 <0.005
Dichlorodifluoromethane	0.01 mg/L daily maximum	Annual	March 2015	<0.0003
Heptachlor	0.01 ug/L daily maximum	Semiannual	March 2015 October 2015	<0.006 <0.006
Hexachlorobenzene	0.2 ug/L daily maximum	Annual	June 2015	<0.02
Lead, Total Recoverable	0.006 mg/L daily maximum	Semiannual	March 2015 October 2015	0.0004 0.0004
Manganese, Total	2.0 mg/L daily maximum	Semiannual	March 2015 October 2015	0.23 0.021
Nickel, Total	0.079 mg/L daily maximum	Semiannual	March 2015 October 2015	0.0031 0.0019
Tributyl phosphate	0.1 mg/L daily maximum	Annual	March 2015	<0.0008
Trichlorofluoromethane	0.01 mg/L daily maximum	Annual	March 2015	<0.0005
Xylene	0.05 mg/L daily maximum	Annual	March 2015	<0.001
Zinc, Total Recoverable	0.13 mg/L daily maximum	Semiannual	March 2015 October 2015	0.011 0.0062

Note: No results exceeded the permit limits.

TABLE B-2G
2015 SPDES Action Level Requirement Monitoring Results for Outfalls 001 and 007
Metals and Water Quality

Outfall	*Action Level Parameters*	*Action Level*	*Monitoring Frequency*	*Sampling Date*	*Maximum Measured (mg/L)*
001	**Antimony, Total**	1.0 mg/L daily maximum	Annual	March 2015	<0.0068
	Barium, Total	0.5 mg/L daily maximum	Annual	March 2015	0.02
	Boron, Total	2.0 mg/L daily maximum	Semiannual	March 2015 October 2015	0.047 0.053
	Bromide, Total	5.0 mg/L daily maximum	Semiannual	March 2015 October 2015	1.9 0.17
	Chloroform	0.3 mg/L daily maximum	Annual	March 2015	<0.0005
	Titanium, Total	0.65 mg/L daily maximum	Semiannual	March 2015 October 2015	0.0055 0.0018
007	**Chloroform**	0.20 mg/L daily maximum	There were no discharges through the 007 outfall in 2015 (discontinued in November 2014).		

Note: No results exceeded the permit limits.

TABLE B-2H
2015 SPDES Results for Outfall 01B (WNSP01B): Water Quality

Internal process monitoring point did not operate during 2015.

TABLE B-2I

2015 Paraquat Dichloride[a] Data in Areas of Herbicide Application

Stormwater Outfalls		Date	Units	Concentration
Group 1 - CDDL	S04	08/20/15	mg/L	<0.002 / <0.002
	S04	10/28/15	mg/L	<0.002
Group 2 - North Plateau	S06	09/09/15	mg/L	<0.00019
	S33	08/20/15	mg/L	<0.002
	S33	10/28/15	mg/L	<0.002
Group 3 - Lagoons	S09	08/20/15	mg/L	<0.002
	S12	08/20/15	mg/L	<0.002
Group 4 - Erdman Brook West	S34	08/20/15	mg/L	<0.002
Group 5 - Erdman Brook East	S14	10/28/15	mg/L	<0.002
	S28	08/20/15	mg/L	<0.002
	S28	10/28/15	mg/L	<0.002
Group 6 - Railroad Spur	S37	08/20/15	mg/L	<0.002
Group 7 - NDA	S20	09/09/15	mg/L	<0.002
	S20	10/28/15	mg/L	<0.002
Group 8 - Drum Cell	S27	08/20/15	mg/L	<0.002
	S35	10/28/15	mg/L	<0.002
Process Effluent Outfalls		**Date**	**Units**	**Concentration**
WNSP001		10/13/15	mg/L	<0.002

[a] The site applied the herbicide Paraquat Dichloride at the WVDP between July 20 and 23, on August 5, and on October 7, 2015. In accordance with the SPDES permit, sampling is required from storm water outfalls and process effluent outfalls within 60 days of herbicide application from the drainage basins potentially affected by the herbicide.

TABLE B-2J

2015 Radioactivity Results for Sewage Treatment Outfall (WNSP007)

There were no discharges from the Sewage Treatment Plant in 2015. SPDES outfall 007 was discontinued in November 2014.

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APPENDIX B-3

SPDES-Permitted Storm Water Outfall Discharge Data

TABLE B-3A

2015 Storm Water Discharge Monitoring Data for Outfall Group 1

STORM WATER OUTFALL S04

Paramater Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			06/08/15	06/08/15
Group A Parameters	BOD_5	mg/L	5.1	2.9
	Oil & Grease[a]	mg/L	< 1.4	NR
	pH	SU	7.2	NR
	Phosphorous, Total	mg/L	0.66	0.56
	Solids, Total Dissolved	mg/L	395	226
	Solids, Total Suspended	mg/L	178	269
Group B Parameters	Aluminum, Total	mg/L	9.9	6.0
	Copper, Total Recoverable	mg/L	0.014	0.025
	Iron, Total	mg/L	14	16
	Lead, Total Recoverable	mg/L	0.0083	0.011
	Zinc, Total Recoverable	mg/L	0.12	0.12
Group C Parameters	Ammonia (as NH_3)	mg/L	0.094	0.083
	Cadmium, Total Recoverable	mg/L	0.00040	0.00030
	Chromium, Hexavalent, Total Recoverable	mg/L	< 0.0050	< 0.0050
	Chromium, Total Recoverable	mg/L	0.0059	0.0090
	Nitrogen, Nitrate (as N)	mg/L	< 0.020	0.098
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	0.032
	Nitrogen, Total (as N)	mg/L	< 1.2	1.1
	Nitrogen, Total Kjeldahl	mg/L	1.2	0.99
	Selenium, Total Recoverable	mg/L	< 0.00044	< 0.00044
	Vanadium, Total Recoverable	mg/L	0.0065	0.0096
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.1	
	Rainfall During Sampling Event	inches	0.47	
Flow	Total Flow During Sampling Event	gallons	580,000	
	Maximum Flow Rate During Sampling Event	gpm	17,000	

gpm - gallons per minute.

NR - Not required by permit.

[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3A *(concluded)*
2015 Storm Water Discharge Monitoring Data for Outfall Group 1

STORM WATER OUTFALL S04

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			08/20/15	***08/20/15***
Group A Parameters	BOD_5	mg/L	3.3	3.4
	Oil & Grease[a]	mg/L	< 1.4	NR
	pH	SU	7.2	NR
	Phosphorous, Total	mg/L	0.25	0.049
	Solids, Total Dissolved	mg/L	399	270
	Solids, Total Suspended	mg/L	107	37
Group B Parameters	Aluminum, Total	mg/L	2.4	1.9
	Copper, Total Recoverable	mg/L	0.0047	0.0050
	Iron, Total	mg/L	4.6	2.2
	Lead, Total Recoverable	mg/L	0.0052	0.0015
	Zinc, Total Recoverable	mg/L	0.030	0.021
Group C Parameters	Ammonia (as NH_3)	mg/L	0.015	0.017
	Cadmium, Total Recoverable	mg/L	0.00030	< 0.000071
	Chromium, Hexavalent, Total Recoverable	mg/L	< 0.0050	NA
	Chromium, Total Recoverable	mg/L	0.0024	0.0019
	Nitrogen, Nitrate (as N)	mg/L	< 0.020	0.094
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 1.3	< 0.88
	Nitrogen, Total Kjeldahl	mg/L	1.3	0.77
	Selenium, Total Recoverable	mg/L	< 0.00044	< 0.00044
	Vanadium, Total Recoverable	mg/L	< 0.0012	< 0.0012
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.5	
	Rainfall During Sampling Event	inches	0.27	
Flow	Total Flow During Sampling Event	gallons	380,000	
	Maximum Flow Rate During Sampling Event	gpm	6,100	

gpm - gallons per minute.
NA - Not available. The hexavalent chromium at outfall S04 was analyazed outside the 24-hour hold time. Therefore this sample result has not been reported.
NR - Not required by permit.
[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3B
2015 Storm Water Discharge Monitoring Data for Outfall Group 2

STORM WATER OUTFALL S06

Paramater Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			06/08/15	06/08/15
Group A Parameters	BOD_5	mg/L	23	6.3
	Oil & Grease[a]	mg/L	< 1.6	NR
	pH	SU	7.2	NR
	Phosphorous, Total	mg/L	0.041	0.071
	Solids, Total Dissolved	mg/L	661	557
	Solids, Total Suspended	mg/L	9.6	19
Group B Parameters	Aluminum, Total	mg/L	0.11	1.1
	Copper, Total Recoverable	mg/L	0.00085	0.0026
	Iron, Total	mg/L	0.79	2.8
	Lead, Total Recoverable	mg/L	< 0.00050	0.0013
	Zinc, Total Recoverable	mg/L	0.0041	0.017
Group C Parameters	Surfactant (as LAS)	mg/L	< 0.0043	< 0.0043
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.1	
	Rainfall During Sampling Event	inches	0.47	
Flow	Total Flow During Sampling Event	gallons	20,000	
	Maximum Flow Rate During Sampling Event	gpm	200	

gpm - gallons per minute.
NR - Not required by permit.
[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3B *(concluded)*
2015 Storm Water Discharge Monitoring Data for Outfall Group 2

STORM WATER OUTFALL S33 / DUPLICATE

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			08/20/15	***08/20/15***
Group A Parameters	BOD_5	mg/L	4.8 / 5.0	3.7
	Oil & Grease[a]	mg/L	< 1.5 / < 1.5	NR
	pH	SU	7.3	NR
	Phosphorous, Total	mg/L	0.48 / 0.65	0.20
	Solids, Total Dissolved	mg/L	420 / 411	356
	Solids, Total Suspended	mg/L	47 / 180	43
Group B Parameters	Aluminum, Total	mg/L	2.8 / 1.5	0.77
	Copper, Total Recoverable	mg/L	0.0057 / 0.0057	0.0028
	Iron, Total	mg/L	14 / 9.6	4.6
	Lead, Total Recoverable	mg/L	0.0042 / 0.0031	0.0013
	Zinc, Total Recoverable	mg/L	0.059 / 0.043	0.021
Group C Parameters	Surfactant (as LAS)	mg/L	0.052 / 0.036	0.049
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.5	
	Rainfall During Sampling Event	inches	0.27	
Flow	Total Flow During Sampling Event	gallons	13,000	
	Maximum Flow Rate During Sampling Event	gpm	210	

Note: The first flush grab samples were sampled and analyzed in duplicate.
gpm - gallons per minute.
NR - Not required by permit.
[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3C
2015 Storm Water Discharge Monitoring Data for Outfall Group 3

STORM WATER OUTFALL S09

Paramater Group	Analyte	Units	First Flush Grab 06/08/15	Flow-weighted Composite 06/08/15
Group A Parameters	BOD_5	mg/L	4.7	2.8
	Oil & Grease[a]	mg/L	< 1.4	NR
	pH	SU	8.4	NR
	Phosphorous, Total	mg/L	2.9	0.92
	Solids, Total Dissolved	mg/L	101	100
	Solids, Total Suspended	mg/L	1210	661
Group B Parameters	Aluminum, Total	mg/L	32	22
	Copper, Total Recoverable	mg/L	0.12	0.078
	Iron, Total	mg/L	61	43
	Lead, Total Recoverable	mg/L	0.064	0.040
	Zinc, Total Recoverable	mg/L	0.82	0.53
Group C Parameters	Alpha BHC	mg/L	<0.0000064	< 0.0000064
	Ammonia (as NH_3)	mg/L	0.33	0.25
	Mercury, Total[b] (1631E)	ng/L	15.6	NR
	Nitrogen, Nitrate (as N)	mg/L	0.17	0.24
	Nitrogen, Nitrite (as N)	mg/L	0.027	0.028
	Nitrogen, Total (as N)	mg/L	2.4	2.2
	Nitrogen, Total Kjeldahl	mg/L	2.2	1.9
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.1	
	Rainfall During Sampling Event	inches	0.47	
Flow	Total Flow During Sampling Event	gallons	380,000	
	Maximum Flow Rate During Sampling Event	gpm	14,000	

gpm - gallons per minute.
NR - Not required by permit.
[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.
[b] The SPDES permit requires that Group 3 outfalls be analyzed for mercury as part of the Mercury Minimization Program.

TABLE B-3C *(concluded)*
2015 Storm Water Discharge Monitoring Data for Outfall Group 3

STORM WATER OUTFALL S12

Paramater Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			08/20/15	*08/20/15*
Group A Parameters	BOD_5	mg/L	7.2	3.5
	Oil & Grease[a]	mg/L	< 1.4	NR
	pH	SU	7.5	NR
	Phosphorous, Total	mg/L	0.77	0.14
	Solids, Total Dissolved	mg/L	174	226
	Solids, Total Suspended	mg/L	460	177
Group B Parameters	Aluminum, Total	mg/L	14	5.4
	Copper, Total Recoverable	mg/L	0.026	0.011
	Iron, Total	mg/L	17	6.8
	Lead, Total Recoverable	mg/L	0.017	0.0071
	Zinc, Total Recoverable	mg/L	0.13	0.054
Group C Parameters	Alpha BHC	mg/L	<0.0000064	< 0.0000063
	Ammonia (as NH_3)	mg/L	0.044	0.016
	Mercury, Total[b] (1631E)	ng/L	22	NR
	Nitrogen, Nitrate (as N)	mg/L	0.32	0.13
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 2.5	< 1.4
	Nitrogen, Total Kjeldahl	mg/L	2.2	1.2
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.5	
	Rainfall During Sampling Event	inches	0.27	
Flow	Total Flow During Sampling Event	gallons	28,000	
	Maximum Flow Rate During Sampling Event	gpm	350	

gpm - gallons per minute.
NR - Not required by permit.
[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.
[b] The SPDES permit requires that Group 3 outfalls be analyzed for mercury as part of the Mercury Minimization Program.

TABLE B-3D
2015 Storm Water Discharge Monitoring Data for Outfall Group 4

STORM WATER OUTFALL S34

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			06/08/15	***06/08/15***
Group A Parameters	BOD_5	mg/L	5.1	3.5
	Oil & Grease[a]	mg/L	< 1.4	NR
	pH	SU	8.1	NR
	Phosphorous, Total	mg/L	2.2	1.3
	Solids, Total Dissolved	mg/L	233	199
	Solids, Total Suspended	mg/L	865	830
Group B Parameters	Aluminum, Total	mg/L	28	21
	Copper, Total Recoverable	mg/L	0.099	0.053
	Iron, Total	mg/L	52	33
	Lead, Total Recoverable	mg/L	0.047	0.032
	Zinc, Total Recoverable	mg/L	0.67	0.41
Group C Parameters	Surfactant (as LAS)	mg/L	0.025	< 0.013
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.1	
	Rainfall During Sampling Event	inches	0.47	
Flow	Total Flow During Sampling Event	gallons	320,000	
	Maximum Flow Rate During Sampling Event	gpm	7,600	

gpm - gallons per minute.
NR - Not required by permit.
[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3D *(concluded)*

2015 Storm Water Discharge Monitoring Data for Outfall Group 4

STORM WATER OUTFALL S34

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			08/20/15	***08/20/15***
Group A Parameters	BOD_5	mg/L	< 2.0	2.7
	Oil & Grease[a]	mg/L	< 1.4	NR
	pH	SU	7.7	NR
	Phosphorous, Total	mg/L	0.064	0.067
	Solids, Total Dissolved	mg/L	531	316
	Solids, Total Suspended	mg/L	47	102
Group B Parameters	Aluminum, Total	mg/L	0.60	3.8
	Copper, Total Recoverable	mg/L	0.0039	0.0075
	Iron, Total	mg/L	1.2	4.5
	Lead, Total Recoverable	mg/L	0.0012	0.0038
	Zinc, Total Recoverable	mg/L	0.029	0.070
Group C Parameters	Surfactant (as LAS)	mg/L	0.058	0.065
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.5	
	Rainfall During Sampling Event	inches	0.27	
Flow	Total Flow During Sampling Event	gallons	71,000	
	Maximum Flow Rate During Sampling Event	gpm	1,700	

gpm - gallons per minute.

NR - Not required by permit.

[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3E

2015 Storm Water Discharge Monitoring Data for Outfall Group 5

STORM WATER OUTFALL S17

Paramater Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			07/14/15	*07/14/15*
Group A Parameters	BOD_5	mg/L	3.7	< 2.0
	Oil & Grease[a]	mg/L	< 1.4	NR
	pH	SU	7.6	NR
	Phosphorous, Total	mg/L	0.46	0.12
	Solids, Total Dissolved	mg/L	212	136
	Solids, Total Suspended	mg/L	582	54
Group B Parameters	Aluminum, Total	mg/L	9.2	3.7
	Copper, Total Recoverable	mg/L	0.012	0.0048
	Iron, Total	mg/L	10	2.8
	Lead, Total Recoverable	mg/L	0.044	0.0063
	Zinc, Total Recoverable	mg/L	0.077	0.021
Group C Parameters	Ammonia (as NH_3)	mg/L	0.13	0.066
	Nitrogen, Nitrate (as N)	mg/L	0.30	0.11
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 1.6	< 0.67
	Nitrogen, Total Kjeldahl	mg/L	1.3	0.54
	Settleable Solids	ml/L	5.0	0.3
	Sulfide	mg/L	< 0.26	< 0.052
	Surfactant (as LAS)	mg/L	< 0.013 R	0.024
	Vanadium, Total Recoverable	mg/L	0.0051	0.0015
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.2	
	Rainfall During Sampling Event	inches	0.40	
Flow	Total Flow During Sampling Event	gallons	130,000	
	Maximum Flow Rate During Sampling Event	gpm	1,900	

gpm - gallons per minute.

NR - Not required by permit.

R - The surfactant (as LAS) result from the first flush grab was a non-detect, but was flagged "ureliable" because the matrix spike result was below the required recovery limits.

[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3E *(concluded)*
2015 Storm Water Discharge Monitoring Data for Outfall Group 5

STORM WATER OUTFALL S28

Paramater Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			10/28/15	*10/28/15*
Group A Parameters	BOD_5	mg/L	13	5.3
	Oil & Grease[a]	mg/L	< 1.6	NR
	pH	SU	7.3	NR
	Phosphorous, Total	mg/L	0.077	0.066
	Solids, Total Dissolved	mg/L	325	256
	Solids, Total Suspended	mg/L	37	70
Group B Parameters	Aluminum, Total	mg/L	2.3	2.8
	Copper, Total Recoverable	mg/L	0.0051	0.0062
	Iron, Total	mg/L	2.7	3.5
	Lead, Total Recoverable	mg/L	0.0030	0.0031
	Zinc, Total Recoverable	mg/L	0.037	0.032
Group C Parameters	Ammonia (as NH_3)	mg/L	0.041	0.016
	Nitrogen, Nitrate (as N)	mg/L	0.056	< 0.020
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 0.57	< 0.23
	Nitrogen, Total Kjeldahl	mg/L	0.49	0.19
	Settleable Solids	ml/L	< 0.1	< 0.1
	Sulfide	mg/L	< 0.052	< 0.052
	Surfactant (as LAS)	mg/L	0.016	0.017
	Vanadium, Total Recoverable	mg/L	0.0018	0.0014
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.8	
	Rainfall During Sampling Event	inches	0.30	
Flow	Total Flow During Sampling Event	gallons	430,000	
	Maximum Flow Rate During Sampling Event	gpm	2,400	

gpm - gallons per minute.
NR - Not required by permit.
[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3F
2015 Storm Water Discharge Monitoring Data for Outfall Group 6

STORM WATER OUTFALL S43

Paramater Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			07/14/15	*07/14/15*
Group A Parameters	BOD_5	mg/L	7.8	5.7
	Oil & Grease[a]	mg/L	< 1.4	NR
	pH	SU	7.7	NR
	Phosphorous, Total	mg/L	0.18	0.15
	Solids, Total Dissolved	mg/L	48	21
	Solids, Total Suspended	mg/L	36	34
Group B Parameters	Aluminum, Total	mg/L	2.3	3.7
	Copper, Total Recoverable	mg/L	0.0024	0.0034
	Iron, Total	mg/L	1.6	2.4
	Lead, Total Recoverable	mg/L	0.0012	0.0021
	Zinc, Total Recoverable	mg/L	0.0075	0.0089
Group C Parameters	Ammonia (as NH_3)	mg/L	0.076	0.13
	Nitrogen, Nitrate (as N)	mg/L	0.022	< 0.020
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	0.025
	Nitrogen, Total (as N)	mg/L	< 1.5	< 1.0
	Nitrogen, Total Kjeldahl	mg/L	1.5	0.95
	Solids, Settleable	ml/L	< 0.1	< 0.1
	Sulfide	mg/L	< 0.052	< 0.052
	Surfactant (as LAS)	mg/L	< 0.013	< 0.013
	Vanadium, Total Recoverable	mg/L	0.00072	0.0014
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.2	
	Rainfall During Sampling Event	inches	0.40	
Flow	Total Flow During Sampling Event	gallons	1,200	
	Maximum Flow Rate During Sampling Event	gpm	10	

gpm - gallons per minute.
NR - Not required by permit.
[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3F *(concluded)*
2015 Storm Water Discharge Monitoring Data for Outfall Group 6

STORM WATER OUTFALL S37

Paramater Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			10/28/15	*10/28/15*
Group A Parameters	BOD_5	mg/L	4.4	< 2.0
	Oil & Grease[a]	mg/L	< 1.6	NR
	pH	SU	6.9	NR
	Phosphorous, Total	mg/L	0.42	0.21
	Solids, Total Dissolved	mg/L	247	340
	Solids, Total Suspended	mg/L	310	52
Group B Parameters	Aluminum, Total	mg/L	11	4.5
	Copper, Total Recoverable	mg/L	0.014	0.0051
	Iron, Total	mg/L	12	4.5
	Lead, Total Recoverable	mg/L	0.0053	0.0021
	Zinc, Total Recoverable	mg/L	0.030	0.013
Group C Parameters	Ammonia (as NH_3)	mg/L	0.036	0.011
	Nitrogen, Nitrate (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 1.1	< 0.34
	Nitrogen, Total Kjeldahl	mg/L	1.1	0.30
	Solids, Settleable	ml/L	0.5	< 0.1
	Sulfide	mg/L	< 0.052	< 0.052
	Surfactant (as LAS)	mg/L	< 0.013	NA
	Vanadium, Total Recoverable	mg/L	0.0097	0.0031
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.8	
	Rainfall During Sampling Event	inches	0.29	
Flow	Total Flow During Sampling Event	gallons	3,900	
	Maximum Flow Rate During Sampling Event	gpm	26	

gpm - gallons per minute.
NA - Not available. The matrix spike result for surfactants (as LAS) for the flow-weighted composite at outfall S37 was low and determined as unreliable. Therefore this sample result has not been reported.
NR - Not required by permit.
[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

NOTE: Storm water outfall S43 in outfall group 6 was also analyzed for total recoverable lead during this sampling event. The total recoverable lead result for S43 in October 2015 = 0.0012 mg/L (Action Level = 0.006 mg/L).

TABLE B-3G
2015 Storm Water Discharge Monitoring Data for Outfall Group 7

STORM WATER OUTFALL S20 / DUPLICATE

Paramater Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			06/08/15	*06/08/15*
Group A Parameters	BOD_5	mg/L	4.7 / 5.0	< 2.0
	Oil & Grease[a]	mg/L	< 1.4 / <1.4	NR
	pH	SU	7.6	NR
	Phosphorous, Total	mg/L	0.38 / 2.2	0.051
	Solids, Total Dissolved	mg/L	86 / 29	37
	Solids, Total Suspended	mg/L	242 / 208	17
Group B Parameters	Aluminum, Total	mg/L	4.9 / 5.5	1.1
	Copper, Total Recoverable	mg/L	0.0096 / 0.010	0.0021
	Iron, Total	mg/L	6.7 / 7.6	1.1
	Lead, Total Recoverable	mg/L	0.0057/0.0061	0.0011
	Zinc, Total Recoverable	mg/L	0.055 / 0.057	0.0071
Group C Parameters	Ammonia (as NH_3)	mg/L	0.50 / 0.092	0.23
	Nitrogen, Nitrate (as N)	mg/L	0.41 / 0.22	0.22
	Nitrogen, Nitrite (as N)	mg/L	0.026 / 0.034	0.029
	Nitrogen, Total (as N)	mg/L	2.8 / 1.3	0.89
	Nitrogen, Total Kjeldahl	mg/L	2.4 / 1.0	0.64
	Sulfide	mg/L	<0.052/<0.052	< 0.052
	Surfactant (as LAS)	mg/L	0.013 /< 0.013	< 0.013
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.1	
	Rainfall During Sampling Event	inches	0.47	
Flow	Total Flow During Sampling Event	gallons	76,000	
	Maximum Flow Rate During Sampling Event	gpm	990	

Note: The first flush grab samples were sampled and analyzed in duplicate.
gpm - gallons per minute.
NR - Not required by permit.
[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3G *(concluded)*
2015 Storm Water Discharge Monitoring Data for Outfall Group 7

STORM WATER OUTFALL S20

Paramater Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			09/09/15	*09/09/15*
Group A Parameters	BOD_5	mg/L	17	3.4
	Oil & Grease[a]	mg/L	< 1.5	NR
	pH	SU	8.2	NR
	Phosphorous, Total	mg/L	0.26	0.030
	Solids, Total Dissolved	mg/L	40	22
	Solids, Total Suspended	mg/L	106	28
Group B Parameters	Aluminum, Total	mg/L	4.8	1.4
	Copper, Total Recoverable	mg/L	0.0061	0.0017
	Iron, Total	mg/L	5.6	1.2
	Lead, Total Recoverable	mg/L	0.0033	0.00098
	Zinc, Total Recoverable	mg/L	0.035	0.0087
Group C Parameters	Ammonia (as NH_3)	mg/L	0.074	0.14
	Nitrogen, Nitrate (as N)	mg/L	2.3	0.64
	Nitrogen, Nitrite (as N)	mg/L	0.026	0.024
	Nitrogen, Total (as N)	mg/L	4.3	1.2
	Nitrogen, Total Kjeldahl	mg/L	2.0	0.51
	Sulfide	mg/L	< 0.052	< 0.052
	Surfactant (as LAS)	mg/L	< 0.013	0.024
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.5	
	Rainfall During Sampling Event	inches	0.14	
Flow	Total Flow During Sampling Event	gallons	88,000	
	Maximum Flow Rate During Sampling Event	gpm	950	

gpm - gallons per minute.
NR - Not required by permit.
[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3H
2015 Storm Water Discharge Monitoring Data for Outfall Group 8

STORM WATER OUTFALL S27

Paramater Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			07/14/15	07/14/15
Group A Parameters	BOD_5	mg/L	2.6	< 2.0
	Oil & Grease[a]	mg/L	< 1.4	NR
	pH	SU	7.6	NR
	Phosphorous, Total	mg/L	0.70	0.13
	Solids, Total Dissolved	mg/L	192	141
	Solids, Total Suspended	mg/L	471	54
Group B Parameters	Aluminum, Total	mg/L	9.5	3.5
	Copper, Total Recoverable	mg/L	0.023	0.0045
	Iron, Total	mg/L	11	2.6
	Lead, Total Recoverable	mg/L	0.034	0.0042
	Zinc, Total Recoverable	mg/L	0.12	0.016
Group C Parameters	Ammonia (as NH_3)	mg/L	0.11	0.077
	Nitrogen, Nitrate (as N)	mg/L	0.37	0.097
	Nitrogen, Nitrite (as N)	mg/L	0.022	< 0.020
	Nitrogen, Total (as N)	mg/L	1.9	< 1.0
	Nitrogen, Total Kjeldahl	mg/L	1.5	0.88
	Surfactant (as LAS)	mg/L	< 0.013	< 0.013
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.2	
	Rainfall During Sampling Event	inches	0.40	
Flow	Total Flow During Sampling Event	gallons	55,000	
	Maximum Flow Rate During Sampling Event	gpm	640	

gpm - gallons per minute.
NR - Not required by permit.
[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3H *(concluded)*
2015 Storm Water Discharge Monitoring Data for Outfall Group 8

STORM WATER OUTFALL S35

Paramater Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			09/09/15	*09/09/15*
Group A Parameters	BOD_5	mg/L	5.6	4.3
	Oil & Grease[a]	mg/L	2.4	NR
	pH	SU	8.1	NR
	Phosphorous, Total	mg/L	1.9	1.5
	Solids, Total Dissolved	mg/L	446	503
	Solids, Total Suspended	mg/L	2190	1460
Group B Parameters	Aluminum, Total	mg/L	23	21
	Copper, Total Recoverable	mg/L	0.047	0.042
	Iron, Total	mg/L	37	33
	Lead, Total Recoverable	mg/L	0.13	0.076
	Zinc, Total Recoverable	mg/L	0.33	0.25
Group C Parameters	Ammonia (as NH_3)	mg/L	0.17	0.11
	Nitrogen, Nitrate (as N)	mg/L	1.8	1.9
	Nitrogen, Nitrite (as N)	mg/L	0.025	0.022
	Nitrogen, Total (as N)	mg/L	4.8	4.0
	Nitrogen, Total Kjeldahl	mg/L	3.0	2.1
	Surfactant (as LAS)	mg/L	< 0.013	< 0.013
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.5	
	Rainfall During Sampling Event	inches	0.14	
Flow	Total Flow During Sampling Event	gallons	11,000	
	Maximum Flow Rate During Sampling Event	gpm	450	

gpm - gallons per minute.
NR - Not required by permit.
[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

TABLE B-3I
2015 Storm Water Discharge Monitoring Data

STORM WATER ACCUMULATED IN THE EQUALIZATION BASIN[a]

Paramater Group	***Analyte***	***Units***	***N***	***Batch Sample***
				10/15/15
Group A Parameters	BOD_5	mg/L	1	< 2.0
	Oil & Grease[b]	mg/L	1	1.4
	pH	SU	1	7.8
	Phosphorous, Total	mg/L	1	0.024
	Solids, Total Dissolved	mg/L	1	141
	Solids, Total Suspended	mg/L	1	16
Group B Parameters	Aluminum, Total	mg/L	1	<0.060
	Copper, Total Recoverable	mg/L	1	0.0011
	Iron, Total	mg/L	1	< 0.019
	Lead, Total Recoverable	mg/L	1	0.00014
	Zinc, Total Recoverable	mg/L	1	0.012
Group C Parameters	Alpha BHC	mg/L	1	<0.0000067
	Ammonia (as NH_3)	mg/L	1	0.035
	Nitrogen, Nitrate (as N)	mg/L	1	0.11
	Nitrogen, Nitrite (as N)	mg/L	1	< 0.020
	Nitrogen, Total (as N)	mg/L	1	< 0.35
	Nitrogen, Total Kjeldahl	mg/L	1	0.22

N - Number of samples.

[a] Accumulated water was discharged from the Equalization Basin. Discharge did not contain sanitary waste water from the WWTF.

[b] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

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APPENDIX B-4
Surface Water Data

TABLE B-4A
Comparison of 2015 Radioactivity Concentrations in Surface Water at the Northeast Swamp (WNSWAMP) With U.S. DOE-Derived Concentration Standards (DCSs)

Isotope [a]	*N*	*Discharge Activity* [b] (Ci)	*Discharge Activity* [b] (Becquerels) [c]	*Average Concentration* (µCi/mL)	*DCS* [d] (µCi/mL)	*Ratio of Average Concentration to DCS*
Gross Alpha	26	-9.78±7.07E-05	-3.62±2.62E+06	-1.22±0.88E-09	NA[e]	NA
Gross Beta	26	2.45±0.01E-01	9.08±0.02E+09	3.07±0.01E-06	NA[e]	NA
Tritium	26	5.01±2.66E-03	1.86±0.99E+08	6.28±3.33E-08	1.9E-03	< 0.0001
C-14	2	0.21±1.60E-03	0.78±5.92E+07	0.27±2.00E-08	6.2E-05	< 0.0003
Sr-90	12	1.02±0.01E-01	3.76±0.02E+09	1.27±0.01E-06	1.1E-06	1.16
I-129	2	2.22±5.39E-05	0.82±1.99E+06	2.78±6.75E-10	3.3E-07	< 0.0020
Cs-137	12	3.14±7.79E-05	1.16±2.88E+06	3.93±9.75E-10	3.0E-06	< 0.0003
U-232[f]	2	-0.26±4.80E-06	-0.10±1.77E+05	-0.33±6.00E-11	9.8E-08	< 0.0006
U-233/234[f]	2	1.40±0.54E-05	5.18±2.01E+05	1.75±0.68E-10	6.6E-07[g]	0.0003
U-235/236[f]	2	4.47±3.08E-06	1.65±1.14E+05	5.59±3.85E-11	7.2E-07	0.0001
U-238[f]	2	8.91±4.23E-06	3.30±1.57E+05	1.12±0.53E-10	7.5E-07	0.0001
Pu-238	2	0.20±2.27E-06	0.75±8.39E+04	0.25±2.84E-11	1.5E-07	< 0.0002
Pu-239/240	2	2.07±2.79E-06	0.77±1.03E+05	2.59±3.49E-11	1.4E-07	< 0.0002
Am-241	2	1.08±2.16E-06	4.00±7.99E+04	1.35±2.70E-11	1.7E-07	< 0.0002
Sum of Ratios						**1.16**

Notes: Average concentrations represent sample composite concentrations weighted to monthly stream flow.
The average pH at this location was 7.4 Standard Units (SU).

N - Number of samples.

NA - Not applicable.

[a] Half-lives are listed in Table UI-4.

[b] Total estimated volume released: 7.99E+10 mL (2.11+07 gal).

[c] 1 Ci = 3.7E+10 Bq: 1Bq = 2.7E-11 Ci.

[d] DCSs are used as reference values for the application of best available technology per DOE Order 458.1.

[e] DCSs do not exist for indicator parameters gross alpha and gross beta.

[f] Total Uranium (g) = 2.62±0.09E+01 ; Average Total Uranium (µg/mL) = 3.28±0.11E-04.

[g] The DCS for Uranium-233 is used for this comparison.

TABLE B-4B
Comparison of 2015 Radioactivity Concentrations in Surface Water at the North Swamp (WNSW74A) With U.S. DOE-Derived Concentration Standards (DCSs)

Isotope [a]	*N*	*Discharge Activity* [b] (Ci)	*Discharge Activity* [b] (Becquerels) [c]	*Average Concentration* (µCi/mL)	*DCS* [d] (µCi/mL)	*Ratio of Average Concentration to DCS*
Gross Alpha	26	-5.76±4.16E-05	-2.13±1.54E+06	-1.23±0.89E-09	NA[e]	NA
Gross Beta	26	6.69±0.36E-04	2.47±0.13E+07	1.43±0.08E-08	NA[e]	NA
Tritium	26	0.77±1.27E-03	2.84±4.69E+07	1.64±2.71E-08	1.9E-03	< 0.0001
C-14	2	-7.28±9.94E-04	-2.69±3.68E+07	-1.56±2.12E-08	6.2E-05	< 0.0003
Sr-90	12	2.18±0.17E-04	8.06±0.62E+06	4.65±0.36E-09	1.1E-06	0.0042
I-129	2	-0.84±3.28E-05	-0.31±1.21E+06	-1.80±7.01E-10	3.3E-07	< 0.0021
Cs-137	12	2.67±4.11E-05	0.99±1.52E+06	5.71±8.79E-10	3.0E-06	< 0.0003
U-232[f]	2	-0.11±1.17E-06	-0.39±4.31E+04	-0.23±2.49E-11	9.8E-08	< 0.0003
U-233/234[f]	2	4.28±3.44E-06	1.58±1.27E+05	9.14±7.34E-11	6.6E-07[g]	0.0001
U-235/236[f]	2	1.24±2.03E-06	4.57±7.50E+04	2.64±4.33E-11	7.2E-07	< 0.0001
U-238[f]	2	2.97±2.72E-06	1.10±1.01E+05	6.35±5.81E-11	7.5E-07	0.0001
Pu-238	2	0.72±1.09E-06	2.68±4.04E+04	1.55±2.33E-11	1.5E-07	< 0.0002
Pu-239/240	2	0.90±1.55E-06	3.34±5.74E+04	1.93±3.32E-11	1.4E-07	< 0.0002
Am-241	2	0.61±1.62E-06	2.27±5.99E+04	1.31±3.46E-11	1.7E-07	< 0.0002
Sum of Ratios						< **0.0081**

Notes: Average concentrations represent sample composite concentrations weighted to monthly stream flow.
The average pH at this location was 7.4 Standard Units (SU).

N - Number of samples.

NA - Not applicable.

[a] Half-lives are listed in Table UI-4.

[b] Total estimated volume released: 4.68E+10 mL (1.24+07 gal).

[c] 1 Ci = 3.7E+10 Bq: 1Bq = 2.7E-11 Ci.

[d] DCSs are used as reference values for the application of best available technology per DOE Order 458.1.

[e] DCSs do not exist for indicator parameters gross alpha and gross beta.

[f] Total Uranium (g) = 3.51±5.49E+00 ; Average Total Uranium (µg/mL) = 0.75±1.17E-04.

[g] The DCS for Uranium-233 is used for this comparison.

TABLE B-4C
2015 Radioactivity and pH in Surface Water at Facility Yard Drainage (WNSP005)

Analyte	Units	N	WNSP005 Concentrations			Guideline [a] or Standard [b]
			Minimum	Average	Maximum	
Gross Alpha	µCi/mL	4	< 6.04E-10	0.95±3.59E-09	1.79E-09	9.8E-08[c]
Gross Beta	µCi/mL	4	4.53E-08	5.15±0.09E-07	9.80E-07	1.1E-06[d]
Tritium	µCi/mL	4	< 8.17E-08	0.01±1.04E-07	< 1.26E-07	1.9E-03
Sr-90	µCi/mL	2	2.21E-07	2.24±0.08E-07	2.28E-07	1.1E-06
Cs-137	µCi/mL	2	< 3.20E-09	-0.72±3.23E-09	< 3.26E-09	3.0E-06
pH	SU	4	7.3	7.5	7.9	6.0–9.5

N - Number of samples.
[a] DOE ingestion-based DCSs for 100 mrem/yr dose limit are provided as a guideline for radiological results.
[b] New York State Water Quality Standards for Class "D" as a comparative reference for non-radiological results.
[c] Alpha as U-232.
[d] Beta as Sr-90.

TABLE B-4D
2015 Radioactivity of Surface Water Downstream of the WVDP at Franks Creek (WNSP006)

Analyte	Units	N	WNSP006 Concentrations		N	Reference Values: WFBCBKG [a] Background Range	Reference Values: Guideline [b]
			Average	Maximum			
Gross Alpha	µCi/mL	26	2.05±1.79E-09	3.66E-08	12	< 6.33E-10 - < 1.61E-09	9.8E-08[c]
Gross Beta	µCi/mL	26	4.74±0.21E-08	1.67E-07	12	< 7.12E-10 - 2.99E-09	1.1E-06[d]
Tritium	µCi/mL	26	5.14±9.59E-08	1.07E-07	12	< 7.19E-08 - < 1.25E-07	1.9E-03
C-14	µCi/mL	4	-2.09±2.92E-08	< 3.12E-08	2	< 2.88E-08 - < 3.22E-08	6.2E-05
Sr-90	µCi/mL	12	1.70±0.22E-08	3.91E-08	2	< 4.48E-10 - < 6.80E-10	1.1E-06
Tc-99	µCi/mL	4	1.26±2.48E-09	< 2.79E-09	2	< 1.45E-09 - 3.04E-09	4.4E-05
I-129	µCi/mL	4	0.33±8.97E-10	9.66E-10	2	8.43E-10 - < 1.11E-09	3.3E-07
Cs-137	µCi/mL	12	9.65±1.09E-08	1.05E-06	2	< 2.58E-09 - < 2.65E-09	3.0E-06
U-232	µCi/mL	4	1.65±1.00E-10	3.83E-10	2	< 2.93E-11 - < 4.30E-11	9.8E-08
U-233/234	µCi/mL	4	5.15±1.67E-10	1.16E-09	2	< 8.17E-11 - 1.92E-10	6.6E-07[e]
U-235/236	µCi/mL	4	8.89±7.81E-11	2.04E-10	2	< 3.94E-11 - < 5.32E-11	7.2E-07
U-238	µCi/mL	4	3.73±1.42E-10	8.37E-10	2	< 5.30E-11 - 9.07E-11	7.5E-07
Total U	µg/mL	4	9.52±0.39E-04	1.99E-03	2	1.48E-04 - 2.59E-04	--
Pu-238	µCi/mL	4	8.72±7.14E-11	3.56E-10	2	< 2.35E-11 - < 3.01E-11	1.5E-07
Pu-239/240	µCi/mL	4	1.81±1.19E-10	6.88E-10	2	< 2.35E-11 - < 2.81E-11	1.4E-07
Am-241	µCi/mL	4	5.33±1.47E-10	2.10E-09	2	< 2.49E-11 - < 2.73E-11	1.7E-07

N - Number of samples.
-- No Guideline or standard available for these analytes.
[a] Background location.
[b] DOE ingestion-based DCSs for 100 mrem/yr dose limit are provided as a guideline for radiological results.
[c] Alpha as U-232.
[d] Beta as Sr-90.
[e] DCS for U-233 is used for this comparison.

TABLE B-4E
2015 Radioactivity in Surface Water Drainage Between the NDA and SDA (WNNDADR)

Analyte	*Units*	*N*	*WNNDADR Concentrations*			*Guideline* [a]
			Minimum	*Average*	*Maximum*	
Gross Alpha	µCi/mL	12	< 5.68E-10	0.48±1.04E-09	2.40E-09	9.8E-08[b]
Gross Beta	µCi/mL	12	1.60E-08	3.00±0.14E-08	3.83E-08	1.1E-06[c]
Tritium	µCi/mL	12	1.43E-07	3.35±1.13E-07	5.36E-07	1.9E-03
Sr-90	µCi/mL	2	1.13E-08	1.22±0.17E-08	1.31E-08	1.1E-06
I-129	µCi/mL	2	< 4.41E-10	0.48±7.12E-10	< 9.04E-10	3.3E-07
Cs-137	µCi/mL	12	< 2.26E-09	1.39±3.30E-09	4.10E-09	3.0E-06

N - Number of samples.
[a] DOE ingestion-based DCSs for 100 mrem/yr dose limit are provided as a guideline for radiological results.
[b] Alpha as U-232.
[c] Beta as Sr-90.

TABLE B-4F
2015 Radioactivity and pH in Surface Water at Erdman Brook (WNERB53)

Analyte	*Units*	*N*	*WNERB53 Concentrations*		*N*	*Reference Values*	
						WFBCBKG [a] *Background Range*	*Guideline* [b] *or Standard* [c]
			Average	*Maximum*			
Gross Alpha	µCi/mL	4	-0.06±1.26E-09	< 1.35E-09	12	< 6.33E-10 - < 1.61E-09	9.8E-08[d]
Gross Beta	µCi/mL	4	7.10±1.08E-09	7.95E-09	12	< 7.12E-10 - 2.99E-09	1.1E-06[e]
Tritium	µCi/mL	4	0.10±1.07E-07	< 1.28E-07	12	< 7.19E-08 - < 1.25E-07	1.9E-03
Sr-90	µCi/mL	2	5.08±8.86E-10	< 9.50E-10	2	< 4.48E-10 - < 6.80E-10	1.1E-06
Cs-137	µCi/mL	2	0.78±2.71E-09	< 2.72E-09	2	< 2.58E-09 - < 2.65E-09	3.0E-06
pH	SU	4	Range: 7.5-7.9		292	6.4–8.7	6.0–9.5

N - Number of samples.
[a] Background data are from Buttermilk Creek, upstream of the WVDP. Sampling for nonradiological data was discontinued. at this location in 2008. The pH range was calculated from the most recent 10 years of sampling, 1998–2007.
[b] DOE ingestion-based DCSs for 100 mrem/yr dose limit are provided as a guideline for radiological results.
[c] New York State Water Quality Standards for surface waters Class "D" as a standard for non-radiological results.
[d] Alpha as U-232.
[e] Beta as Sr-90.

TABLE B-4G
2015 Radioactivity and pH in Surface Water at Franks Creek (WNFRC67)

Analyte	Units	N	WNFRC67 Concentrations		N	Reference Values	
			Average	Maximum		WFBCBKG [a] Background Range	Guideline [b] or Standard [c]
Gross Alpha	µCi/mL	4	-0.36±1.03E-09	1.54E-09	12	< 6.33E-10 - < 1.61E-09	9.8E-08[d]
Gross Beta	µCi/mL	4	2.38±0.85E-09	4.15E-09	12	< 7.12E-10 - 2.99E-09	1.1E-06[e]
Tritium	µCi/mL	4	0.11±1.09E-07	< 1.25E-07	12	< 7.19E-08 - < 1.25E-07	1.9E-03
Sr-90	µCi/mL	2	-0.06±1.07E-09	< 1.08E-09	2	< 4.48E-10 - < 6.80E-10	1.1E-06
Cs-137	µCi/mL	2	1.55±3.17E-09	< 3.35E-09	2	< 2.58E-09 - < 2.65E-09	3.0E-06
pH	SU	4	Range: 7.4-7.8		292	6.4–8.7	6.0–9.5

N - Number of samples.
[a] Background data are from Buttermilk Creek, upstream of the WVDP. Sampling for nonradiological data was discontinued. at this location in 2008. The pH range was calculated from the most recent 10 years of sampling, 1998–2007.
[b] DOE ingestion-based DCSs for 100 mrem/yr dose limit are provided as a guideline for radiological results.
[c] New York State Water Quality Standards for Class "D" surface waters as a standard for non-radiological results.
[d] Alpha as U-232.
[e] Beta as Sr-90.

TABLE B-4H
2015 Water Quality of Surface Water Downstream of the WVDP in Buttermilk Creek at Thomas Corners Bridge (WFBCTCB)

RADIOACTIVITY CONCENTRATIONS

Analyte	Units	N	WFBCTCB Concentrations		N	Reference Values	
			Average	Maximum		WFBCBKG [a] Background Range	Guideline [b]
Gross Alpha	µCi/mL	12	0.45±1.03E-09	2.09E-09	12	< 6.33E-10 - < 1.61E-09	9.8E-08[c]
Gross Beta	µCi/mL	12	6.18±0.89E-09	8.50E-09	12	< 7.12E-10 - 2.99E-09	1.1E-06[d]
Tritium	µCi/mL	12	-0.36±9.06E-08	< 1.27E-07	12	< 7.19E-08 - < 1.25E-07	1.9E-03
Sr-90	µCi/mL	2	1.05±0.94E-09	1.51E-09	2	< 4.48E-10 - < 6.80E-10	1.1E-06
Cs-137	µCi/mL	2	2.18±2.33E-09	5.40E-09	2	< 2.58E-09 - < 2.65E-09	3.0E-06

N - Number of samples.
[a] Background location.
[b] DOE ingestion based derived consentration standards (DCSs) for 100 mrem/yr dose limit are provided as a guideline for radiological results.
[c] Alpha as U-232.
[d] Beta as Sr-90.

TABLE B-4I
2015 Radioactivity and pH in Surface Water Downstream of the WVDP in Cattaraugus Creek at Felton Bridge (WFFELBR)

Analyte	Units	N	WFFELBR Concentrations [c]		N	Reference Values	
			Average	Maximum		WFBIGBR Background Range	Guideline [a] or Standard [b]
Gross Alpha	µCi/mL	12	0.60±1.27E-09	2.77E-09	98	<3.59E-10–4.62E-09	9.8E-08[d]
Gross Beta	µCi/mL	12	3.43±1.03E-09	5.78E-09	98	<9.03E-10–1.37E-08	1.1E-06[e]
Tritium	µCi/mL	12	0.21±1.02E-07	1.11E-07	98	<4.46E-08–2.65E-07	1.9E-03
Sr-90	µCi/mL	12	-0.71±8.36E-10	< 1.11E-09	98	<3.57E-10–1.10E-08	1.1E-06
Cs-137	µCi/mL	12	0.44±2.98E-09	< 3.65E-09	98	<1.34E-09–5.29E-09	3.0E-06
pH	SU	26	Range: 7.6-8.5		98	5.8–8.3	6.5–8.5

Note: Historical background data are from Bigelow Bridge, on Cattaraugus Creek upstream of WFFELBR. Sampling at WFBIGBR was discontinued in 2008. Range was calculated from the most recent 10 years of sampling, 1998-2007.
N - Number of samples.
[a] DOE ingestion-based DCSs for 100 mrem/yr dose limit are provided as a guideline for radiological results in the absence of water quality standards.
[b] New York Water Quality Standards for Class "B" as a comparative reference for non-radiological results.
[c] Except for pH, values represent composite concentrations weighted to monthly stream flow.
[d] Alpha as U-232.
[e] Beta as Sr-90.

TABLE B-4J
Historical Radioactivity and pH in Surface Water at Bigelow Bridge Cattaraugus Creek Background (WFBIGBR)

Analyte	Units	N	WFBIGBR [a] Concentrations		Reference Values Guideline [b] or Standard [c]
			Average	Maximum	
Gross Alpha	µCi/mL	98	0.45±1.05E-09	4.62E-09	9.8E-08[d]
Gross Beta	µCi/mL	98	2.64±1.35E-09	1.37E-08	1.1E-06[e]
Tritium	µCi/mL	98	0.71±7.79E-08	2.65E-07	1.9E-03
Sr-90	µCi/mL	98	1.27±1.46E-09	1.10E-08	1.1E-06
Cs-137	µCi/mL	98	0.59±3.27E-09	5.29E-09	3.0E-06
pH	SU	98	Range: 5.8–8.3		6.5–8.5

N - Number of samples.
[a] Sampling was discontinued in 2008. Data represent measurements from the most recent 10 years of sampling, 1998 through 2007.
[b] DOE ingestion-based DCSs for 100 mrem/yr dose limit are provided as a guideline for radiological results.
[c] The New York Water Quality Standard for Class "B" is provided as a comparative reference for pH.
[d] Alpha as U-232.
[e] Beta as Sr-90.

TABLE B-4K
2015 Radioactivity and pH in Surface Water at Fox Valley Road
Buttermilk Creek Background (WFBCBKG)

Analyte	Units	N	WFBCBKG [a] Concentrations		Reference Values Guideline [b] or Standard [c]
			Average	Maximum	
Gross Alpha	µCi/mL	12	-0.08±1.13E-09	< 1.61E-09	9.8E-08[d]
Gross Beta	µCi/mL	12	1.88±0.83E-09	2.99E-09	1.1E-06[e]
Tritium	µCi/mL	12	2.63±9.19E-08	< 1.25E-07	1.9E-03
C-14	µCi/mL	2	-1.58±3.05E-08	< 3.22E-08	6.2E-05
Sr-90	µCi/mL	2	-1.46±5.76E-10	< 6.80E-10	1.1E-06
Tc-99	µCi/mL	2	0.82±2.18E-09	3.04E-09	4.4E-05
I-129	µCi/mL	2	4.45±9.49E-10	8.43E-10	3.3E-07
Cs-137	µCi/mL	2	1.33±2.62E-09	< 2.65E-09	3.0E-06
U-232	µCi/mL	2	-1.06±3.68E-11	< 4.30E-11	9.8E-08
U-233/234	µCi/mL	2	1.31±0.95E-10	1.92E-10	6.6E-07[f]
U-235/236	µCi/mL	2	1.54±4.68E-11	< 5.32E-11	7.2E-07
U-238	µCi/mL	2	5.88±6.49E-11	9.07E-11	7.5E-07
Total U	µg/mL	2	2.04±0.12E-04	2.59E-04	--
Pu-238	µCi/mL	2	-0.44±2.70E-11	< 3.01E-11	1.5E-07
Pu-239/240	µCi/mL	2	0.05±2.59E-11	< 2.81E-11	1.4E-07
Am-241	µCi/mL	2	0.25±2.61E-11	< 2.73E-11	1.7E-07
pH[a]	SU	292	Range: 6.4–8.7		6.0–9.5

N - Number of samples.
-- No Guideline or standard available for these analytes.
[a] Sampling for nonradiological constituents was discontinued in 2008. The pH values represent measurements from the most recent 10 years of sampling, 1998 through 2007.
[b] DOE ingestion-based DCSs for 100 mrem/yr dose limit are provided as a guideline for radiological results.
[c] The New York Water Quality Standard for Class "D" is provided as a comparative reference for pH.
[d] Alpha as U-232.
[e] Beta as Sr-90.
[f] DCS for U-233 used for this comparison.

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APPENDIX B-5
Potable Water (Drinking Water) Data

TABLE B-5A
2015 Water Quality Results in Drinking Water
at Tap Water Locations Inside the MPPB and RHWF

Analyte	*Units*	*N*	*WNDNKMP (Main Plant)*	*WNDNKRH (RHWF)*	*Standard [a]*
Gross Alpha	µCi/mL	1	-0.92±1.54E-09	NA	1.5E-08
Gross Beta	µCi/mL	1	2.67±0.91E-09	NA	1.5E-08
Tritium	µCi/mL	1	1.41±8.56E-08	NA	2.0E-05
Disinfection Byproducts					
Haloacetic Acids-Five (5)	mg/L	1	NA	0.005	0.060
Total Trihalomethanes	mg/L	1	NA	0.013	0.080

N - Number of samples.
NA - Not applicable, constituent not analyzed.
[a] New York State Department of Health (NYSDOH) MCLs or screening levels for drinking water used as a comparative reference (see Table B-1C).

TABLE B-5B
2015 Biological and Chlorine Results in Drinking Water
at Sitewide Tap Water Locations

Analyte	*Units*	*N*	*Results from Various Site Tap Water Locations*	*Standard [a]*
E. coli[b]	NA	8	0 Postive: 8 Negative	one positive sample
Total Coliform[b]	NA	8	0 Postive: 8 Negative	two or more positive samples
Free Residual Chlorine[b]	mg/L	8	Range: 0.27 - 1.22	greater than 0.2 and less than 4.0
Nitrate (as N)[b]	mg/L	1	1.16	10 mg/L

N- Number of samples.
NA - Not applicable.
[a] NYSDOH MCLs for drinking water or EPA MCLGs, whichever is more stringent. Notify health department if exceeded.
[b] Analyzed by Cattaraugus County Health Department (CCHD).

TABLE B-5C
2015 Metals and Water Quality Results in Treated Potable Water

Analyte	Units	N	Average Concentration	Standard or Guideline [a]
		Metals [b]		
Antimony, Total	mg/L	1	<0.001	0.006
Arsenic, Total	mg/L	1	0.0014	0.010
Barium, Total	mg/L	1	1.55	2.00
Beryllium, Total	mg/L	1	<0.0004	0.004
Cadmium, Total	mg/L	1	<0.0001	0.005
Chromium, Total	mg/L	1	<0.002	0.10
Mercury, Total	mg/L	1	<0.0002	0.002
Nickel, Total	mg/L	1	0.0030	--
Selenium, Total	mg/L	1	<0.002	0.05
Silver, Total	mg/L	1	<0.001	0.1
Sodium, Total [d]	mg/L	1	36.5	20/270 [e]
Thallium, Total	mg/L	1	<0.0002	0.002
		Water Quality		
Cyanide, Total [b]	mg/L	1	<0.01	0.2
Fluoride [b]	mg/L	1	0.32	2.2
Nitrate-N [d]	mg/L	1	<0.05	10
Free Residual Chlorine [c]	mg/L	365	Range: 0.26 - 3.26	0.2 - 4.0

Note: Sample collected March 18, 2015 in utility room after chlorination and iron treatment (sampling location WNDFIN) prior to distribution into the water supply system.

N - Number of samples.
-- No guideline or standard available for these analytes.
[a] New York State Department of Health (NYSDOH) MCLs for drinking water.
[b] Metals, cyanide and fluoride are analyzed for once every three years. The current data represent the first collection (March 18, 2015). The next sampling will be in 2018.
[c] Samples of finished water are collected and analyzed for chlorine daily.
[d] Sodium and Nitrate are analyzed for once every year.
[e] Although there is no designated limit for sodium, recommended limits are provided for people on severely and moderately sodium restricted diets.

TABLE B-5D
2015 Water Quality Results for Organic Parameters in Treated Potable Water

Location Code	*Date Collected*	*Analyte*	*Results - All Quarters (mg/L)*
		Principal Organic Contaminants (POCs)	
WNDFIN	Mar-2015 Jun-2015 Sep-2015	1,1,1,2-Tetrachloroethane	< 0.00050
		1,1,1-Trichloroethane	< 0.00050
		1,1,2,2-Tetrachloroethane	< 0.00050
		1,1,2-Trichloroethane	< 0.00050
		1,1-Dichloroethane	< 0.00050
		1,1-Dichloroethene	< 0.00050
		1,1-Dichloropropene	< 0.00050
		1,2,3-Trichlorobenzene	< 0.00050
		1,2,3-Trichloropropane	< 0.00050
		1,2,4-Trichlorobenzene	< 0.00050
		1,2,4-Trimethylbenzene	< 0.00050
		1,2-Dichlorobenzene	< 0.00050
		1,2-Dichloroethane	< 0.00050
		1,2-Dichloropropane	< 0.00050
		1,3,5-Trimethylbenzene	< 0.00050
		1,3-Dichlorobenzene	< 0.00050
		1,3-Dichloropropane	< 0.00050
		1,4-Dichlorobenzene	< 0.00050
		2,2-Dichloropropane	< 0.00050
		2-Chlorotoluene	< 0.00050
		4-Chlorotoluene	< 0.00050
		Benzene	< 0.00050
		Bromobenzene	< 0.00050
		Bromochloromethane	< 0.00050
		Bromomethane	< 0.0010
		Carbon Tetrachloride	< 0.00050
		Chlorobenzene	< 0.00050
		Chloroethane	< 0.0010
		Chloromethane	< 0.00050
		cis-1,2-Dichloroethene	< 0.00050
		cis-1,3-Dichloropropene	< 0.00050
		Dibromomethane	< 0.00050
		Dichlorodifluoromethane	< 0.00050
		Ethylbenzene	< 0.00050
		Hexachlorobutadiene	< 0.00050
		Isopropylbenzene	< 0.00050
		Methyl-tert butyl-ether (MTBE)	< 0.00050
		Methylene Chloride	< 0.00050
		N-Butylbenzene	< 0.00050
		n-Propylbenzene	< 0.00050
		p-Isopropyltoluene	< 0.00050
		Sec-Butylbenzene	< 0.00050
		Styrene	< 0.00050
		Tert-Butylbenzene	< 0.00050
		Tetrachloroethene	< 0.00050
		Toluene	< 0.00050
		trans-1,2-Dichloroethene	< 0.00050
		trans-1,3-Dichloropropene	< 0.00050
		Trichloroethene	< 0.00050
		Trichlorofluoromethane	< 0.00050
		Vinyl chloride	< 0.00050

TABLE B-5D *(concluded)*
2015 Water Quality Results for Organic Parameters in Treated Potable Water

Location Code	*Date Collected*	*Analyte*	*Results - All Quarters (mg/L)*
Principal Organic Contaminants (POCs) (continued)			
WNDFIN	Mar-2015 Jun-2015 Sep-2015	Xylenes	< 0.00050
		m-Xylene and p-Xylene	< 0.00050
		o-Xylene	< 0.00050
Specific Organic Chemicals (SOCs)			
WNDFIN	Mar-2015 Jun-2015 Sep-2015	2,3,7,8-TCDD (dioxin)	< 0.00000000475
		2,4,5-TP (silvex)	< 0.00025
		2,4-D	< 0.00050
		3-Hydroxycarbofuran	< 0.0025
		Alachlor	< 0.00020
		Aldicarb	< 0.0025
		Aldicarb sulfone	< 0.0025
		Aldicarb sulfoxide	< 0.0025
		Aldrin	< 0.000025
		Atrazine	< 0.00020
		Butachlor	< 0.00050
		Carbaryl	< 0.0025
		Carbofuran	< 0.0025
		Chlordane	< 0.00025
		Dalapon	< 0.0050
		Dibromochloropropane (DBCP)	< 0.000020
		Dicamba	< 0.00050
		Dieldrin	< 0.000025
		Dinoseb	< 0.0010
		Endrin	< 0.000025
		Ethylene Dibromide (EDB)	< 0.000020
		Heptachlor	< 0.000025
		Heptachlor epoxide	< 0.000025
		Hexachlorobenzene	< 0.00020
		Hexachlorocyclopentadiene	< 0.0020
		Lindane (gamma BHC)	< 0.000025
		Methomyl	< 0.0025
		Methoxychlor	< 0.000025
		Metolachlor	< 0.00020
		Metribuzin	< 0.00020
		Oxymal	< 0.0025
		PCB-1016	< 0.00050
		PCB-1221	< 0.00050
		PCB-1232	< 0.00050
		PCB-1242	< 0.00050
		PCB-1248	< 0.00050
		PCB-1254	< 0.00050
		PCB-1260	< 0.00050
		PCBs, total	< 0.00050
		Pentachlorophenol	< 0.00020
		Picloram	< 0.00050
		Propachlor	< 0.00020
		Simazine	< 0.00050
		Toxaphene	< 0.0025

Note: Sample collected quarterly for first year of system operation. First quarterly sample was collected in December 2014 and reported in the CY2014 ASER. Sample is collected in the utility room after chlorination and iron treatment (at sampling location WNDFIN) prior to distribution into the water supply system.

TABLE B-5E
2015 Radiological Indicator Water Quality Results in Raw (Untreated) Potable Water

Location Code	*Date Collected*	*Gross Alpha µCi/mL*	*Gross Beta µCi/mL*	*Tritium µCi/mL*
Groundwater Background [a]		***7.61E-09***	***1.56E-08***	***1.78E-07***
Supply Well #1 Pumping				
WNDRAW1	1/21/2015	1.07±2.30E-09	1.13±1.97E-09	2.61±9.86E-08
WNDRAW1	2/10/2015	0.59±1.03E-09	3.91±0.92E-09	-4.42±9.12E-08
WNDRAW1	3/18/2015	-0.62±1.05E-09	2.89±0.81E-09	-3.46±9.11E-08
WNDRAW1	4/15/2015	4.73±7.57E-10	3.84±0.78E-09	-3.20±6.89E-08
WNDRAW1	5/13/2015	-9.89±9.00E-10	3.30±0.88E-09	-4.00±6.65E-08
WNDRAW1	6/10/2015	3.02±1.18E-09	4.72±0.83E-09	0.53±1.04E-07
WNDRAW1	7/16/2015	0.10±1.45E-09	2.89±0.83E-09	0.20±8.89E-08
WNDRAW1	8/11/2015	1.92±1.34E-09	2.61±1.08E-09	2.88±9.20E-08
WNDRAW1	9/8/2015	-0.88±1.35E-09	2.51±0.90E-09	-2.59±6.33E-08
WNDRAW1	10/14/2015	0.43±1.40E-09	4.04±0.88E-09	-0.03±9.17E-08
WNDRAW1	11/10/2015	-0.42±1.01E-09	4.52±0.84E-09	-1.44±8.53E-08
WNDRAW1	12/9/2015	0.14±1.92E-09	4.93±0.97E-09	5.93±6.80E-08
Supply Well #2 Pumping				
WNDRAW2	1/21/2015	-1.53±1.89E-09	2.59±2.01E-09	-6.70±9.84E-08
WNDRAW2	2/10/2015	2.70±1.65E-09	4.23±1.42E-09	4.24±9.94E-08
WNDRAW2	3/18/2015	1.52±1.39E-09	3.70±0.96E-09	-4.75±8.77E-08
WNDRAW2	4/15/2015	1.32±1.50E-09	3.09±0.95E-09	-2.84±6.76E-08
WNDRAW2	5/13/2015	0.93±7.62E-10	1.94±1.06E-09	-4.64±6.59E-08
WNDRAW2	6/10/2015	2.18±1.68E-09	3.95±0.86E-09	0.63±1.04E-07
WNDRAW2	7/16/2015	-0.48±1.66E-09	3.23±0.92E-09	-1.95±8.30E-08
WNDRAW2	8/11/2015	9.96±9.33E-10	2.73±1.13E-09	-2.21±8.90E-08
WNDRAW2	9/8/2015	0.13±1.40E-09	3.57±0.91E-09	1.70±6.82E-08
WNDRAW2	10/14/2015	-1.63±1.24E-09	3.67±0.82E-09	-0.66±8.81E-08
WNDRAW2	11/10/2015	0.81±1.48E-09	2.45±1.21E-09	3.16±9.13E-08
WNDRAW2	12/9/2015	-0.80±1.72E-09	4.01±1.29E-09	-5.54±7.06E-08

[a] Guideline used for screening groundwater supply wells is the background groundwater concentration as shown in Table D-1A, Appendix D, Summary of Groundwater. Potable water has been supplied by two bedrock groundwater wells since the fall of 2014.

TABLE B-5F

2015 RadisotopIc Results in Raw (Untreated) Potable Water [a]

Location Code	*Date Collected*	*Cesium-137 µCi/mL*	*Iodine-129 µCi/mL*
EPA Standard [b]		*2.00E-07*	*1.00E-09*
Supply Well #1 Pumping			
WNDRAW1	3/18/2015	0.24±3.20E-09	-2.08±6.15E-10
Supply Well #2 Pumping			
WNDRAW2	3/18/2015	0.05±3.26E-09	5.17±4.55E-10

[a] Untreated potable water is analyzed for radioisotopes once per year.

[b] Standard used for screening radionulides are from the EPA Safe Drinking Water Act Implemention Guidance for Radionuclides (40 CFR Part 141 Subpart F §141.66).

TABLE B-5G

2015 Radiological Indicator Results from the Source Water Protection Plan Wells

Analyte	*Units*	*N*	*Concentrations*		*Reference Values Guideline [a] or Standard [b]*
			Average	*Maximum*	
WNCT272					
Gross Alpha	µCi/mL	26	0.35E±7.17E-10	1.87E-09	7.61E-09
Gross Beta	µCi/mL	26	1.72E±0.81E-09	3.77E-09	1.56E-08
Conductivity	µmhos/cm@ 25ºC	26	146	385	NA
pH	SU	26	Range: 7.8-9.5		6.5-8.5
WNEHMKE					
Gross Alpha	µCi/mL	26	2.63E±8.50E-10	1.18E-09	7.61E-09
Gross Beta	µCi/mL	26	2.51E±0.81E-09	4.94E-09	1.56E-08
Conductivity	µmhos/cm@ 25ºC	26	240	564	NA
pH	SU	26	Range: 7.7-8.8		6.5-8.5
WWCOURT					
Gross Alpha	µCi/mL	26	0.26E±1.14E-09	1.91E-09	7.61E-09
Gross Beta	µCi/mL	26	2.71E±0.87E-09	4.43E-09	1.56E-08
Conductivity	µmhos/cm@ 25ºC	26	440	698	NA
pH	SU	26	Range: 6.7-8.2		6.5-8.5

NA - Not applicable.

SU - Standard units.

[a] Guideline used for screening sentinel wells is the background groundwater concentrations as shown in Table D-1A, Appendix D, Summary of Groundwater.

[b] The New York Water Quality Standard for Class "B" is provided as a comparative reference for pH.

APPENDIX C

Summary of Air Monitoring Data

TABLE C-1
Total Radioactivity Released at Main Plant Stack (ANSTACK) in 2015
and Comparison of Discharge Concentrations with U.S. DOE-Derived Concentration Standards (DCSs)

Isotope [a]	*N*	*Total Activity Released* [b] *(Ci)*	*Average Concentration (µCi/mL)*	*Maximum Concentration (µCi/mL)*	*DCS* [c] *(µCi/mL)*	*Ratio of Average Concentration to DCS*
Gross Alpha	26	7.07±0.60E-07	9.52±0.81E-16	4.88E-15	NA[d]	NA
Gross Beta	26	1.63±0.03E-05	2.20±0.04E-14	2.60E-13	NA[d]	NA
H-3	26	1.91±0.06E-03	2.57±0.08E-12	5.04E-12	2.1E-07	<0.0001
Co-60	2	3.47±4.25E-08	4.68±5.72E-17	< 1.05E-16	3.6E-10	<0.0001
Sr-90	2	3.27±0.13E-06	4.40±0.17E-15	7.12E-15	1.0E-10	<0.0001
I-129	2	1.26±0.04E-05	1.70±0.05E-14	1.83E-14	1.0E-10	0.0002
Cs-137	2	7.89±0.14E-06	1.06±0.02E-14	1.74E-14	8.8E-10	<0.0001
Eu-154	2	-1.41±8.01E-08	-0.19±1.08E-16	< 1.73E-16	7.5E-11	<0.0001
U-232[e]	2	3.93±4.34E-09	5.30±5.84E-18	9.69E-18	4.7E-13	<0.0001
U-233/234[e]	2	2.45±0.65E-08	3.30±0.87E-17	3.47E-17	1.0E-12[f]	<0.0001
U-235/236[e]	2	2.34±2.69E-09	3.15±3.63E-18	< 5.38E-18	1.2E-12	<0.0001
U-238[e]	2	1.33±0.51E-08	1.79±0.69E-17	2.57E-17	1.3E-12	<0.0001
Pu-238	2	1.31±0.20E-07	1.76±0.27E-16	2.85E-16	8.8E-14	0.0020
Pu-239/240	2	2.24±0.26E-07	3.02±0.34E-16	4.17E-16	8.1E-14	0.0037
Am-241	2	4.06±0.31E-07	5.47±0.42E-16	8.18E-16	9.7E-14	0.0056
Sum of Ratios						**0.0117**

N - Number of samples.
NA - Not applicable.
[a] Half-lives are listed in Table UI-4.
[b] Total volume released at 50,000 cubic feet per minute = 7.42E+14 mL/year.
[c] DCSs are used as reference values for the application of best available technology per DOE Order 458.1.
[d] DCSs do not exist for indicator parameters gross alpha and gross beta.
[e] Total Uranium = 5.99±0.16E-02 g; average = 8.07±0.21E-11 µg/mL, includes uranium contribution from glass fiber filter matrix.
[f] DCS for Uranium-233 used for this comparison.

TABLE C-2
2015 Effluent Airborne Radioactivity at Main Plant
Replacement Ventilation Emission Unit 1 (ANRVEU1)

Isotope	*N*	*Total Activity Released (Ci)*	*Average Concentration (µCi/mL)*	*Maximum Concentration (µCi/mL)*	*DCS*[a] *(µCi/mL)*
Gross Alpha	10	1.15±3.36E-09	2.65±7.79E-17	6.46E-16	NA[b]
Gross Beta	10	9.62±9.99E-09	2.23±2.31E-16	7.48E-16	NA[b]
Co-60	1	-2.11±1.61E-08	-4.88±3.73E-16	< 3.73E-16	3.6E-10
Sr-90	1	-1.03±1.29E-08	-2.38±2.99E-16	< 2.99E-16	1.0E-10
I-129	1	2.29±0.42E-07	5.31±0.98E-15	5.31E-15	1.0E-10
Cs-137	1	0.66±1.72E-08	1.52±3.99E-16	< 3.99E-16	8.8E-10
Eu-154	1	3.23±3.56E-08	7.49±8.25E-16	< 8.25E-16	7.5E-11
U-232[c]	1	3.27±8.82E-10	0.76±2.04E-17	< 2.04E-17	4.7E-13
U-233/234[c]	1	4.31±1.73E-09	9.97±4.01E-17	9.97E-17	1.0E-12[d]
U-235/236[c]	1	4.31±8.46E-10	1.00±1.96E-17	< 1.96E-17	1.2E-12
U-238[c]	1	3.59±1.47E-09	8.32±3.39E-17	8.32E-17	1.3E-12
Pu-238	1	-5.49±8.03E-10	-1.27±1.86E-17	< 1.86E-17	8.8E-14
Pu-239/240	1	-0.03±8.84E-10	-0.01±2.05E-17	< 2.05E-17	8.1E-14
Am-241	1	6.31±9.89E-10	1.46±2.29E-17	< 2.29E-17	9.7E-14

N - Number of samples. NA - Not applicable.

[a] DOE-derived concentration standards (DCS's) are used as reference values for the application of best available technology per DOE Order 458.1.

[b] DCSs do not exist for indicator parameters gross alpha and gross beta.

[c] Total Uranium = 6.99±0.27E-03 g; average = 1.62±0.06E-10 µg/mL, includes uranium contribution from glass fiber filter matrix.

[d] DCS for Uranium-233 used for this comparison.

TABLE C-3
2015 Effluent Airborne Radioactivity at Vitrification System HVAC (ANVITSK)

Isotope	*N*	*Total Activity Released (Ci)*	*Average Concentration (µCi/mL)*	*Maximum Concentration (µCi/mL)*	*DCS [a] (µCi/mL)*
Gross Alpha	26	-0.24±1.02E-08	-0.64±2.76E-17	< 2.40E-16	NA[b]
Gross Beta	26	4.95±3.13E-08	1.33±0.84E-16	4.20E-16	NA[b]
Co-60	2	-0.18±2.02E-08	-0.48±5.44E-17	< 8.12E-17	3.6E-10
Sr-90	2	-2.09±1.90E-08	-5.63±5.11E-17	< 7.25E-17	1.0E-10
I-129	2	1.54±0.64E-07	4.15±1.73E-16	4.37E-16	1.0E-10
Cs-137	2	1.88±1.55E-08	5.07±4.17E-17	< 6.12E-17	8.8E-10
Eu-154	2	1.82±5.11E-08	0.49±1.38E-16	< 2.14E-16	7.5E-11
U-232[c]	2	-0.17±1.28E-09	-0.45±3.46E-18	< 6.12E-18	4.7E-13
U-233/234[c]	2	9.08±2.54E-09	2.45±0.68E-17	2.67E-17	1.0E-12[d]
U-235/236[c]	2	1.44±1.06E-09	3.89±2.86E-18	< 4.33E-18	1.2E-12
U-238[c]	2	1.02±0.25E-08	2.74±0.67E-17	2.75E-17	1.3E-12
Pu-238	2	0.47±1.56E-09	1.28±4.20E-18	< 7.33E-18	8.8E-14
Pu-239/240	2	2.43±2.65E-09	6.56±7.14E-18	< 1.28E-17	8.1E-14
Am-241	2	1.13±1.50E-09	3.04±4.04E-18	< 6.76E-18	9.7E-14

N - Number of samples. NA - Not applicable.

[a] DOE-derived concentration standards (DCS's) are used as reference values for the application of best available technology per DOE Order 458.1.

[b] DCSs do not exist for indicator parameters gross alpha and gross beta.

[c] Total Uranium = 2.60±0.07E-02 g; average = 7.01±0.19E-11 µg/mL, includes uranium contribution from glass fiber filter matrix.

[d] DCS for Uranium-233 used for this comparison.

TABLE C-4
2015 Effluent Airborne Radioactivity at Supernatant Treatment System (ANSTSTK)

Isotope	*N*	*Total Activity Released (Ci)*	*Average Concentration (µCi/mL)*	*Maximum Concentration (µCi/mL)*	*DCS [a] (µCi/mL)*
Gross Alpha	26	0.51±2.21E-09	0.76±3.31E-17	< 3.03E-16	NA[b]
Gross Beta	26	9.80±6.32E-09	1.47±0.95E-16	5.38E-16	NA[b]
H-3	26	1.53±0.50E-05	2.29±0.75E-13	7.60E-13	2.1E-07
Co-60	2	1.27±3.74E-09	1.90±5.60E-17	< 8.09E-17	3.6E-10
Sr-90	2	2.47±4.98E-09	3.69±7.46E-17	1.24E-16	1.0E-10
I-129	2	9.64±0.08E-06	1.44±0.01E-13	2.03E-13	1.0E-10
Cs-137	2	7.85±6.19E-09	1.17±0.93E-16	1.27E-16	8.8E-10
Eu-154	2	6.54±9.29E-09	0.98±1.39E-16	< 1.98E-16	7.5E-11
U-232[c]	2	0.88±3.18E-10	1.31±4.77E-18	< 7.60E-18	4.7E-13
U-233/234[c]	2	2.18±0.58E-09	3.27±0.86E-17	3.44E-17	1.0E-12[d]
U-235/236[c]	2	2.55±2.20E-10	3.82±3.30E-18	5.49E-18	1.2E-12
U-238[c]	2	1.98±0.56E-09	2.97±0.84E-17	3.47E-17	1.3E-12
Pu-238	2	1.60±3.32E-10	2.39±4.96E-18	< 7.75E-18	8.8E-14
Pu-239/240	2	4.73±5.01E-10	7.08±7.50E-18	< 1.11E-17	8.1E-14
Am-241	2	6.34±4.64E-10	9.49±6.95E-18	1.78E-17	9.7E-14

N - Number of samples. NA - Not applicable.

[a] DOE-derived concentration standards (DCS's) are used as reference values for the application of best available technology per DOE Order 458.1.

[b] DCSs do not exist for indicator parameters gross alpha and gross beta.

[c] Total Uranium = 5.33±0.14E-03 g; average = 7.99±0.22E-11 µg/mL, includes uranium contribution from glass fiber filter matrix.

[d] DCS for Uranium-233 used for this comparison.

TABLE C-5
2015 Effluent Airborne Radioactivity at Remote-Handled Waste Facility (ANRHWFK)

Isotope	*N*	*Total Activity Released (Ci)*	*Average Concentration (µCi/mL)*	*Maximum Concentration (µCi/mL)*	*DCS* [a] *(µCi/mL)*
Gross Alpha	26	-3.26±6.04E-09	-2.69±4.97E-17	2.34E-16	NA[b]
Gross Beta	26	-1.56±1.78E-08	-1.28±1.47E-16	8.81E-16	NA[b]
Co-60	2	0.13±1.16E-08	1.04±9.53E-17	< 1.50E-16	3.6E-10
Sr-90	2	-1.18±0.99E-08	-9.67±8.12E-17	< 1.17E-16	1.0E-10
I-129	2	3.27±3.42E-08	2.69±2.81E-16	< 4.40E-16	1.0E-10
Cs-137	2	0.98±1.05E-08	8.10±8.65E-17	1.64E-16	8.8E-10
Eu-154	2	1.14±3.30E-08	0.94±2.71E-16	< 4.47E-16	7.5E-11
U-232[c]	2	3.03±8.61E-10	2.49±7.08E-18	< 1.16E-17	4.7E-13
U-233/234[c]	2	4.23±1.50E-09	3.48±1.24E-17	3.84E-17	1.0E-12[d]
U-235/236[c]	2	5.47±6.84E-10	4.50±5.63E-18	1.05E-17	1.2E-12
U-238[c]	2	5.95±1.66E-09	4.90±1.37E-17	4.91E-17	1.3E-12
Pu-238	2	0.50±1.03E-09	4.10±8.50E-18	< 1.43E-17	8.8E-14
Pu-239/240	2	1.59±1.34E-09	1.31±1.10E-17	1.79E-17	8.1E-14
Am-241	2	0.80±8.42E-10	0.66±6.92E-18	< 1.01E-17	9.7E-14

N - Number of samples. NA - Not applicable.

[a] DOE-derived concentration standards (DCS's) are used as reference values for the application of best available technology per DOE Order 458.1.

[b] DCSs do not exist for indicator parameters gross alpha and gross beta.

[c] Total Uranium = 1.24±0.03E-02 g; average = 1.02±0.03E-10 µg/mL, includes uranium contribution from glass fiber filter matrix.

[d] DCS for Uranium-233 used for this comparison.

TABLE C-6

2015 Effluent Airborne Radioactivity at Contact Size-Reduction Facility (ANCSRFK)

Permanent Stack Ventilation Inoperable.[a] No operation of stack ventilation during CY2015.

[a] When needed, building air ventilated and monitored with a PVU. No PVU use required during 2015.

TABLE C-7

2015 Effluent Airborne Radioactivity at Container Sorting and Packaging Facility (ANCSPFK)

Stack Ventilation Off; System Did Not Operate During CY 2015. No activity requiring ventilation in the CSPF in 2015.

TABLE C-8

2015 Effluent Airborne Radioactivity at Outdoor Ventilation Enclosures/Portable Ventilation Units (OVE/PVUs)

Isotope	*N*	*Total Activity Released (Ci)*	*Average Concentration (µCi/mL)*	*Maximum Concentration [a] (µCi/mL)*	*DCS [b] (µCi/mL)*
Gross Alpha	81	7.45±2.11E-09	2.59±0.74E-17	1.16E-16	NA[c]
Gross Beta	81	4.06±0.62E-08	1.41±0.22E-16	1.05E-15	NA[c]
Co-60	2	-0.82±1.80E-09	-2.84±6.25E-18	< 1.10E-17	3.6E-10
Sr-90	2	-1.39±2.31E-09	-4.82±8.05E-18	< 1.34E-17	1.0E-10
Cs-137	2	-0.45±2.13E-09	-1.55±7.42E-18	< 1.41E-17	8.8E-10
Eu-154	2	4.87±5.41E-09	1.69±1.88E-17	< 3.43E-17	7.5E-11
U-232[d]	2	0.56±1.61E-10	1.94±5.61E-19	< 8.13E-19	4.7E-13
U-233/234[d]	2	2.60±0.42E-09	9.06±1.46E-18	9.34E-18	1.0E-12[e]
U-235/236[d]	2	2.96±1.58E-10	1.03±0.55E-18	1.11E-18	1.2E-12
U-238[d]	2	2.36±0.39E-09	8.20±1.37E-18	8.21E-18	1.3E-12
Pu-238	2	-0.72±1.33E-10	-2.51±4.63E-19	< 7.99E-19	8.8E-14
Pu-239/240	2	1.64±2.10E-10	5.72±7.31E-19	< 1.23E-18	8.1E-14
Am-241	2	1.61±2.44E-10	5.59±8.49E-19	< 1.38E-18	9.7E-14

N - Number of samples. NA - Not applicable.

[a] Maximum concentrations for gross alpha and gross beta were selected from PVUs that ran long enough to obtain detection limits comparable to continuously operated units.

[b] DOE-derived concentration standards (DCS's) are used as reference values for the application of best available technology per DOE Order 458.1.

[c] DCSs do not exist for indicator parameters gross alpha and gross beta.

[d] Total Uranium = 8.05±0.23E-03 g; average = 2.80±0.08E-11 µg/mL, includes uranium contribution from glass fiber filter matrix.

[e] DCS for Uranium-233 used for this comparison.

TABLE C-9
2015 Gross Alpha and Gross Beta Radioactivity at Nearsite Ambient Air Sampling Locations and at Background Great Valley Location (AFGRVAL)

Monitoring Location	*N*	*Gross Alpha µCi/mL*		*Gross Beta µCi/mL*	
		Average	*Maximum*	*Average*	*Maximum*
AF01_N	26	9.20±2.59E-16	1.86E-15	1.79±0.10E-14	3.39E-14
AF02_NNE	26	8.80±1.93E-16	1.67E-15	1.78±0.08E-14	3.65E-14
AF03_NE	26	9.51±2.22E-16	1.70E-15	1.76±0.08E-14	3.35E-14
AF04_ENE	26	9.39±1.88E-16	2.20E-15	1.75±0.07E-14	3.35E-14
AF05_E	26	9.55±2.01E-16	1.83E-15	1.77±0.08E-14	3.55E-14
AF06_ESE	26	9.76±2.00E-16	2.11E-15	1.79±0.08E-14	3.26E-14
AF07_SE	26	9.04±1.81E-16	1.77E-15	1.70±0.07E-14	3.25E-14
AF08_SSE	26	9.46±1.91E-16	1.67E-15	1.72±0.07E-14	3.26E-14
AF09_S	26	9.42±1.96E-16	1.83E-15	1.73±0.07E-14	3.36E-14
AF10_SSW	26	9.67±2.11E-16	1.82E-15	1.76±0.08E-14	3.34E-14
AF11_SW	26	9.55±1.94E-16	2.01E-15	1.75±0.07E-14	3.61E-14
AF12_WSW	26	9.38±1.86E-16	1.80E-15	1.77±0.07E-14	3.30E-14
AF13_W	26	1.00±0.21E-15	1.97E-15	1.76±0.08E-14	3.47E-14
AF14_WNW	26	9.94±1.93E-16	1.78E-15	1.73±0.07E-14	3.43E-14
AF15_NW	26	1.01±0.19E-15	1.87E-15	1.71±0.07E-14	3.41E-14
AF16_NNW	26	9.97±1.96E-16	1.85E-15	1.74±0.07E-14	3.29E-14
AF16HNNW	26	1.01±0.17E-15	2.05E-15	1.83±0.07E-14	3.91E-14
AFGRVAL	26	9.70±1.90E-16	1.60E-15	1.73±0.07E-14	3.13E-14

N - Number of samples.

TABLE C-10
2015 Ambient Airborne Radioactivity
and Comparison to the NESHAP[a] Concentration Levels for Environmental Compliance

Location	N	Annual Average Concentration (µCi/mL)			
		Sr-90	I-129	Cs-137	U-232
NESHAP Compliance		1.9E-14	9.1E-15	1.9E-14	1.3E-15
AF01_N	4	-0.15±1.20E-16	-1.27±7.27E-17	-0.42±1.07E-16	1.22±9.27E-18
AF02_NNE	4	-0.55±1.26E-16	-0.06±6.95E-17	2.21±9.15E-17	0.08±1.05E-17
AF03_NE	4	0.04±1.28E-16	4.30±8.27E-17	0.24±1.13E-16	4.69±8.36E-18
AF04_ENE	4	-0.32±1.10E-16	-0.31±1.04E-16	1.79±9.89E-17	3.83±9.82E-18
AF05_E	4	-0.33±1.24E-16	3.02±9.33E-17	-0.34±1.19E-16	3.88±9.73E-18
AF06_ESE	4	-0.41±1.15E-16	-0.45±1.01E-16	0.64±1.26E-16	-0.48±8.67E-18
AF07_SE	4	0.63±1.29E-16	1.02±6.72E-17	0.11±1.01E-16	1.14±8.28E-18
AF08_SSE	4	0.10±1.23E-16	-0.91±7.98E-17	0.53±1.29E-16	2.06±8.83E-18
AF09_S	4	0.33±1.36E-16	-0.26±7.83E-17	-0.22±1.04E-16	-0.12±8.48E-18
AF10_SSW	4	0.05±1.42E-16	0.99±9.47E-17	1.05±8.82E-17	1.31±8.21E-18
AF11_SW	4	-0.81±1.13E-16	-0.46±1.04E-16	-0.29±1.04E-16	0.35±9.31E-18
AF12_WSW	4	-0.52±1.15E-16	0.57±1.47E-16	3.62±9.23E-17	0.42±9.32E-18
AF13_W	4	-0.12±1.23E-16	0.25±7.63E-17	1.80±9.48E-17	0.22±1.01E-17
AF14_WNW	4	0.50±1.14E-16	0.26±6.09E-17	5.10±8.66E-17	-0.11±1.05E-17
AF15_NW	4	0.15±1.19E-16	-1.44±7.13E-17	1.49±9.04E-17	-0.28±8.28E-18
AF16_NNW	4	0.29±1.32E-16	0.05±9.11E-17	0.03±9.26E-17	0.36±1.03E-17
AF16HNNW[c]	4	-0.31±2.24E-17	0.05±9.11E-17[d]	1.31±3.65E-17	1.57±2.38E-18
AFGRVAL[e]	4	-0.26±1.13E-16	-0.87±1.16E-16	0.02±1.12E-16	1.47±7.46E-18

Location	N	Annual Average Concentration (µCi/mL)			Compliance Ratio (Sum of Ratios)	
		Pu-238	Pu-239/240	Am-241		
NESHAP Compliance		2.1E-15	2.0E-15	1.9E-15		
AF01_N	4	3.53±8.85E-18	1.16±1.27E-17	1.35±8.50E-18	< 0.042	
AF02_NNE	4	-0.86±6.77E-18	-0.80±9.22E-18	1.36±9.28E-18	< 0.040	
AF03_NE	4	2.75±8.56E-18	2.20±7.88E-18	2.47±8.31E-18	< 0.041	
AF04_ENE	4	0.27±7.21E-18	0.40±1.06E-17	2.08±8.67E-18	< 0.043	
AF05_E	4	0.53±1.24E-17	0.14±1.10E-17	1.66±9.71E-18	< **0.047**	<= Max ratio in 2015.
AF06_ESE	4	-1.44±9.04E-18	-0.03±1.07E-17	2.87±7.22E-18	< 0.044	
AF07_SE	4	1.11±9.17E-18	3.08±9.71E-18	1.50±5.99E-18	< 0.038	
AF08_SSE	4	3.80±8.48E-18	1.41±8.95E-18	1.21±7.77E-18	< 0.041	
AF09_S	4	4.65±8.51E-18	2.97±8.37E-18	2.83±6.28E-18	< 0.039	
AF10_SSW	4	0.47±6.53E-18	0.69±7.40E-18	2.60±9.56E-18	< 0.041	
AF11_SW	4	-1.33±7.09E-18	4.57±8.48E-18	2.99±8.75E-18	< 0.042	
AF12_WSW	4	-0.17±5.74E-18	4.14±8.66E-18	2.74±8.83E-18	< 0.046	
AF13_W	4	0.91±6.48E-18	3.98±8.17E-18	0.34±1.05E-17	< 0.040	
AF14_WNW	4	-0.21±6.13E-18	3.97±8.08E-18	2.40±5.97E-18	< 0.035	
AF15_NW	4	0.04±7.23E-18	0.54±8.71E-18	5.07±9.68E-18	< 0.038	
AF16_NNW	4	1.77±6.81E-18	1.18±8.36E-18	3.99±8.52E-18	< 0.042	
AF16HNNW[c]	4	0.01±1.45E-18	0.17±2.00E-18	0.82±1.85E-18	< 0.018	
AFGRVAL[e]	4	0.43±8.51E-18	0.58±1.28E-17	1.92±6.78E-18	< 0.044	

[a] NESHAP - National Emmissions Standards for Hazardous Air Pollutants, U.S. EPA 40 CFR Part 61.
[b] NESHAP Concentration Levels for Environmental Compliance, 40 CFR Part 61, Appendix E, Table 2.
[c] Location AF16HNNW is the high volume sampler at the same location as AF16_NNW.
[d] The low volume result for I-129 is reported at the high volume sampler in order to calculate an equivalent sum of ratios and estimated dose. I-129 is not measured at the high volume sampler.
[e] AFGRVAL is the background sampling location, approximately 29 km south of the WVDP.

TABLE C-11

2015 Summary of NESHAP[a] Concentration Levels for Environmental Compliance

Location	*Sum of Ratios* [b]	*Notes*
Non-Network Sampler		
AFGRVAL[c]	< 0.044	Background sampling location (2015 Dose < 0.44 mrem/year)
Compliance Network Samplers		
AF01_N	< 0.042	
AF02_NNE	< 0.040	
AF03_NE	< 0.041	
AF04_ENE	< 0.043	
AF05_E	< **0.047**	**Critical Receptor** (for reporting purposes) **(2015 Dose < 0.47 mrem/year)**
AF06_ESE	< 0.044	
AF07_SE	< 0.038	
AF08_SSE	< 0.041	
AF09_S	< 0.039	
AF10_SSW	< 0.041	
AF11_SW	< 0.042	
AF12_WSW	< 0.046	
AF13_W	< 0.040	
AF14_WNW	< 0.035	
AF15_NW	< 0.038	
AF16_NNW	< 0.042	
Non-Network Sampler		
AF16HNNW[d]	< 0.018	High volume sampler

[a] NESHAP - National Emission Standards for Hazardous Air Pollutants, U.S. EPA 40 CFR Part 61.
[b] Sum of ratios = sum of (Average concentration per isotope / NESHAP Concentration Levels for Environmental Compliance, 40 CFR Part 61, Appendix E, Table 2).
[c] AFGRVAL is the background sampling location, approximately 29 km south of the WVDP.
[d] Location AF16HNNW is the high volume sampler at the same location as AF16_NNW.

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APPENDIX D-1

Summary of Groundwater Screening Levels and Practical Quantitation Limits

Groundwater Sampling Methodology

Groundwater samples are collected from monitoring wells using either dedicated Teflon well bailers or bladder pumps. Bailers are used in low-yield wells; bladder pumps are used in wells with good water-yielding characteristics. This sampling equipment is dedicated to an individual well to reduce the likelihood of sample contamination from external materials or cross contamination.

To ensure that only representative groundwater is sampled, three well volumes are removed (purged) from the well before the actual samples are collected. In low-yield wells, pumping or bailing to dryness provides sufficient purging. Conductivity and pH are measured before and after sampling to confirm the geochemical stability of the groundwater during sampling.

The bailer, a tube with a check valve at the bottom, is lowered slowly into the well to minimize agitation of the water column. The bailer containing the groundwater is then withdrawn from the well and emptied into a sample container. Bladder pumps use compressed air to gently squeeze a Teflon bladder that prevents air contact with the groundwater as it is pumped into a sample container with a minimum of agitation and mixing. A check valve ensures that the water flows in only one direction.

Groundwater samples are cooled and preserved, with chemicals if required, to minimize chemical and/or biological changes after sample collection. A strict chain-of-custody protocol is followed for all samples collected by the WVDP.

Groundwater Screening Levels (GSLs) for Radiological Constituents: Background values for radiological constituents in groundwater were derived for the Corrective Measures Studies in 2009 using data from background wells 301, 401, 706, and 1302 in the sand and gravel unit on the north plateau for samples collected from 1991 through September 2009. The 95% upper confidence limit (UCL) was applied in a similar statistical calculation for each radiological constituent. The site-specific GSLs for radiological constituents were set to the greater of the background levels or the NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Class GA groundwater quality standard for each radiological constituent. The NYSDEC TOGS standards are only established for gross alpha and gross beta concentrations, consequently most of the screening values for radiological constituents are set to equal the site background values. The GSLs for radiological constituents are listed in Table D-1A.

The site monitoring well radiological concentrations presented in the data tables in Appendix D-2 are compared with these GSLs. Bolding indicates that the measured concentration exceeded the GSL.

Groundwater Screening Levels for Metals: The calculated WVDP GSLs for metals were established in WVDP-494, North Plateau Plume Area Characterization Report. The GSLs for metals were selected as a greater of the NYSDEC TOGS 1.1.1 Class GA Groundwater Quality Standards or background concentrations in groundwater as documented in Appendix E of WVDP-494. The groundwater background concentrations were derived from a statistical calculation of the mean plus two standard deviations for metals data collected from four background wells (301, 401, 706, and well 1302). Elevated levels of chromium and nickel were identified in site wells constructed with stainless steel (which includes 301, 401, and 706), as presented to NYSDEC in a report entitled Final Report: Evaluation of the Pilot Program to Investigate Chromium & Nickel Concentration in Groundwater in the Sand & Gravel Unit (WVNSCO, 1998). The findings of this report were subsequently accepted by NYSDEC in their memorandum dated September 15, 1998.

Consequently, the majority of the chromium and nickel results from these stainless-steel wells were omitted from the dataset used to establish background, relying primarily on the results from polyvinyl chloride (PVC) well 1302 for these two constituents. The groundwater screening values for metals are listed in Table D-1B.

The site monitoring well metals concentrations presented in the data tables in Appendix D-2 are compared with these GSLs. Bolding indicates that the measured concentration exceeded the GSL.

TABLE D-1A
Groundwater Screening Levels (GSLs) for Radiological Constituents

Radiological Constituent	*Range of Observed Concentrations From Background Monitoring Wells 301, 401, 706, and 1302* [a] *(µCi/mL)*	*WVDP 95% UCL Background Groundwater Concentration* [a] *(µCi/mL)*	*NYSDEC TOGS 1.1.1 Class GA Groundwater Quality Standards* [b] *(µCi/mL)*	*WVDP GSLs* [c] *(µCi/mL)*
Gross alpha	< 7.78E-10 – 1.55E-08	7.61E-09	1.50E-08	1.50E-08
Gross beta	< 2.15E-09 – 2.35E-08	1.56E-08	1.00E-06	1.00E-06
Tritium	< 3.17E-08 – 2.63E-07	1.78E-07	NE	1.78E-07
Carbon-14	< 1.36E-11 – 5.02E-08	2.82E-08	NE	2.82E-08
Cesium-137	5.79E-10 – 1.90E-08	1.03E-08	NE	1.03E-08
Iodine-129	< 2.85E-10 – 1.58E-09	9.61E-10	NE	9.61E-10
Potassium-40	< 5.00E-08 – 3.56E-07	1.99E-07	NE	1.99E-07
Radium-226	< 1.10E-10 – 2.99E-09	1.33E-09	NE	1.33E-09
Radium-228	< 2.23E-10 – 3.20E-09	2.16E-09	NE	2.16E-09
Strontium-90	< 2.41E-10 – 6.40E-09	5.90E-09	NE	5.90E-09
Technetium-99	< 8.21E-10 – 8.61E-09	5.02E-09	NE	5.02E-09
Total Uranium (µg/mL)	< 1.27E-06 – 3.46E-03	1.34E-03	NE	1.34E-03
Uranium-232	< 1.71E-11 – 3.78E-10	1.38E-10	NE	1.38E-10
Uranium-233/234	< 3.85E-11 – 1.53E-09	6.24E-10	NE	6.24E-10
Uranium-235/236	< 1.80E-11 – 1.39E-10	8.07E-11	NE	8.07E-11
Uranium-238	< 1.32E-11 – 1.26E-09	4.97E-10	NE	4.97E-10

NE - No NYSDEC TOGS 1.1.1 groundwater quality standard has been established for this analyte.

[a] The data used for the calculation of background values was taken from background wells 301, 401, 706, and 1302 in the sand and gravel unit on the north plateau for samples collected from 1991 through September 2009. The background was set to the upper limit of the 95% confidence interval.

[b] NYSDEC TOGS 1.1.1 (June 1998/2004 addendum) Class GA groundwater quality standards and guidance values.

[c] The GSLs for radiological constituents were set equal to the larger of the background concentrations or the NYSDEC TOGS 1.1.1 Class GA Groundwater Quality Standards.

TABLE D-1B
Groundwater Screening Levels for Metals

Analyte [a]	*Range of Observed Concentrations From Background Monitoring Wells 301, 401, 706, and 1302* [a] *(µg/L)*	*Background Groundwater Concentration* [b] *(µg/L)*	*NYSDEC TOGS 1.1.1 Class GA Groundwater Quality Standards (µg/L)*	*WVDP Groundwater Screening Levels (GSLs)* [c] *(µg/L)*
Antimony, total	0.5 – 19.7	15.1	3	15.1
Arsenic, total	1.5 – 34.4	20.9	25	25
Barium, total	71.7 – 499	441	1,000	1,000
Beryllium, total	0.10 – 2.50	1.85	3	3
Cadmium, total	0.30 – 5.30	7.27	5	7.27
Chromium, total[d]	5 – 66	52.3	50	52.3
Cobalt, total	2.05 – 60.9	67.8	NE	67.8
Copper, total	1.4 – 90.5	59.9	200	200
Lead, total	0.5 – 120	42.7	25	42.7
Mercury, total	0.03 – 0.4	0.263	0.7	0.7
Nickel, total[d]	10 – 77.8	59.5	100	100
Selenium, total	1.0 – 25.0	10.1	10	10.1
Silver, total	0.1 – 10	15.5	50	50
Thallium, total	0.3 – 13.1	13.9	0.5	13.9
Tin, total	5.6 – 3,000	4,083	NE	4,083
Vanadium, total	0.6 – 73.1	69.6	NE	69.6
Zinc, total	5.71 – 256	127	2,000	2,000

NE - No TOGS 1.1.1 Class GA Groundwater quality standard has been established for this analyte.

[a] Analytes listed are those identified in the 6 NYCRR Part 373-2 Appendix 33 List.

[b] Data used for the calculation of background values was taken from wells 301, 401, 706, and 1302 in the S&G unit on the north plateau for samples collected from 1991 to December 2008. The background concentration was set equal to the mean plus two standard deviations (as reported in WVDP-494). Ninety-five percent of measurements are expected to fall below this value. Data were rounded to three significant digits or the closest integer.

[c] Metals GSLs were set equal to the larger of the background concentration or the TOGS 1.1.1 Class GA Groundwater Quality Standards.

[d] Elevated chromium and nickel concentrations attributed to well corrosion were noted in wells 301, 401, and 706 over the monitoring period. All results suspected to be affected by corrosion (i.e., all chromium and nickel results for 301 and 401, and all results after May 2004 from 706) were excluded from the background calculation.

TABLE D-1C
Practical Quantitation Limits (PQLs)

6 NYCRR[a] Appendix 33 Volatile Organic Compounds			
Compound	**PQL (µg/L)**	**Compound**	**PQL (µg/L)**
Acetone	10	cis-1,3-Dichloropropene	5
Acetonitrile	100	Ethyl Benzene	5
Acrolein	11	Ethyl methacrylate	5
Acrylonitrile	5	2-Hexanone	10
Allyl chloride	5	Isobutyl alcohol	100
Benzene	5	Methacrylonitrile	5
Bromodichloromethane	5	Methyl ethyl ketone	10
Bromoform (methyl bromide)	5	Methyl iodide	5
Bromomethane	10	Methyl methacrylate	5
Carbon disulfide	10	4-Methyl-2-pentanone (MIBK)	10
Carbon tetrachloride	5	Methylene bromide	10
Chlorobenzene	5	Methylene chloride	5
Chloroethane	10	Pentachloroethane	5
Chloroform	5	Propionitrile	50
Chloromethane (methyl chloride)	10	Styrene	5
Chloroprene	5	1,1,1,2-Tetrachloroethane	5
1,2-Dibromo-3-chloropropane	5	1,1,2,2-Tetrachloroethane	5
Dibromochloromethane	5	Tetrachloroethylene	5
1,2-Dibromoethane	5	Toluene	5
trans-1,4-Dichloro-2-butene	5	1,1,1-Trichloroethane (1,1,1-TCA)	5
1,1-Dichloroethane (1,1-DCA)	5	1,1,2-Trichloroethane (1,1,2-TCA)	5
1,2-Dichloroethane (1,2-DCA)	5	Trichloroethylene (TCE)	5
1,1-Dichloroethylene (1,1-DCE)	5	Trichlorofluoromethane	5
trans-1,2-Dichloroethylene (1,2-DCE[trans])	5	1,2,3-Trichloropropane	5
Dichlorodifluoromethane (DCDF Meth)	5	Vinyl acetate	10
1,2-Dichloropropane	5	Vinyl chloride	10
trans-1,3-Dichloropropene	5	Xylene (total)	5
6 NYCRR[a] Appendix 33 Metals			
Compound	**PQL (µg/L)**	**Compound**	**PQL (µg/L)**
Aluminum[b]	200	Manganese[b]	15
Antimony	10	Mercury	0.2
Arsenic	10	Nickel	40
Barium	200	Selenium	5
Beryllium	1	Silver	10
Cadmium	5	Thallium	2
Chromium	10	Tin	3,000
Cobalt	50	Vanadium	50
Copper	25	Zinc	20
Lead	3		

Note: Specific quantitation limits are highly matrix dependent and may not always be achievable.
[a] Title 6 of the Official Compilation of Codes, Rules, and Regulations of the State of New York.
[b] Not a 6 NYCRR Appendix 33 parameter; sampled for the north plateau early warning program.

TABLE D-1C (*continued*)
Practical Quantitation Limits (PQLs)

6 NYCRR[a] Appendix 33 Semi-Volatile Organic Compounds			
Compound	**PQL (µg/L)**	**Compound**	**PQL (µg/L)**
Acenaphthene	10	2,4-Dinitrotoluene	10
Acenaphthylene	10	2,6-Dinitrotoluene	10
Acetophenone	10	Diphenylamine	10
2-Acetylaminofluorene	10	Ethyl methanesulfonate	10
4-Aminobiphenyl	10	Famphur	10
Analine	10	Fluoranthene	10
Anthracene	10	Fluorene	10
Aramite	10	Hexachlorobenzene	10
Benzo[a]anthracene	10	Hexachlorobutadiene	10
Benzo[a]pyrene	10	Hexachlorocyclopentadiene	10
Benzo[b]fluoranthene	10	Hexachloroethane	10
Benzo[ghi]perylene	10	Hexachlorophene	10
Benzo[k]fluoranthene	10	Hexachloropropene	10
Benzyl alcohol	10	Indeno(1,2,3,-cd)pyrene	10
Bis(2-chloroethyl)ether	10	Isodrin	10
Bis(2-chloroethoxy)methane	10	Isophorone	10
Bis(2-chloroisopropyl)ether	10	Isosafrole	10
Bis(2-ethylhexyl)phthalate	10	Kepone	10
4-Bromophenyl phenyl ether	10	Methapyrilene	10
Butyl benzyl phthalate	10	Methyl methanesulfonate	10
Chlorobenzilate	10	3-Methylcholanthrene	10
2-Chloronaphthalene	10	2-Methylnapthalene	10
2-Chlorophenol	10	1,4-Naphthoquinone	10
4-Chlorophenyl phenyl ether	10	1-Naphthylamine	10
Chrysene	10	2-Naphthylamine	10
Di-n-butyl phthalate	10	Nitrobenzene	10
Di-n-octyl phthalate	10	5-Nitro-o-toluidine	10
Diallate	10	4-Nitroquinoline 1-oxide	40
Dibenz[a,h]anthracine	10	N-Nitrosodi-n-butylamine	10
Dibenzofuran	10	N-Nitrosodiethylamine	10
3,3-Dichlorobenzidine	10	N-Nitrosodimethylamine	10
2,4-Dichlorophenol	10	N-Nitroso-di-n-propylamine	10
2,6-Dichlorophenol	10	N-Nitrosodiphenylamine	10
Diethyl phthalate	10	N-Nitrosomethylethylamine	10
Dimethoate	10	N-Nitrosomorpholine	10
7,12-Dimethylbenz[a]anthracene	10	N-Nitrosopiperidine	10
3,3-Dimethylbenzidine	20	N-Nitrosopyrrolidine	10
2,4-Dimethylphenol	10	Naphthalene	10
Dimethyl phthalate	10	0,0,0-Triethyl phosphorothioate	10
4,6-Dinitro-o-cresol	25	O,O-Diethyl O-2-pyrazinylphosphorothioate	10
2,4-Dinitrophenol	25		

Note: Specific quantitation limits are highly matrix dependent and may not always be achievable.
[a] Title 6 of the Official Compilation of Codes, Rules, and Regulations of the State of New York.

TABLE D-1C (*concluded*)
Practical Quantitation Limits (PQLs)

6 NYCRR[a] Appendix 33 Semi-Volatile Organic Compounds			
Compound	**PQL (µg/L)**	**Compound**	**PQL (µg/L)**
p-(Dimethylamino)azobenzene	10	2,3,4,6-Tetrachlorophenol	10
p-Chloroaniline	10	Tetraethyl dithiopyrophosphate	10
p-Chloro-m-cresol	10	1,2,4-Trichlorobenzene	10
p-Cresol	10	2,4,5-Trichlorophenol	25
p-Dichlorobenzene	10	2,4,6-Trichlorophenol	10
p-Nitroaniline	25	alpha,alpha-Dimethylphenethylamine	50
p-Nitrophenol	25	m-Cresol	10
p-Phenylenediamine	10	m-Dichlorobenzene	10
Parathion	10	m-Dinitrobenzene	10
Pentachlorobenzene	10	m-Nitroanaline	25
Pentachloronitrobenzene	10	o-Cresol	10
Pentachlorophenol	25	o-Dichlorobenzene	10
Phenacetin	10	o-Nitroaniline	25
Phenanthrene	10	o-Nitrophenol	10
Phenol	10	o-Toluidine	10
Pronamide	10	sym-Trinitrobenzene	10
Pyrene	10	2-Picoline	10
Safrole	10	Pyridine	10
1,2,4,5-Tetrachlorobenzene	10	1,4-Dioxane	10
Other Organic Compounds			
Compound	**PQL (µg/L)**		
1,2-Dichloroethylene (Total)	5		
N-Dodecane	60		
Tributyl phosphate	10		

Note: Specific quantitation limits are highly matrix dependent and may not always be achievable.
[a] Title 6 of the Official Compilation of Codes, Rules, and Regulations of the State of New York.

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APPENDIX D-2

Groundwater Monitoring Data

TABLE D-2A
2015 Indicator Results From the Sand and Gravel Unit

Location Code	Hydraulic Position [a]	Date Collected	pH SU	Conductivity µmhos/cm@ 25 ºC	Gross Alpha µCi/mL	Gross Beta µCi/mL	Tritium µCi/mL
Groundwater Screening Levels [b]			NA	NA	1.50E-08	1.00E-06	1.78E-07
301	UP	Mar-15	6.87	2732	-9.22±8.47E-09	1.48±5.14E-09	-0.08±1.13E-07
301	UP	Jun-15	6.69	2703	-9.23±6.10E-09	8.13±4.21E-09	0.01±1.08E-07
301	UP	Sep-15	6.75	3136	-0.21±1.00E-08	5.28±4.61E-09	-4.61±9.08E-08
301	UP	Dec-15	6.80	2457	4.52±5.42E-09	6.40±5.09E-09	-0.21±1.04E-07
302	UP	Jun-15	6.93	5626	**1.72±1.38E-08**	-1.21±8.54E-09	-1.02±1.02E-07
302	UP	Dec-15	6.94	5878	-2.67±2.09E-08	-1.40±1.04E-08	0.02±1.04E-07
401	UP	Mar-15	7.29	3190	-7.93±7.70E-09	-1.97±5.62E-09	-0.14±1.16E-07
401	UP	Jun-15	7.17	4329	0.26±6.61E-09	5.69±6.24E-09	0.31±1.08E-07
401	UP	Sep-15	7.00	4210	-2.01±6.23E-09	6.72±6.85E-09	-1.03±9.55E-08
401	UP	Dec-15	7.06	4490	-0.78±1.13E-08	2.77±8.11E-09	-5.86±9.88E-08
402	UP	Jun-15	7.05	5832	-2.07±1.47E-08	4.87±8.73E-09	-0.36±1.06E-07
402	UP	Dec-15	7.03	6065	-0.43±1.47E-08	-0.39±1.06E-08	-7.06±9.66E-08
403	UP	Jun-15	6.50	1940	5.50±4.43E-09	6.88±3.04E-09	1.04±1.11E-07
403	UP	Dec-15	7.22	1654	-2.69±6.11E-09	4.84±4.19E-09	2.83±9.13E-08
706	UP	Mar-15	7.15	798	-3.08±2.39E-09	3.47±2.01E-09	0.13±1.15E-07
706	UP	Jun-15	7.02	1310	-6.43±4.31E-09	7.61±2.89E-09	0.94±1.14E-07
706	UP	Sep-15	6.48	1268	0.00±5.34E-09	1.13±0.32E-08	3.27±9.95E-08
706	UP	Dec-15	7.12	903	-1.63±2.74E-09	7.18±2.04E-09	0.76±8.95E-08
1302	UP	Dec-15	7.11	736	-1.84±1.30E-09	-0.68±1.41E-09	1.92±9.03E-08
103	DOWN	Mar-15	8.08	3205	-9.89±6.89E-09	4.32±0.62E-08	-0.14±1.14E-07
103	DOWN	Jun-15	7.47	4014	-8.49±5.40E-09	8.47±0.68E-08	0.12±1.11E-07
103	DOWN	Sep-15	7.79	2794	-2.04±5.97E-09	4.47±0.75E-08	0.26±9.54E-08
103	DOWN	Dec-15	7.98	1697	1.32±0.43E-08	1.73±0.34E-08	6.67±9.56E-08

Note: Bolding indicates radiological concentration that exceeds the GSL.
NA - Not applicable.
SU - Standard units.
[a] Hydraulic position is relative to other wells within the same hydrogeologic unit.
[b] The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards (see Table D-1A).

TABLE D-2A (*continued*)
2015 Indicator Results From the Sand and Gravel Unit

Location Code	*Hydraulic Position* [a]	*Date Collected*	*pH SU*	*Conductivity µmhos/cm@ 25 ºC*	*Gross Alpha µCi/mL*	*Gross Beta µCi/mL*	*Tritium µCi/mL*
Groundwater Screening Levels [b]			*NA*	*NA*	*1.50E-08*	*1.00E-06*	*1.78E-07*
104	DOWN	Mar-15	7.21	1990	1.04±5.50E-09	**5.93±0.01E-05**	**2.19±1.22E-07**
104	DOWN	Jun-15	7.21	2142	-6.01±4.18E-09	**6.83±0.01E-05**	1.33±1.07E-07
104	DOWN	Sep-15	6.97	2190	-3.35±3.96E-09	**7.46±0.01E-05**	0.97±1.03E-07
104	DOWN	Dec-15	7.13	2124	-0.72±3.21E-09	**7.18±0.01E-05**	**2.31±1.08E-07**
105	DOWN	Mar-15	7.24	2436	-3.61±4.62E-09	**5.88±0.01E-05**	**1.81±1.23E-07**
105	DOWN	Jun-15	7.21	2454	6.51±5.67E-09	**5.70±0.01E-05**	1.32±1.06E-07
105	DOWN	Sep-15	7.08	2508	-1.32±4.98E-09	**6.20±0.01E-05**	1.35±1.09E-07
105	DOWN	Dec-15	7.20	2588	6.11±4.87E-09	**7.03±0.01E-05**	1.22±1.04E-07
106	DOWN	Mar-15	6.59	1314	1.31±4.30E-09	**1.24±0.02E-06**	**4.58±1.32E-07**
106	DOWN	Jun-15	6.84	1713	-7.54±4.44E-09	**1.90±0.02E-06**	**5.05±1.43E-07**
106	DOWN	Sep-15	6.75	1814	-5.76±5.27E-09	**2.30±0.02E-06**	**6.30±1.48E-07**
106	DOWN	Dec-15	6.88	1722	-0.56±3.47E-09	**2.37±0.02E-06**	**7.27±1.25E-07**
111	DOWN	Mar-15	6.81	764	**1.82±0.47E-08**	**4.27±0.03E-06**	0.44±1.16E-07
111	DOWN	Jun-15	6.75	964	9.81±3.72E-09	**3.81±0.02E-06**	0.84±1.02E-07
111	DOWN	Sep-15	6.52	1772	1.06±0.36E-08	**6.75±0.03E-06**	0.65±1.02E-07
111	DOWN	Dec-15	6.57	955	5.85±3.73E-09	**6.13±0.03E-06**	0.94±1.00E-07
116	DOWN	Jun-15	7.15	2618	-5.24±5.24E-09	**3.03±0.01E-05**	5.88±9.99E-08
116	DOWN	Dec-15	7.06	2602	-3.15±5.06E-09	**3.98±0.01E-05**	1.33±1.04E-07
205	DOWN	Jun-15	7.06	5744	-1.07±0.67E-08	1.10±0.79E-08	1.02±1.13E-07
205	DOWN	Dec-15	7.04	3052	-3.41±9.35E-09	1.22±0.65E-08	-1.79±9.98E-08
406	DOWN	Mar-15	7.38	818	-1.73±1.63E-09	1.60±1.67E-09	0.33±1.14E-07
406	DOWN	Jun-15	7.13	970	-3.48±2.30E-09	6.34±1.86E-09	0.95±1.10E-07
406	DOWN	Sep-15	7.20	829	2.21±2.05E-09	7.34±1.96E-09	-2.58±8.45E-08
406	DOWN	Dec-15	7.25	806	-2.27±1.71E-09	6.66±1.57E-09	2.36±9.13E-08
408	DOWN	Mar-15	7.30	4068	-1.31±0.94E-08	**2.10±0.01E-04**	0.29±1.16E-07
408	DOWN	Jun-15	7.33	4358	4.77±8.07E-09	**2.28±0.01E-04**	0.99±1.04E-07
408	DOWN	Sep-15	7.09	4470	**1.80±1.49E-08**	**2.54±0.01E-04**	2.65±9.92E-08
408	DOWN	Dec-15	7.23	4205	0.10±1.43E-08	**2.10±0.01E-04**	9.91±9.96E-08

Note: Bolding indicates radiological concentration that exceeds the GSL.
NA - Not applicable.
SU - Standard units.
[a] Hydraulic position is relative to other wells within the same hydrogeologic unit.
[b] The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1

TABLE D-2A (*continued*)
2015 Indicator Results From the Sand and Gravel Unit

Location Code	*Hydraulic Position* [a]	*Date Collected*	*pH SU*	*Conductivity µmhos/cm@ 25 °C*	*Gross Alpha µCi/mL*	*Gross Beta µCi/mL*	*Tritium µCi/mL*
Groundwater Screening Levels [b]			*NA*	*NA*	*1.50E-08*	*1.00E-06*	*1.78E-07*
501	DOWN	Mar-15	7.51	3392	0.40±7.29E-09	**9.26±0.02E-05**	0.76±1.19E-07
501	DOWN	Jun-15	7.34	3472	-2.68±0.80E-08	**1.05±0.01E-04**	0.84±1.03E-07
501	DOWN	Sep-15	7.22	3682	-0.30±1.20E-08	**1.11±0.01E-04**	0.50±1.01E-07
501	DOWN	Dec-15	7.38	3300	-0.13±1.01E-08	**1.02±0.01E-04**	5.68±8.83E-08
502	DOWN	Mar-15	7.42	3051	-8.84±7.11E-09	**8.36±0.02E-05**	1.38±1.22E-07
502	DOWN	Jun-15	7.49	3128	-1.76±7.14E-09	**8.47±0.02E-05**	0.68±1.00E-07
502	DOWN	Sep-15	7.09	3280	0.79±6.49E-09	**9.55±0.02E-05**	0.80±9.60E-08
502	DOWN	Dec-15	7.30	3255	-1.21±0.99E-08	**9.16±0.02E-05**	6.30±9.88E-08
602A	DOWN	Jun-15	6.78	1016	1.91±2.72E-09	1.40±0.22E-08	**2.12±1.16E-07**
602A	DOWN	Dec-15	7.22	862	-1.08±1.53E-09	9.76±1.69E-09	1.46±1.00E-07
604	DOWN	Jun-15	6.40	1822	0.19±3.91E-09	8.15±2.58E-09	-0.64±1.08E-07
604	DOWN	Dec-15	6.51	2001	6.78±4.39E-09	4.58±3.64E-09	0.32±1.08E-07
605	DOWN	Jun-15	7.00	1162	-1.12±1.61E-09	2.62±0.22E-08	1.52±1.18E-07
605	DOWN	Dec-15	7.33	932	-1.55±1.73E-09	2.46±0.21E-08	3.52±9.12E-08
801	DOWN	Mar-15	6.86	2256	-0.39±4.94E-09	**6.79±0.04E-06**	1.49±1.21E-07
801	DOWN	Jun-15	6.67	2691	-1.38±0.58E-08	**6.24±0.04E-06**	4.84±9.89E-08
801	DOWN	Sep-15	6.59	2410	-4.36±5.34E-09	**5.73±0.04E-06**	0.77±1.03E-07
801	DOWN	Dec-15	6.65	2083	6.33±4.60E-09	**5.38±0.03E-06**	0.83±1.02E-07
802	DOWN	Mar-15	7.54	180	1.42±1.14E-09	4.82±0.30E-08	0.66±1.21E-07
802	DOWN	Jun-15	7.03	566	-1.03±0.80E-09	4.16±0.04E-07	0.71±1.02E-07
802	DOWN	Sep-15	6.75	1360	4.65±3.51E-09	**1.13±0.01E-06**	-1.34±9.40E-08
802	DOWN	Dec-15	6.87	1372	-4.38±3.35E-09	**1.36±0.01E-06**	4.12±8.83E-08
803	DOWN	Mar-15	7.27	2707	-1.04±0.73E-08	**2.39±0.03E-06**	1.10±1.19E-07
803	DOWN	Jun-15	7.15	2544	-6.80±4.62E-09	**2.23±0.02E-06**	**1.86±1.15E-07**
803	DOWN	Sep-15	7.06	2670	-4.71±5.87E-09	**2.37±0.02E-06**	3.23±9.81E-08
803	DOWN	Dec-15	7.13	2803	-1.16±0.84E-08	**2.50±0.03E-06**	1.24±1.05E-07
804	DOWN	Mar-15	7.13	2131	-5.73±6.24E-09	3.48±0.09E-07	8.80±8.04E-08
804	DOWN	Jun-15	6.80	2012	-1.47±0.72E-08	3.32±0.11E-07	-0.24±1.12E-07
804	DOWN	Sep-15	6.55	2126	0.27±6.20E-09	3.47±0.11E-07	1.79±9.85E-08
804	DOWN	Dec-15	6.78	2004	-2.80±4.79E-09	3.56±0.09E-07	1.22±1.04E-07

Note: Bolding indicates radiological concentration that exceeds the GSL.
NA - Not applicable.
SU - Standard units.
[a] Hydraulic position is relative to other wells within the same hydrogeologic unit.
[b] The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards (See Table D-1A).

TABLE D-2A *(continued)*

2015 Indicator Results From the Sand and Gravel Unit

Location Code	*Hydraulic Position* [a]	*Date Collected*	*pH SU*	*Conductivity µmhos/cm@ 25 ºC*	*Gross Alpha µCi/mL*	*Gross Beta µCi/mL*	*Tritium µCi/mL*
Groundwater Screening Levels [b]			*NA*	*NA*	*1.50E-08*	*1.00E-06*	*1.78E-07*
1304	DOWN	Mar-15	7.34	2408	-4.01±6.28E-09	8.68±4.63E-09	0.63±1.15E-07
1304	DOWN	Jun-15	7.04	3704	-2.71±0.77E-08	-7.84±5.25E-09	-0.24±1.09E-07
1304	DOWN	Sep-15	6.84	2602	1.44±6.14E-09	5.56±4.50E-09	0.88±8.67E-08
1304	DOWN	Dec-15	7.09	2015	4.82±4.82E-09	1.01±0.34E-08	1.81±8.98E-08
8603	DOWN	Jun-15	7.35	2486	-6.06±5.39E-09	**5.59±0.01E-05**	1.34±1.08E-07
8603	DOWN	Dec-15	7.25	2622	-4.56±6.28E-09	**8.04±0.01E-05**	**1.86±1.06E-07**
8604	DOWN	Jun-15	7.20	2261	0.89±4.69E-09	**4.82±0.01E-05**	1.75±1.11E-07
8604	DOWN	Dec-15	6.98	2392	-4.39±3.82E-09	**6.40±0.01E-05**	1.23±0.82E-07
8605	DOWN	Mar-15	6.78	822	**1.99±0.74E-08**	**6.61±0.04E-06**	1.64±1.23E-07
8605	DOWN	Jun-15	6.79	862	6.79±2.91E-09	**6.22±0.03E-06**	1.59±1.10E-07
8605	DOWN	Sep-15	6.90	2146	**1.73±0.55E-08**	**4.63±0.03E-06**	1.01±1.07E-07
8605	DOWN	Dec-15	6.72	990	**2.62±0.48E-08**	**8.97±0.04E-06**	9.61±7.97E-08
8607	DOWN	Mar-15	6.76	2736	0.00±4.69E-09	2.31±0.38E-08	0.47±1.17E-07
8607	DOWN	Jun-15	6.81	1743	0.10±3.49E-09	3.65±0.42E-08	0.70±1.15E-07
8607	DOWN	Sep-15	6.56	1995	2.61±3.81E-09	1.90±0.42E-08	3.70±9.91E-08
8607	DOWN	Dec-15	6.81	1070	-1.21±1.58E-09	3.10±0.29E-08	0.18±8.65E-08
8609	DOWN	Mar-15	7.14	2642	1.14±0.92E-08	**1.60±0.02E-06**	1.50±1.20E-07
8609	DOWN	Jun-15	7.18	2654	-2.22±4.71E-09	**1.39±0.02E-06**	1.63±1.11E-07
8609	DOWN	Sep-15	7.00	2843	1.80±8.14E-09	**1.60±0.02E-06**	1.18±1.07E-07
8609	DOWN	Dec-15	7.07	2583	-3.96±7.88E-09	**1.47±0.02E-06**	1.05±0.90E-07
8612	DOWN	Mar-15	7.08	2314	-1.11±0.81E-08	1.81±0.68E-08	1.15±1.18E-07
8612	DOWN	Jun-15	7.12	2370	2.40±4.38E-09	2.83±0.49E-08	0.40±1.13E-07
8612	DOWN	Sep-15	6.85	2392	-6.20±6.02E-09	3.23±0.58E-08	0.59±1.03E-07
8612	DOWN	Dec-15	7.11	2488	-1.76±6.45E-09	4.85±0.53E-08	1.60±1.06E-07
WP-A	DOWN	Sep-15	7.05	152	-0.53±6.65E-10	1.19±0.10E-08	**8.26±0.36E-06**
WP-C	DOWN	Sep-15	7.02	2968	-2.03±6.50E-09	2.87±0.11E-07	**2.31±0.06E-05**
WP-H	DOWN	Sep-15	6.63	1258	-0.86±3.06E-09	**9.12±0.03E-06**	**6.61±1.51E-07**

Note: Bolding indicates radiological concentration that exceeds the GSL.

NA - Not applicable.

SU - Standard units.

[a] Hydraulic position is relative to other wells within the same hydrogeologic unit.

[b] The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards (See Table D-1A).

TABLE D-2A *(concluded)*
2015 Indicator Results From the Sand and Gravel Unit

Location Code	*Hydraulic Position* [a]	*Date Collected*	*pH SU*	*Conductivity µmhos/cm@ 25 ºC*	*Gross Alpha µCi/mL*	*Gross Beta µCi/mL*	*Tritium µCi/mL*
Groundwater Screening Levels [b]			*NA*	*NA*	*1.50E-08*	*1.00E-06*	*1.78E-07*
GSEEP	DOWN	Mar-15	7.47	1318	-0.33±3.01E-09	1.85±0.05E-07	1.66±0.88E-07
GSEEP	DOWN	Jun-15	7.07	1888	1.97±3.84E-09	2.54±0.07E-07	**2.50±1.24E-07**
GSEEP	DOWN	Sep-15	7.30	1964	-2.73±4.33E-09	2.67±0.07E-07	**1.85±1.15E-07**
GSEEP	DOWN	Dec-15	6.81	1941	1.87±4.74E-09	2.86±0.08E-07	**2.61±1.15E-07**
SP04	DOWN	Jun-15	0.00	NS	-7.60±6.06E-09	4.98±0.10E-07	**2.54±1.29E-07**
SP04	DOWN	Dec-15	0.00	NS	-0.49±5.65E-09	3.85±0.09E-07	1.17±1.16E-07
SP06	DOWN	Jun-15	0.00	NS	-3.78±4.00E-09	3.70±0.08E-07	0.85±1.12E-07
SP06	DOWN	Dec-15	0.00	NS	2.66±3.29E-09	4.51±0.10E-07	3.44±9.44E-08
SP11	DOWN	Jun-15	0.00	NS	-6.14±6.05E-09	**1.27±0.02E-06**	1.05±1.14E-07
SP11	DOWN	Dec-15	0.00	NS	3.35±3.92E-09	**1.58±0.02E-06**	7.41±7.64E-08
SP12	DOWN	Jun-15	7.31	2434	0.41±4.80E-09	3.16±0.10E-07	0.76±1.10E-07
SP12	DOWN	Dec-15	7.28	2419	5.39±5.60E-09	3.38±0.10E-07	1.35±1.02E-07
MP-01	DOWN	Mar-15	7.35	4542	-0.12±1.05E-08	**3.52±0.01E-04**	1.72±1.22E-07
MP-01	DOWN	Jun-15	7.25	5302	-2.60±1.15E-08	**4.15±0.01E-04**	6.43±9.99E-08
MP-01	DOWN	Sep-15	7.29	4438	-0.44±1.19E-08	**3.10±0.01E-04**	0.68±1.03E-07
MP-01	DOWN	Dec-15	7.28	4305	-0.96±1.10E-08	**2.98±0.01E-04**	3.95±7.38E-08
MP-02	DOWN	Mar-15	7.25	4013	-4.30±8.78E-09	**4.73±0.01E-04**	0.56±1.19E-07
MP-02	DOWN	Jun-15	7.14	3642	-1.57±0.70E-08	**3.65±0.01E-04**	3.84±9.59E-08
MP-02	DOWN	Sep-15	7.17	4042	-0.90±1.22E-08	**4.01±0.01E-04**	1.82±9.74E-08
MP-02	DOWN	Dec-15	7.16	3627	0.35±1.44E-08	**3.84±0.01E-04**	3.28±7.14E-08
MP-03	DOWN	Mar-15	7.44	3155	-0.66±1.18E-08	**2.82±0.01E-04**	**1.86±1.21E-07**
MP-03	DOWN	Jun-15	7.32	3850	-1.48±1.11E-08	**3.73±0.01E-04**	0.55±1.01E-07
MP-03	DOWN	Sep-15	7.33	2780	1.38±5.58E-09	**2.30±0.01E-04**	2.98±9.96E-08
MP-03	DOWN	Dec-15	7.27	2748	-6.07±7.36E-09	**2.56±0.01E-04**	1.01±0.80E-07
MP-04	DOWN	Mar-15	7.56	2822	-3.14±6.67E-09	**3.28±0.01E-04**	1.11±1.26E-07
MP-04	DOWN	Jun-15	7.42	4073	-1.96±7.60E-09	**5.23±0.01E-04**	1.59±1.12E-07
MP-04	DOWN	Sep-15	7.35	3210	-2.42±6.52E-09	**3.76±0.01E-04**	1.19±1.09E-07
MP-04	DOWN	Dec-15	7.27	2906	-3.83±7.35E-09	**3.44±0.01E-04**	8.99±7.64E-08

Note: Bolding indicates radiological concentration that exceeds the GSL.
NA - Not applicable.
SU - Standard units.
[a] Hydraulic position is relative to other wells within the same hydrogeologic unit.
[b] The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards (See Table D-1A).

TABLE D-2B
2015 Indicator Results From the Lavery Till-Sand Unit

Location Code	Hydraulic Position [a]	Date Collected	pH SU	Conductivity µmhos/cm@ 25 °C	Gross Alpha µCi/mL	Gross Beta µCi/mL	Tritium µCi/mL
Groundwater Screening Levels [b]			NA	NA	1.50E-08	1.00E-06	1.78E-07
204	DOWN	Mar-15	7.39	2016	-1.00±6.23E-09	1.08±3.47E-09	0.44±1.14E-07
204	DOWN	Jun-15	7.42	1956	-8.14±3.16E-09	1.36±2.88E-09	0.86±1.04E-07
204	DOWN	Sep-15	7.00	2025	-0.22±3.88E-09	4.96±4.17E-09	-6.77±8.86E-08
204	DOWN	Dec-15	7.40	2012	1.47±4.09E-09	-4.61±3.73E-09	-0.20±1.02E-07
206	DOWN	Jun-15	7.36	2150	-5.03±3.90E-09	0.16±2.70E-09	0.33±1.11E-07
206	DOWN	Dec-15	7.17	2062	-3.74±5.15E-09	4.36±3.48E-09	-0.14±1.03E-07

NA - Not applicable.
SU - Standard units.
[a] Hydraulic position is relative to other wells within the same hydrogeologic unit.
[b] The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards (See Table D-1A).

TABLE D-2C
2015 indicator Results From the Weathered Lavery Till Unit

Location Code	*Hydraulic Position* [a]	*Date Collected*	*pH SU*	*Conductivity µmhos/cm@ 25 °C*	*Gross Alpha µCi/mL*	*Gross Beta µCi/mL*	*Tritium µCi/mL*
Groundwater Screening Levels [b]			*NA*	*NA*	*1.50E-08*	*1.00E-06*	*1.78E-07*
908R	UP	Dec-15	7.07	1347	**2.32±0.78E-08**	1.69±0.37E-08	-1.14±1.07E-07
1005	UP	Jun-15	7.20	770	-1.76±1.76E-09	3.16±1.45E-09	-0.48±1.07E-07
1005	UP	Dec-15	7.27	754	-2.73±2.70E-09	1.00±1.74E-09	0.53±1.11E-07
1008C	UP	Jun-15	7.49	606	-0.97±1.97E-09	1.64±1.36E-09	0.18±1.09E-07
1008C	UP	Dec-15	7.65	580	-2.98±2.36E-09	0.07±1.62E-09	-9.20±9.50E-08
906	DOWN	Jun-15	7.32	677	2.54±2.58E-09	0.02±1.61E-09	1.13±1.05E-07
906	DOWN	Dec-15	7.33	631	2.46±2.62E-09	5.22±1.66E-09	0.04±1.13E-07
909	DOWN	Jun-15	6.69	1430	-0.57±4.15E-09	2.52±0.08E-07	**8.79±1.33E-07**
909	DOWN	Dec-15	7.01	1492	-1.52±7.04E-09	3.67±0.11E-07	**7.61±1.34E-07**
1006	DOWN	Jun-15	7.13	1503	-5.38±4.57E-09	4.69±2.55E-09	-0.54±1.09E-07
1006	DOWN	Dec-15	7.12	1497	3.03±5.85E-09	2.10±3.42E-09	-0.12±1.04E-07
NDATR	DOWN	Mar-15	7.90	887	-0.84±1.34E-09	3.98±0.06E-07	1.26±1.21E-07
NDATR	DOWN	Jun-15	7.24	1005	-1.39±3.22E-09	5.31±0.09E-07	0.72±1.08E-07
NDATR	DOWN	Sep-15	6.97	1115	0.84±4.94E-09	6.99±0.10E-07	1.58±1.10E-07
NDATR	DOWN	Dec-15	7.49	768	-0.43±1.60E-09	4.62±0.06E-07	5.76±8.20E-08

Note: Bolding indicates radiological concentration that exceeds the GSL.
NA - Not applicable.
SU - Standard units.
[a] Hydraulic position is relative to other wells within the same hydrogeologic unit.
[b] The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards (See Table D-1A).

TABLE D-2D
2015 Indicator Results From the Unweathered Lavery Till

Location Code	Hydraulic Position [a]	Date Collected	pH SU	Conductivity µmhos/cm@ 25 °C	Gross Alpha µCi/mL	Gross Beta µCi/mL	Tritium µCi/mL
Groundwater Screening Levels [b]			NA	NA	1.50E-08	1.00E-06	1.78E-07
405	UP	Mar-15	8.25	1849	-2.55±5.37E-09	0.72±3.64E-09	0.58±1.26E-07
405	UP	Jun-15	7.08	1712	-4.50±4.38E-09	-0.34±3.49E-09	-0.36±1.09E-07
405	UP	Sep-15	6.84	1602	-4.12±5.08E-09	2.78±3.21E-09	-5.15±9.10E-08
405	UP	Dec-15	7.50	1598	-4.59±3.57E-09	5.81±2.83E-09	0.26±8.81E-08
1303	UP	Mar-15	7.99	287	-0.93±1.05E-09	4.16±0.77E-09	-0.09±1.10E-07
1303	UP	Jun-15	7.94	373	-7.74±8.24E-10	7.35±6.89E-10	0.54±1.10E-07
1303	UP	Sep-15	6.86	267	1.43±0.99E-09	1.05±0.75E-09	-1.05±0.86E-07
1303	UP	Dec-15	8.07	326	1.06±1.19E-09	0.70±1.08E-09	2.48±8.96E-08
107	DOWN	Mar-15	6.70	726	1.87±1.75E-09	2.15±0.19E-08	7.71±7.94E-08
107	DOWN	Jun-15	7.66	848	1.04±1.85E-09	1.95±0.21E-08	1.72±1.09E-07
107	DOWN	Sep-15	7.33	752	0.81±1.26E-09	2.45±0.23E-08	1.00±1.06E-07
107	DOWN	Dec-15	7.70	736	2.11±1.68E-09	1.50±0.20E-08	1.21±1.01E-07
108	DOWN	Jun-15	7.45	620	0.76±1.20E-09	1.94±0.93E-09	**2.78±1.15E-07**
108	DOWN	Dec-15	7.64	594	2.02±1.46E-09	1.82±1.24E-09	**1.86±1.21E-07**
110	DOWN	Mar-15	7.63	572	1.49±0.98E-09	3.34±1.00E-09	**5.33±1.19E-07**
110	DOWN	Jun-15	7.19	544	-4.31±1.34E-09	0.34±1.28E-09	**7.49±1.30E-07**
110	DOWN	Sep-15	7.36	574	0.65±1.76E-09	3.21±1.87E-09	**6.14±1.47E-07**
110	DOWN	Dec-15	7.43	572	-1.08±1.79E-09	1.01±1.29E-09	**4.13±1.27E-07**
409	DOWN	Mar-15	7.64	365	-1.77±1.18E-09	-0.01±7.30E-10	0.48±1.14E-07
409	DOWN	Jun-15	7.87	343	1.17±0.96E-09	8.05±8.40E-10	0.37±1.10E-07
409	DOWN	Sep-15	8.02	342	0.46±8.32E-10	1.17±0.84E-09	-2.97±9.31E-08
409	DOWN	Dec-15	8.05	344	0.11±1.27E-09	1.31±0.78E-09	-0.60±1.00E-07
704	DOWN	Mar-15	6.75	1139	-0.35±2.86E-09	7.16±2.08E-09	2.30±7.37E-08
704	DOWN	Jun-15	6.60	980	-4.40±2.95E-09	4.92±1.94E-09	-0.74±1.05E-07
704	DOWN	Sep-15	6.33	1182	3.38±3.14E-09	8.48±2.33E-09	2.18±7.67E-08
704	DOWN	Dec-15	6.63	1090	-2.13±2.91E-09	6.67±2.36E-09	-0.36±1.00E-07
707	DOWN	Jun-15	6.54	600	-3.84±1.87E-09	3.45±1.31E-09	0.32±1.08E-07
707	DOWN	Dec-15	6.84	700	-1.53±1.39E-09	4.57±1.44E-09	-0.14±1.03E-07
910R	DOWN	Jun-15	7.11	1409	-1.87±3.39E-09	4.15±2.68E-09	-1.79±9.78E-08
910R	DOWN	Dec-15	7.12	1444	6.97±4.94E-09	9.45±3.22E-09	-0.84±1.10E-07
1303	DOWN	Mar-15	7.99	287	-0.93±1.05E-09	4.16±0.77E-09	-0.09±1.10E-07
1303	DOWN	Jun-15	7.94	373	-7.74±8.24E-10	7.35±6.89E-10	0.54±1.10E-07
1303	DOWN	Sep-15	6.86	267	1.43±0.99E-09	1.05±0.75E-09	-1.05±0.86E-07
1303	DOWN	Dec-15	8.07	326	1.06±1.19E-09	0.70±1.08E-09	2.48±8.96E-08

Note: Bolding indicates radiological concentration that exceeds the GSL.
NA - Not applicable.
SU - Standard units.
[a] Hydraulic position is relative to other wells within the same hydrogeologic unit.
[b] The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards (See Table D-1A).

TABLE D-2E
2015 Indicator Results From the Kent Recessional Sequence

Location Code	Hydraulic Position [a]	Date Collected	pH SU	Conductivity µmhos/cm@ 25 °C	Gross Alpha µCi/mL	Gross Beta µCi/mL	Tritium µCi/mL
Groundwater Screening Levels [b]			NA	NA	1.50E-08	1.00E-06	1.78E-07
901	UP	Jun-15	7.19	406	3.03±8.41E-10	3.04±0.75E-09	0.46±1.03E-07
901	UP	Dec-15	7.00	396	1.87±0.93E-09	2.85±0.89E-09	-0.70±1.05E-07
902	UP	Jun-15	7.81	436	0.21±1.40E-09	2.50±0.94E-09	0.99±1.07E-07
902	UP	Dec-15	7.95	423	-1.08±1.47E-09	1.51±1.09E-09	-0.17±1.09E-07
1008B	UP	Dec-15	7.88	378	0.00±1.32E-09	1.48±1.18E-09	-6.96±9.79E-08
903	DOWN	Jun-15	7.45	980	-2.16±3.09E-09	1.28±1.84E-09	-5.28±9.94E-08
903	DOWN	Dec-15	7.46	922	-0.84±2.18E-09	-0.10±1.85E-09	-0.75±1.08E-07
8610	DOWN	Jun-15	7.63	1416	-9.16±3.93E-09	1.18±0.28E-08	0.23±1.02E-07
8610	DOWN	Dec-15	7.68	1489	-4.68±4.13E-09	1.49±3.09E-09	-0.40±1.11E-07
8611	DOWN	Jun-15	7.26	1366	-0.75±2.31E-09	6.00±2.50E-09	-4.18±9.84E-08
8611	DOWN	Dec-15	7.32	1375	-8.16±6.37E-09	-0.67±2.27E-09	0.31±1.12E-07

NA - Not applicable.
SU - Standard units.
[a] Hydraulic position is relative to other wells within the same hydrogeologic unit.
[b] The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards (See Table D-1A).

TABLE D-2F
2015 Metals Results for Early Warning Monitoring Well 502

Location	Date Collected	Aluminum µg/L	Iron µg/L	Manganese µg/L
502	Jun-15	257	33,300	229

Note: Special monitoring parameters at well 502, upgradient of the NPGRS, were used to assess potential water quality changes that could affect the SPDES treatment system. Since the NPGRS has not operated since April 2013, this monitoring is no longer needed. Sampling for these metals was discontinued in August 2015.

TABLE D-2G
2015 Results for Metals in Groundwater
Compared With WVDP Groundwater Screening Levels

Location Code	*Hydraulic Position*	*Date Collected*	*Antimony µg/L*	*Arsenic µg/L*	*Barium µg/L*	*Beryllium µg/L*	*Cadmium µg/L*	*Chromium µg/L*	*Cobalt µg/L*	*Copper µg/L*
Groundwater Screening Levels [a]			***15.1***	***25***	***1,000***	***3***	***7.27***	***52.3***	***67.8***	***200***
Sand and Gravel Unit										
706	UP	Mar-15	<3	<10	<200	<1	<5	**58**	<50	<25
706	UP	Jun-16	<3	<10	<200	<1	<5	**99**	<50	<25
706	UP	Sep-15	<3	<10	<200	<1	<5	22	<50	<25
706	UP	Dec-15	<3	<10	<200	<1	<5	31	<50	<25
1302	UP	Dec-15	<3	<10	<200	<1	<5	<10	<50	<25
111	DOWN	Dec-15	<3	<10	<200	<1	<5	<10	<50	<25
502	DOWN	Jun-16	NS	<10	680	NS	<5	**1750**	<50	86
1302	DOWN	Dec-15	<3	<10	<200	<1	<5	<10	<50	<25
1304	DOWN	Mar-15	<3	<10	<200	<1	<5	<10	<50	<25
1304	DOWN	Jun-16	<3	<10	210	<1	<5	<10	<50	<25
1304	DOWN	Sep-15	<3	<10	<200	<1	<5	<10	<50	<25
1304	DOWN	Dec-15	4.7	<10	<200	<1	<5	<10	<50	<25
8605	DOWN	Dec-15	<3	<10	<200	<1	<5	<10	<50	<25
MP-01	DOWN	Mar-15	<3	<10	544	<1	<5	**141**	<50	<25
MP-01	DOWN	Jun-16	<3	<10	649	<1	<5	28	<50	<25
MP-01	DOWN	Sep-15	<3	<10	502	<1	<5	<10	<50	<25
MP-01	DOWN	Dec-15	<3	<10	446	<1	<5	19	<50	<25
MP-02	DOWN	Mar-15	<3	<10	294	<1	<5	40	<50	<25
MP-02	DOWN	Jun-16	<3	<10	231	<1	<5	<10	<50	<25
MP-02	DOWN	Sep-15	<3	<10	279	<1	<5	16	<50	<25
MP-02	DOWN	Dec-15	<3	<10	240	<1	<5	<10	<50	<25
MP-03	DOWN	Mar-15	<3	<10	397	<1	<5	14	<50	<25
MP-03	DOWN	Jun-16	<3	<10	510	<1	<5	<10	<50	<25
MP-03	DOWN	Sep-15	<3	<10	361	<1	<5	18	<50	<25
MP-03	DOWN	Dec-15	<3	<10	300	<1	<5	15	<50	<25
MP-04	DOWN	Mar-15	<3	<10	306	<1	<5	**57**	<50	143
MP-04	DOWN	Jun-16	<3	<10	460	<1	<5	<10	<50	<25
MP-04	DOWN	Sep-15	<3	<10	344	<1	<5	<10	<50	<25
MP-04	DOWN	Dec-15	<3	<10	285	<1	<5	<10	<50	<25

Note: Bolding indicates a metal concentration that exceeds the GSL.
NS - Not sampled.

[a] GSLs have been established by selection of the larger of the WVDP background concentration or the 6 NYCRR TOGS 1.1.1 Class GA Groundwater Quality Standards. (See Table D-1B).

TABLE D-2G (*continued*)
2015 Results for Metals in Groundwater
Compared with WVDP Groundwater Screening Levels

Location Code	*Hydraulic Position*	*Date Collected*	*Lead µg/L*	*Mercury µg/L*	*Nickel µg/L*	*Selenium µg/L*	*Silver µg/L*	*Thallium µg/L*	*Tin µg/L*	*Vanadium µg/L*	*Zinc µg/L*
Groundwater Screening Levels [a]			*42.7*	*0.7*	*100*	*10.1*	*50*	*13.9*	*4,083*	*69.6*	*2,000*
Sand and Gravel Unit											
706	UP	Mar-15	<3	<0.2	**390**	<5	<10	<0.5	<3000	<50	<20
706	UP	Jun-16	<3	<0.2	**460**	<5	<10	<0.5	<3000	<50	<20
706	UP	Sep-15	<3	<0.2	**270**	<5	<10	<0.5	<3000	<50	<20
706	UP	Dec-15	<3	<0.2	**210**	<5	<10	<0.5	<3000	<50	<20
1302	UP	Dec-15	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
111	DOWN	Dec-15	<3	<0.2	55	<5	<10	<2	<3000	<50	<20
502	DOWN	Jun-16	<3	<0.2	230	<5	<10	NS	NS	<50	<20
1302	DOWN	Dec-15	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
1304	DOWN	Mar-15	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
1304	DOWN	Jun-16	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
1304	DOWN	Sep-15	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
1304	DOWN	Dec-15	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
8605	DOWN	Dec-15	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-01	DOWN	Mar-15	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-01	DOWN	Jun-16	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-01	DOWN	Sep-15	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-01	DOWN	Dec-15	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-02	DOWN	Mar-15	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-02	DOWN	Jun-16	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-02	DOWN	Sep-15	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-02	DOWN	Dec-15	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-03	DOWN	Mar-15	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-03	DOWN	Jun-16	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-03	DOWN	Sep-15	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-03	DOWN	Dec-15	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-04	DOWN	Mar-15	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-04	DOWN	Jun-16	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-04	DOWN	Sep-15	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-04	DOWN	Dec-15	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20

Note: Bolding indicates a metal concentration that exceeds the GSL.

NS - Not sampled.

[a] GSLs have been established by selection of the larger of the WVDP background concentration or the 6 NYCRR TOGS 1.1.1 Class GA Groundwater Quality Standards (See Table D-1B).

TABLE D-2G (*continued*)
2015 Results for Metals in Groundwater
Compared with WVDP Groundwater Screening Levels

Location Code	*Hydraulic Position*	*Date Collected*	*Antimony µg/L*	*Arsenic µg/L*	*Barium µg/L*	*Beryllium µg/L*	*Cadmium µg/L*	*Chromium µg/L*	*Cobalt µg/L*	*Copper µg/L*
Groundwater Screening Levels [a]			*15.1*	*25*	*1,000*	*3*	*7.27*	*52.3*	*67.8*	*200*
Weathered Lavery Till Unit										
909	DOWN	Dec-15	<3	15	210	<1	<5	<10	<50	<25
NDATR	DOWN	Mar-15	<3	<10	<200	<1	<5	<10	<50	<25
NDATR	DOWN	Jun-16	<3	<10	<200	<1	<5	<10	<50	<25
NDATR	DOWN	Sep-15	<3	<10	<200	<1	<5	<10	<50	<25
NDATR	DOWN	Dec-15	<3	<10	<200	<1	<5	<10	<50	<25
Unweathered Lavery Till Unit										
405	UP	Mar-15	<3	<10	<200	<1	<5	**480**	<50	<25
405	UP	Jun-16	<3	<10	<200	<1	<5	**290**	<50	<25
405	UP	Sep-15	<3	<10	<200	<1	<5	13	<50	<25
405	UP	Dec-15	<3	<10	<200	<1	<5	**280**	<50	<25
1303	UP	Mar-15	<3	<10	<200	<1	<5	<10	<50	<25
1303	UP	Jun-16	<3	20	280	<1	<5	20	<50	<25
1303	UP	Sep-15	<3	<10	<200	<1	<5	<10	<50	<25
1303	UP	Dec-15	<3	<10	<200	<1	<5	<10	<50	<25

[a] GSLs have been established by selection of the larger of the WVDP background concentration or the 6 NYCRR TOGS 1.1.1 Class GA Groundwater Quality Standards (See Table D-1B).

TABLE D-2G (*concluded*)
2015 Results for Metals in Groundwater
Compared with WVDP Groundwater Screening Levels

Location Code	*Hydraulic Position*	*Date Collected*	*Lead µg/L*	*Mercury µg/L*	*Nickel µg/L*	*Selenium µg/L*	*Silver µg/L*	*Thallium µg/L*	*Tin µg/L*	*Vanadium µg/L*	*Zinc µg/L*
Groundwater Screening Levels [a]			*42.7*	*0.7*	*100*	*10.1*	*50*	*13.9*	*4,083*	*69.6*	*2,000*
Weathered Lavery Till Unit											
909	DOWN	Dec-15	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
NDATR	DOWN	Mar-15	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
NDATR	DOWN	Jun-16	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
NDATR	DOWN	Sep-15	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
NDATR	DOWN	Dec-15	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
Unweathered Lavery Till Unit											
405	UP	Mar-15	<3	<0.2	**770**	<5	<10	<0.5	<3000	<50	<20
405	UP	Jun-16	<3	<0.2	**990**	<5	<10	<0.5	<3000	<50	<20
405	UP	Sep-15	<3	<0.2	**2800**	<5	<10	<0.5	<3000	<50	<20
405	UP	Dec-15	<3	<0.2	**2900**	<5	<10	<0.5	<3000	<50	<20
1303	UP	Mar-15	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
1303	UP	Jun-16	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	85
1303	UP	Sep-15	15	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
1303	UP	Dec-15	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20

Note: Bolding indicates a metal concentration that exceeds the GSL.
[a] GSLs have been established by selection of the larger of the WVDP background concentration or the 6 NYCRR TOGS 1.1.1 Class GA Groundwater Quality Standards (See Table D-1B).

TABLE D-2H
2015 Radioactivity in Groundwater From Selected Monitoring Locations

Location	*Hydraulic Position* [a]	*Date Collected*	*C-14 µCi/mL*	*Sr-90 µCi/mL*	*Tc-99 µCi/mL*	*I-129 µCi/mL*	*Cs-137 µCi/mL*	*Ra-226 µCi/mL*
Groundwater Screening Levels [b]			*2.82E-08*	*5.90E-09*	*5.02E-09*	*9.61E-10*	*1.03E-08*	*1.33E-09*
Sand and Gravel Unit								
401	UP	Dec-15	-0.24±2.39E-08	0.85±1.11E-09	-1.13±1.82E-09	-0.23±1.16E-09 [c]	-2.32±3.09E-09	5.51±2.27E-10
406	DOWN	Dec-15	-0.15±2.37E-08	6.87±9.96E-10	1.25±1.99E-09	0.08±1.14E-09 [c]	-1.43±3.50E-09	4.05±2.38E-10
408	DOWN	Dec-15	0.79±3.35E-08	**7.88±0.01E-05**	**1.33±0.16E-08**	2.61±7.03E-10	-1.70±4.93E-09	7.23±2.30E-10
501	DOWN	Dec-15	NS	**3.50±0.01E-05**	NS	NS	NS	NS
502	DOWN	Dec-15	NS	**3.59±0.01E-05**	NS	NS	NS	NS
801	DOWN	Dec-15	NS	**1.90±0.03E-06**	NS	NS	NS	NS
1304	DOWN	Dec-15	-0.89±2.40E-08	6.60±9.54E-10	-1.43±1.79E-09	0.29±1.01E-09 [c]	-0.34±2.47E-09	3.98±2.07E-10
8609	DOWN	Dec-15	NS	**5.83±0.13E-07**	NS	NS	NS	NS
MP-01	DOWN	Dec-15	2.99±3.45E-08 [c]	**1.08±0.01E-04**	**2.58±0.16E-08**	4.60±8.85E-10	-1.43±3.52E-09	NS
MP-02	DOWN	Dec-15	1.63±3.39E-08	**1.48±0.01E-04**	**4.06±0.29E-08**	0.08±7.17E-10	5.95±5.02E-09	NS
MP-03	DOWN	Dec-15	1.93±3.26E-08	**8.52±0.02E-05**	**2.22±0.14E-08**	6.17±9.80E-10	0.88±3.53E-09	NS
MP-04	DOWN	Dec-15	1.57±3.32E-08	**1.09±0.01E-04**	**3.04±0.20E-08**	**1.04±1.15E-09**	-3.08±5.06E-09	NS
Weathered Lavery Till Unit								
909	DOWN	Dec-15	1.63±2.44E-08	**1.35±0.02E-07**	0.09±1.32E-09	**1.34±0.28E-08**	-1.38±2.71E-09	2.85±1.94E-10
NDATR	DOWN	Jun-15	0.81±3.26E-08	**2.20±0.07E-07**	1.66±2.12E-09	**1.47±0.19E-08**	1.96±3.02E-09	2.04±2.23E-10
NDATR	DOWN	Dec-15	-1.66±2.37E-08	**1.63±0.03E-07**	-0.03±1.89E-09	**1.53±0.28E-08**	-0.20±2.62E-09	5.73±2.66E-10

Note: Bolding indicates radiological concentration that exceeds the GSL.
NS - Not sampled.
[a] Hydraulic position is relative to other wells within the same hydrologic unit.
[b] The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards (See Table D-1A).
[c] This result is not bolded because it was flagged with a "UJ" as not detected above the level of the associated value. The sample quantitation limit is an estimated quantity.

TABLE D-2H (*continued*)
2015 Radioactivity in Groundwater From Selected Monitoring Locations

Location	*Hydraulic Position* [a]	*Date Collected*	*Ra-228 µCi/mL*	*U-232 µCi/mL*	*U-233/234 µCi/mL*	*U-235/236 µCi/mL*	*U-238 µCi/mL*	*Total U µg/mL*
Groundwater Screening Levels [b]			*2.16E-09*	*1.38E-10*	*6.24E-10*	*8.07E-11*	*4.97E-10*	*1.34E-03*
Sand and Gravel Unit								
401	UP	Dec-15	1.87±3.09E-10	-0.27±2.40E-11	3.11±0.73E-10	7.46±3.66E-11	2.29±0.62E-10	5.46±0.27E-04
406	DOWN	Dec-15	2.71±4.03E-10	-0.50±2.62E-11	2.04±0.61E-10	8.03±4.45E-11	1.32±0.52E-10	3.12±0.18E-04
408	DOWN	Dec-15	6.93±3.91E-10	2.92±9.17E-11	**6.28±2.07E-10**	6.33±8.22E-11	**5.07±1.85E-10**	1.20±0.04E-03
1304	DOWN	Dec-15	2.82±2.58E-10	2.06±4.29E-11	2.87±0.76E-10	7.80±4.06E-11	2.04±0.66E-10	4.17±0.22E-04
MP-01	DOWN	Dec-15	NS	0.72±1.02E-10	5.86±1.99E-10	2.53±5.81E-11	3.07±1.46E-10	NS
MP-02	DOWN	Dec-15	NS	6.70±9.16E-11	**9.15±2.36E-10**	**2.36±1.25E-10**	**5.50±1.84E-10**	NS
MP-03	DOWN	Dec-15	NS	1.55±6.93E-11	**1.00±0.25E-09**	**1.81±1.09E-10**	**8.80±2.34E-10**	NS
MP-04	DOWN	Dec-15	NS	0.68±1.03E-10	**1.33±0.31E-09**	7.19±7.92E-11	**9.81±2.63E-10**	NS
Weathered Lavery Till Unit								
909	DOWN	Dec-15	8.54±4.97E-10	-3.62±3.93E-11	**8.97±1.28E-10**	**8.46±4.19E-11**	**5.86±1.02E-10**	**1.80±0.07E-03**
NDATR	DOWN	Jun-15	1.82±4.00E-10	2.08±3.45E-11	**1.38±0.14E-09**	**6.87±3.35E-11**	**1.02±0.13E-09**	**3.60±0.10E-03**
NDATR	DOWN	Dec-15	8.10±3.67E-10	-6.43±8.03E-11	**1.08±0.27E-09**	**1.50±1.04E-10**	**7.27±2.19E-10**	**2.64±0.10E-03**

Note: Bolding indicates radiological concentration that exceeds the GSL.
NS - Not sampled.
[a] Hydraulic position is relative to other wells within the same hydrologic unit.
[b] The GSLs for radiological constituents are set equal to the larger of the background concentrations or the TOGS 1.1.1 Class GA Groundwater Quality Standards (See Table D-1A).

TABLE D-2H (*concluded)*
2015 Radioactivity in Groundwater From Selected Monitoring Locations

Location	*Hydraulic Position* [a]	*Date Collected*	*Np-237* [b] *µCi/mL*	*Pu-238* [b] *µCi/mL*	*Pu-239/240* [b] *µCi/mL*	*Pu-241* [b] *µCi/mL*	*Am-241* [b] *µCi/mL*	*Cm-243/244* [b] *µCi/mL*
Sand and Gravel Unit								
MP-01	DOWN	Dec-15	4.79±6.55E-11	-0.50±2.92E-11	0.00±3.07E-11	-6.24±9.79E-09	0.49±2.56E-11	-0.49±1.66E-11
MP-02	DOWN	Dec-15	1.73±1.55E-10	2.47±5.68E-11	3.70±6.55E-11	-0.03±1.12E-08	0.96±2.66E-11	0.95±2.28E-11
MP-03	DOWN	Dec-15	0.12±5.48E-11	0.84±4.65E-11	1.29±5.77E-11	-0.10±1.05E-08	0.78±2.15E-11	-1.15±1.99E-11
MP-04	DOWN	Dec-15	1.42±5.34E-11	-0.26±5.97E-11	7.66±7.80E-11	-8.50±9.46E-09	2.98±2.31E-11	1.48±3.23E-11

[a] Hydraulic position is relative to other wells within the same hydrologic unit.
[b] Groundwater screening levels have not been established for Np-237, Pu-238, Pu-239/240, Pu-241, Am-241, or Cm-234/244.

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APPENDIX E

Summary of Biological Data

TABLE E-1
2015 Radioactivity Concentrations in Milk

Location	K-40 (µCi/mL)	Sr-90 (µCi/mL)	I-129 (µCi/mL)	Cs-137 (µCi/mL)
BFMFLDMN Annual	1.42±0.16E-06	0.74±1.11E-09	2.28±5.01E-10	-1.51±5.07E-09

Note: The near-site milk sample (BFMFLDMN) is located 5.1 km southeast of the site. The control milk sample (BFMCTLS) was last sampled in 2012. It will be sampled again in 2017.

TABLE E-2
2015 Radioactivity Concentrations in Venison

Location	% Moisture	H-3 (µCi/mL)	K-40 (µCi/g - dry)	Sr-90 (µCi/g - dry)	Cs-137 (µCi/g - dry)
Deer Flesh Background (BFDCTRL 10/19/2015)	72.0	1.01±1.12E-07	9.30±0.76E-06	-1.23±2.57E-09	-0.63±2.07E-08
Deer Flesh Background (BFDCTRL 11/5/2015)	74.3	0.82±1.08E-07	1.15±0.08E-05	-2.03±2.50E-09	3.05±0.40E-07
Deer Flesh Background (BFDCTRL 11/5/2015)	73.7	0.97±1.09E-07	1.24±0.08E-05	-0.32±2.64E-09	4.18±2.48E-08
Deer Flesh Near-Site (BFDNEAR 10/20/2015)	72.9	1.03±1.06E-07	1.02±0.04E-05	0.40±2.56E-09	8.03±1.68E-08
Deer Flesh Near-Site (BFDNEAR 10/27/2015)	72.9	1.14±1.09E-07	9.48±0.78E-06	1.75±2.79E-09	1.05±0.33E-07
Deer Flesh Near-Site (BFDNEAR 11/12/2015)	72.9	0.67±1.07E-07	1.15±0.04E-05	3.96±2.87E-09	0.01±1.67E-08

TABLE E-3
2015 Radioactivity Concentrations in Food Crops

The frequency of sampling of food crops has been decreased from annual to once every five years, consistent with guidance on periodic confirmatory sampling in DOE/EH-0173T.
Food crops will next be sampled in CY 2017.

TABLE E-4
2015 Radioactivity Concentrations in Edible Portions of Fish

The frequency of sampling fish has been decreased from annual to once every five years, consistent with guidance on periodic confirmatory sampling in DOE/EH-0173T.
Fish will next be sampled in CY 2017.

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APPENDIX F

Summary of Direct Radiation Monitoring Data

TABLE F-1
Summary of 2015 Semiannual Averages of Off-Site TLD Measurements[a]
(mR±2 SD/quarter)

Location Number [b]	*1st Half*	*2nd Half*	*Location Average*
DFTLD01	15±1	17±2	16±2
DFTLD02	14±1	16±1	15±1
DFTLD03	12±1	13±1	13±1
DFTLD04	14±1	16±1	15±1
DFTLD05	14±1	17±1	16±1
DFTLD06	13±1	15±2	14±1
DFTLD07	11±1	14±1	12±1
DFTLD08	14±1	16±1	15±1
DFTLD09	13±1	15±1	14±1
DFTLD10	13±1	17±1	15±1
DFTLD11	12±1	14±1	13±1
DFTLD12	13±1	15±2	14±1
DFTLD13	15±2	17±1	16±2
DFTLD14	13±1	16±2	15±1
DFTLD15	13±1	15±1	14±1
DFTLD16	13±1	16±2	15±1
DFTLD20	12±1	14±1	13±1
DFTLD23 (Background)	14±1	17±2	16±1

[a] The frequency of collection at the TLD locations was reduced from quarterly to semiannual in 2008, however data are reported in units of mR per quarter for comparability with historical results.
[b] Off-site locations are shown on Figures A-13 and A-14.

Conversion factor: Milliroentgen (mR) units are used to report exposure rates in air. To convert mR to mrem (dose to humans), a conversion factor of 1.03 must be applied. For example, a reported exposure rate of 18.1mR/quarter would be equivalent to 18.6 mrem/quarter (based upon dose-equivalent phantom calibration using cesium-137).

TABLE F-2

Summary of 2015 Semiannual Averages of On-Site TLD Measurements[a]

(mR±2SD/quarter)

Location Number[b]	*1st Half*	*2nd Half*	*Location Average*
DNTLD24	416±37	506±50	461±44
DNTLD28	15±1	17±1	16±1
DNTLD32	14±1	17±2	15±1
DNTLD33	15±1	18±2	17±1
DNTLD34	14±1	NS	14±1
DNTLD35	15±1	17±2	16±1
DNTLD36	13±1	15±1	14±1
DNTLD38	42±5	50±7	46±6
DNTLD40	111±13	89±12	100±13
DNTLD43	13±1	14±1	14±1
DNTLD44	16±1	18±1	17±1

NS - Not sampled. TLD 34 was replaced by TLD 44, installed to monitor the property boundary closest to the HLW Cask Storage Pad.

[a] The frequency of collection at the TLD locations was reduced from quarterly to semiannual in 2008, however data are reported in units of mR per quarter for comparability with historical results.

[b] On-site locations are shown on Figure A-12.

Conversion factor: Milliroentgen (mR) units are used to report exposure rates in air. To convert mR to mrem (dose to humans), a conversion factor of 1.03 must be applied. For example, a reported exposure rate of 18.1mR/quarter would be equivalent to 18.6 mrem/quarter (based upon dose-equivalent phantom calibration using cesium-137).

APPENDIX G

Summary of Quality Assurance Crosscheck Analyses

TABLE G-1
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a]; Study 32; March 2015

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?[b]*	*Analyzed by:*
MAPEP – 15 – GrF32, Air Filter – Gross Alpha/Beta							
Gross alpha	Air Filter	Bq/sample	1.41	1.77	0.530 - 3.01	Yes	ES
Gross beta	Air Filter	Bq/sample	0.779	0.75	0.380 - 1.13	Yes	ES
MAPEP – 15 – RdF32, Air Filter – Radiological							
Am-241	Air Filter	Bq/sample	0.0657	0.0681	0.0477 - 0.0885	Yes	GEL
Cs-137	Air Filter	Bq/sample	0.00963	[c]	*False Positive Test*[d]	Yes	ES
Co-60	Air Filter	Bq/sample	0.00141	[c]	*False Positive Test*[d]	Yes	ES
Cs-137	Air Filter	Bq/sample	0.0116	[c]	*False Positive Test*[d]	Yes	GEL
Co-60	Air Filter	Bq/sample	0.0162	[c]	*False Positive Test*[d]	Yes	GEL
Pu-238	Air Filter	Bq/sample	0.000506	[c]	*False Positive Test*[d]	Yes	GEL
Pu-239/240	Air Filter	Bq/sample	0.0778	0.0847	0.0593 - 0.1101	Yes	GEL
Sr-90	Air Filter	Bq/sample	-0.0253	[c]	*False Positive Test*[d]	Yes	GEL
U-234/233	Air Filter	Bq/sample	0.0165	0.0155	0.0109 - 0.0202	Yes	GEL
U-238	Air Filter	Bq/sample	0.0958	0.099	0.069 - 0.129	Yes	GEL
U – total	Air Filter	µg/sample	7.96	7.97	5.58 - 10.36	Yes	GEL
MAPEP – 15 – GrW32, Water – Gross Alpha/Beta							
Gross alpha	Water	Bq/L	1.29	1.066	0.320 - 1.812	Yes	ES
Gross beta	Water	Bq/L	3.06	2.79	1.40 - 4.19	Yes	ES
Gross alpha	Water	Bq/L	1.05	1.066	0.320 - 1.812	Yes	GEL
Gross beta	Water	Bq/L	3.22	2.79	1.40 - 4.19	Yes	GEL
MAPEP – 15 – XaW32, Water – Alkaline							
Iodine-129	Water	Bq/L	1.72	1.49	1.04 - 1.94	Yes	GEL
MAPEP – 15 – MaW32, Water – Radiological							
Cs-137	Water	Bq/L	19.1	19.1	13.4 - 24.8	Yes	ES
Co-60	Water	Bq/L	0.105	[c]	*False Positive Test*[d]	Yes	ES
H-3	Water	Bq/L	578	563	394 - 732	Yes	ES
Sr-90	Water	Bq/L	8.87	9.48	6.64 - 12.32	Yes	ES
Am-241	Water	Bq/L	0.657	0.654	0.458 - 0.850	Yes	GEL
Cs-137	Water	Bq/L	19.7	19.1	13.4 - 24.8	Yes	GEL
Co-60	Water	Bq/L	0.0159	[c]	*False Positive Test*[d]	Yes	GEL
H-3	Water	Bq/L	633	563	394 - 732	Yes	GEL
Pu-238	Water	Bq/L	0.0103	0.0089	*Sensitivity Evaluation*[e]	Yes	GEL
Pu-239/240	Water	Bq/L	0.770	0.832	0.582 - 1.082	Yes	GEL
Sr-90	Water	Bq/L	8.49	9.48	6.64 - 12.32	Yes	GEL
Tc-99	Water	Bq/L	2.90	3.18	2.23 - 4.13	Yes	GEL
U-234/233	Water	Bq/L	0.146	0.148	0.104 - 0.192	Yes	GEL
U-238	Water	Bq/L	0.918	0.97	0.68 - 1.26	Yes	GEL

Note: This report includes only those matrix/analyte combinations performed in support of the analysis of environmental samples collected as part of the WVDP monitoring program or special investigations.

ES - WVDP Environmental Services. GEL - GEL Laboratories, LLC.
[a] MAPEP monitors performance and requests corrective action as required.
[b] "Yes" - Result acceptable.
[c] Although no actual reference value or acceptance range was provided, the results were assessed by MAPEP as acceptable.
[d] The false positive test is used to identify laboratory results indicating the presence of an analyte, when, in fact, the analyte is far below the detection limit.
[e] A sensistivity evaluation tests the laboratory's ability to measure the analyte near the detection limit. This sensitivity evaluation reported a statistically zero result.

TABLE G-1 (*continued*)
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a] ; Study 32; March 2015

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?[b]*	*Analyzed by:*
MAPEP – 15– MaW32, Water – Inorganic							
Antimony	Water	mg/L	0.000288	[c]	*False Positive Test[d]*	Yes	GEL
Arsenic	Water	mg/L	2.41	2.48	1.74 - 3.22	Yes	GEL
Barium	Water	mg/L	2.67	2.72	1.90 - 3.54	Yes	GEL
Beryllium	Water	mg/L	0.0000219	[c]	*False Positive Test[d]*	Yes	GEL
Cadmium	Water	mg/L	0.905	0.93	*0.65 - 1.21*	Yes	GEL
Chromium	Water	mg/L	1.99	1.96	1.37 - 2.55	Yes	GEL
Cobalt	Water	mg/L	0.0342	0.035	*Sensitivity Evaluation[e]*	Yes	GEL
Copper	Water	mg/L	6.31	6.34	4.44 - 8.24	Yes	GEL
Lead	Water	mg/L	1.20	1.22	0.85 - 1.59	Yes	GEL
Mercury	Water	mg/L	0.089	0.092	0.064 - 0.120	Yes	GEL
Nickel	Water	mg/L	4.13	4.18	2.93 - 5.43	Yes	GEL
Selenium	Water	mg/L	0.695	0.778	0.545 - 1.011	Yes	GEL
Thallium	Water	mg/L	3.47	3.51	2.46 - 4.56	Yes	GEL
Uranium – total	Water	mg/L	0.0781	0.078	0.055 - 0.101	Yes	GEL
Vanadium	Water	mg/L	5.61	5.48	3.84 - 7.12	Yes	GEL
Zinc	Water	mg/L	0.00292	0.0113	*Sensitivity Evaluation[f]*	No	GEL
MAPEP – 15 – MaS32, Soil – Inorganic							
Antimony	Soil	mg/kg	99.3	120	84 - 156	Yes	GEL
Arsenic	Soil	mg/kg	51.0	55.6	38.9 - 72.3	Yes	GEL
Barium	Soil	mg/kg	443	485	340 - 631	Yes	GEL
Beryllium	Soil	mg/kg	37.1	39.3	27.5 - 51.1	Yes	GEL
Cadmium	Soil	mg/kg	16.9	18.9	13.2 - 24.6	Yes	GEL
Chromium	Soil	mg/kg	88.7	98.0	68.6 - 127.4	Yes	GEL
Cobalt	Soil	mg/kg	98.8	109	76 - 142	Yes	GEL
Copper	Soil	mg/kg	180	183	128 - 238	Yes	GEL
Lead	Soil	mg/kg	64.9	71.0	49.7 - 92.3	Yes	GEL
Mercury	Soil	mg/kg	0.402	0.416	0.291 - 0.541	Yes	GEL
Nickel	Soil	mg/kg	123	135	95 - 176	Yes	GEL
Selenium	Soil	mg/kg	9.74	12.3	8.6 - 16.0	W	GEL
Silver	Soil	mg/kg	94.2	99.7	69.8 - 129.6	Yes	GEL
Thallium	Soil	mg/kg	179	202	141 - 263	Yes	GEL
Uranium – total	Soil	mg/kg	16.2	16.2	11.3 - 21.1	Yes	GEL
Vanadium	Soil	mg/kg	90.7	98	69 - 127	Yes	GEL
Zinc	Soil	mg/kg	136	161	113 - 209	Yes	GEL

GEL - GEL Laboratories, LLC.

[a] MAPEP monitors performance and requests corrective action as required.

[b] "Yes" - Result acceptable. "W" - Result acceptable with warning 20%<Bias<30%.

[c] Although no actual reference value or acceptance range was provided, the results were assessed by MAPEP as acceptable.

[d] The false positive test is used to identify laboratory results indicating the presence of an analyte, when, in fact, the analyte is far below the detection limit.

[e] A sensistivity evaluation tests the laboratory's ability to measure the analyte near the detection limit.

[f] This sensitivity evaluation reported a false negative.

TABLE G-1 (*continued*)
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a]; Study 32; March 2015

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?[b]*	*Analyzed by:*
MAPEP – 15– MaS32, Soil – Radiological							
Am-241	Soil	Bq/kg	114	97	68 - 126	Yes	GEL
Cs-137	Soil	Bq/kg	-0.279	[c]	*False Positive Test*[d]	Yes	GEL
Co-60	Soil	Bq/kg	852	817	572 - 1062	Yes	GEL
Pu-238	Soil	Bq/kg	80.3	83.9	58.7 - 109.1	Yes	GEL
Pu-239/240	Soil	Bq/kg	69.1	70.8	49.6 - 92.0	Yes	GEL
K-40	Soil	Bq/kg	684	622	435 - 809	Yes	GEL
Sr-90	Soil	Bq/kg	601	653	457 - 849	Yes	GEL
Tc-99	Soil	Bq/kg	694	867	607 - 1127	Yes	GEL
U-234/233	Soil	Bq/kg	57.6	52.5	36.8 - 68.3	Yes	GEL
U-238	Soil	Bq/kg	204	201	141 - 261	Yes	GEL
MAPEP – 15 – RdV32, Vegetation – Radiological							
Cs-137	Veg	Bq/sample	9.30	9.18	6.43 - 11.93	Yes	GEL
Co-60	Veg	Bq/sample	5.68	5.55	3.89 - 7.22	Yes	GEL
Sr-90	Veg	Bq/sample	0.852	1.08	0.76 - 1.40	W	GEL
MAPEP – 15 – OrW32, Water – Organic Compounds							
Heptachlor	Water	µg/L	5.70	6.07	2.54 - 9.59	Yes	GEL
1,2,4-Trichlorobenzene	Water	µg/L	17.9	21.8	3.1 - 41.0	Yes	GEL
1,2-Dichlorobenzene	Water	µg/L	<10	<10	[c]	Yes	GEL
1,3-Dichlorobenzene	Water	µg/L	<10	<10	[c]	Yes	GEL
1,4-Dichlorobenzene	Water	µg/L	77.6	100	17 - 185	Yes	GEL
2,4,5-Trichlorophenol	Water	µg/L	98.1	80	37 - 124	Yes	GEL
2,4,6-Trichlorophenol	Water	µg/L	154	115	54 - 176	Yes	GEL
2,4-Dichlorophenol	Water	µg/L	116	98	42 - 153	Yes	GEL
2,4-Dimethylphenol	Water	µg/L	85.9	75	28 - 122	Yes	GEL
2,4-Dinitrophenol	Water	µg/L	87.3	70	10 - 147	Yes	GEL
2,4-Dinitrotoluene	Water	µg/L	137	125	66 - 185	Yes	GEL
2,6-Dichlorophenol	Water	µg/L	83.6	69.6	28.4 - 110.9	Yes	GEL
2,6-Dinitrotoluene	Water	µg/L	<10	<10	[c]	Yes	GEL
2-Chloronaphthalene	Water	µg/L	91.1	85	32 - 138	Yes	GEL
2-Chlorophenol	Water	µg/L	<10	<10	[c]	Yes	GEL
2-Methylnaphthalene	Water	µg/L	<1.0	<10	[c]	Yes	GEL

GEL - GEL Laboratories, LLC.
[a] MAPEP monitors performance and requests corrective action as required.
[b] "Yes" - Result acceptable. "W" - Result acceptable with warning 20% < Bias < 30%.
[c] Although no actual reference value or acceptance range was provided, the results were assessed by MAPEP as acceptable.
[d] The false positive test is used to identify laboratory results indicating the presence of an analyte, when, in fact, the analyte is far below the detection limit.

TABLE G-1 (*concluded*)
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a] ; Study 32; March 2015

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?[b]*	*Analyzed by:*
MAPEP – 15 – OrW32, Water – Organic Compounds							
2-Methylphenol	Water	µg/L	52.0	47.2	15.3 - 79.2	Yes	GEL
2-Nitrophenol	Water	µg/L	93.6	82	34 - 130	Yes	GEL
4-Methylphenol	Water	µg/L	<10	<10	[c]	Yes	GEL
4,6-Dinitro-2-methylphenol	Water	µg/L	164	160	63 - 258	Yes	GEL
4-Bromophenyl-phenylether	Water	µg/L	48.3	45.2	21.8 - 68.7	Yes	GEL
4-Chloro-3-methylphenol	Water	µg/L	97.8	81	21.8 - 68.7	Yes	GEL
4-Chlorophenyl-phenylether	Water	µg/L	174	146	67 - 226	Yes	GEL
4-Nitrophenol	Water	µg/L	61.2	73	13 - 179	Yes	GEL
Acenaphthene	Water	µg/L	49.0	45.1	20.3 - 69.9	Yes	GEL
Acenaphthylene	Water	µg/L	68.9	62.2	27.2 - 97.3	Yes	GEL
Anthracene	Water	µg/L	<1.0	<10	[c]	Yes	GEL
Benzo(a)anthracene	Water	µg/L	26.0	27.3	14.4 - 40.2	Yes	GEL
Benzo(a)pyrene	Water	µg/L	19.0	20.2	7.9 - 32.5	Yes	GEL
Benzo(b)fluoranthene	Water	µg/L	<1.0	<10	[c]	Yes	GEL
Benzo(g,h,i)perylene	Water	µg/L	<1.0	<10	[c]	Yes	GEL
Benzo(k)fluoranthene	Water	µg/L	<1.0	<10	[c]	Yes	GEL
bis(2-chloroethoxy)methane	Water	µg/L	32.0	30.4	11.7 - 49.2	Yes	GEL
bis(2-chloroethyl)ether	Water	µg/L	<10	<10	[c]	Yes	GEL
bis(2-chloroisopropyl)ether	Water	µg/L	66.0	64.9	22.3 - 107.6	Yes	GEL
Bis(2-ethylhexyl)phthalate	Water	µg/L	95.1	83	34 - 132	Yes	GEL
Butylbenzylphthalate	Water	µg/L	<10	<13.4	[c]	Yes	GEL
Chrysene	Water	µg/L	<1.0	<10	[c]	Yes	GEL
Di-n-butylphthalate	Water	µg/L	87.6	79	34 - 124	Yes	GEL
Di-n-octylphthalate	Water	µg/L	97.0	88	31 - 146	Yes	GEL
Dibenzo(a,h)anthracene	Water	µg/L	33.4	31.4	12.7 - 50.1	Yes	GEL
Dibenzofuran	Water	µg/L	161	146	76 - 217	Yes	GEL
Diethylphthalate	Water	µg/L	103	92	22 - 162	Yes	GEL
Dimethylphthalate	Water	µg/L	106	79	12 - 170	Yes	GEL
Fluoranthene	Water	µg/L	<1.0	<15.6	[c]	Yes	GEL
Fluorene	Water	µg/L	110	113	60 - 167	Yes	GEL
Hexachlorobenzene	Water	µg/L	42.7	38.8	20.9 - 56.6	Yes	GEL
Hexachlorobutadiene	Water	µg/L	46.2	70	12 - 128	Yes	GEL
Hexachlorocyclopentadiene	Water	µg/L	<10	<10	[c]	Yes	GEL
Hexachloroethane	Water	µg/L	36.0	57	10 - 107	Yes	GEL
Indeno(1,2,3-c,d)pyrene	Water	µg/L	41.2	35.5	12.8 - 58.1	Yes	GEL
Isophorone	Water	µg/L	<10	<10	[c]	Yes	GEL
N-Nitroso-di-n-propylamine	Water	µg/L	112	108	44 - 171	Yes	GEL
N-Nitrosodimethylamine	Water	µg/L	49.5	51	9 - 109	Yes	GEL
N-Nitrosodiphenylamine	Water	µg/L	<10	<10	[c]	Yes	GEL
Napthalene	Water	µg/L	77.8	83	28 - 138	Yes	GEL
Nitrobenzene	Water	µg/L	31.7	29.1	12 - 46.2	Yes	GEL
Pentachlorophenol	Water	µg/L	118	97	38 - 155	Yes	GEL
Phenanthrene	Water	µg/L	158	153	88 - 219	Yes	GEL
Phenol	Water	µg/L	71.8	95	17 - 227	Yes	GEL
Pyrene	Water	µg/L	<1.0	<10	[c]	Yes	GEL

GEL - GEL Laboratories, LLC.
[a] MAPEP monitors performance and requests corrective action as required.
[b] "Yes" - Result acceptable.
[c] Although no actual reference value or acceptance range was provided, the results were assessed by MAPEP as acceptable.

TABLE G-2
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a] ; Study 33; August 2015

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?[b]*	*Analyzed by:*
MAPEP – 15 – GrF33, Air Filter – Gross Alpha/Beta							
Gross Alpha	Air Filter	Bq/sample	0.594	0.90	0.27 - 1.53	Yes	ES
Gross Beta	Air Filter	Bq/sample	1.48	1.56	0.78 - 2.34	Yes	ES
MAPEP – 15 – RdF33, Air Filter – Radiological							
Am-241	Air Filter	Bq/sample	0.155	0.147	0.103 - 0.191	Yes	GEL
Cs-137	Air Filter	Bq/sample	1.88	1.96	1.37 - 2.55	Yes	ES
Co-60	Air Filter	Bq/sample	1.62	1.71	1.20 - 2.22	Yes	ES
Cs-137	Air Filter	Bq/sample	1.94	1.96	1.37 - 2.55	Yes	GEL
Co-60	Air Filter	Bq/sample	1.80	1.71	1.20 - 2.22	Yes	GEL
Pu-238	Air Filter	Bq/sample	0.0993	0.104	0.073 - 0.135	Yes	GEL
Pu-239/240	Air Filter	Bq/sample	0.00403	0.0025	*Sensitivity Evaluation*[d]	Yes	GEL
Sr-90	Air Filter	Bq/sample	2.09	2.18	1.53 - 2.83	Yes	GEL
U-234/233	Air Filter	Bq/sample	0.153	0.143	0.100 - 0.186	Yes	GEL
U-238	Air Filter	Bq/sample	0.159	0.148	0.104 - 0.192	Yes	GEL
U – total	Air Filter	µg/sample	11.3	12.0	8.4 - 15.6	Yes	GEL
MAPEP – 15 – GrW33, Water – Gross Alpha/Beta							
Gross Alpha	Water	Bq/L	0.390	0.429	0.129 - 0.729	Yes	ES
Gross Beta	Water	Bq/L	3.70	3.52	1.76 - 5.28	Yes	ES
Gross Alpha	Water	Bq/L	0.425	0.429	0.129 - 0.729	Yes	GEL
Gross Beta	Water	Bq/L	3.59	3.52	1.76 - 5.28	Yes	GEL
MAPEP – 15 – XaW33, Water – Alkaline							
Iodine-129	Water	Bq/L	1.60	*1.49*	1.04 - 1.94	Yes	GEL
MAPEP – 15 – MaW33, Water – Radiological							
Cs-137	Water	Bq/L	0.112	[c]	*False Positive Test*[e]	Yes	ES
Co-60	Water	Bq/L	16.6	17.1	12.0 - 22.2	Yes	ES
H-3	Water	Bq/L	215	216	151 - 281	Yes	ES
Sr-90	Water	Bq/L	4.51	4.80	3.36 - 6.24	Yes	ES
Am-241	Water	Bq/L	1.03	1.055	0.739 - 1.372	Yes	GEL
Cs-137	Water	Bq/L	0.00355	[c]	*False Positive Test*[e]	Yes	GEL
Co-60	Water	Bq/L	17.5	17.1	12.0 - 22.2	Yes	GEL
H-3	Water	Bq/L	212	216	151 - 281	Yes	GEL
Pu-238	Water	Bq/L	0.607	0.681	0.477 - 0.885	Yes	GEL
Pu-239/240	Water	Bq/L	0.843	0.900	0.630 - 1.170	Yes	GEL
Sr-90	Water	Bq/L	4.06	4.80	3.36 - 6.24	Yes	GEL
Tc-99	Water	Bq/L	7.27	7.19	5.03 - 9.35	Yes	GEL
U-234/233	Water	Bq/L	1.13	1.14	0.80 - 1.48	Yes	GEL
U-238	Water	Bq/L	1.18	1.18	0.83 - 1.53	Yes	GEL

Note: This report includes only those matrix/analyte combinations performed in support of the analysis of environmental samples collected as part of the WVDP monitoring program or special investigations.

ES - WVDP Environmental Services. GEL - GEL Laboratories, LLC.

[a] MAPEP monitors performance and requests corrective action as required.

[b] "Yes" - Result acceptable.

[c] Although no actual reference value or acceptance range was provided, the results were assessed by MAPEP as acceptable.

[d] A sensitivity evaluation tests the laboratory's ability to measure the analyte near the detection limit.

[e] The false positive test is used to identify laboratory results indicating the presence of an analyte, when, in fact, the analyte is far below the detection limit.

TABLE G-2 (*continued*)
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a] ; Study 33; August 2015

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?[b]*	*Analyzed by:*
MAPEP – 15 – MaW33, Water – Inorganic							
Antimony	Water	mg/L	12.8	13.6	9.5 - 17.7	Yes	GEL
Arsenic	Water	mg/L	4.06	4.07	2.85 - 5.29	Yes	GEL
Barium	Water	mg/L	7.75	8.02	5.61 - 10.43	Yes	GEL
Beryllium	Water	mg/L	2.26	2.27	1.59 - 2.95	Yes	GEL
Cadmium	Water	mg/L	0.707	0.739	0.517 - 0.961	Yes	GEL
Chromium	Water	mg/L	3.75	3.83	2.68 - 4.98	Yes	GEL
Cobalt	Water	mg/L	14.1	14.8	10.4 - 19.2	Yes	GEL
Copper	Water	mg/L	4.66	4.40	3.08 - 5.72	Yes	GEL
Lead	Water	mg/L	3.72	3.98	2.79 - 5.17	Yes	GEL
Mercury	Water	mg/L	0.121	0.127	0.089 - 0.165	Yes	GEL
Nickel	Water	mg/L	16.3	16.8	11.8 - 21.8	Yes	GEL
Selenium	Water	mg/L	0.526	0.537	0.376 - 0.698	Yes	GEL
Thallium	Water	mg/L	2.08	2.32	1.62 - 3.02	Yes	GEL
Uranium – total	Water	mg/L	0.0969	0.095	0.067 - 0.124	Yes	GEL
Vanadium	Water	mg/L	10.5	10.3	7.2 - 13.4	Yes	GEL
Zinc	Water	mg/L	15.3	15.8	11.1 - 20.5	Yes	GEL
MAPEP – 15 – MaS33, Soil – Inorganic							
Antimony	Soil	mg/kg	3.09	0.31	*Sensitivity Evaluation*[c]	No	GEL
Arsenic	Soil	mg/kg	7.70	6.2	*Sensitivity Evaluation*[c]	Yes	GEL
Barium	Soil	mg/kg	536	561	393 - 729	Yes	GEL
Beryllium	Soil	mg/kg	57.0	60.3	42.2 - 78.4	Yes	GEL
Cadmium	Soil	mg/kg	10.1	11.1	7.8 - 14.4	Yes	GEL
Chromium	Soil	mg/kg	55.7	59.1	41.4 - 76.8	Yes	GEL
Cobalt	Soil	mg/kg	235	257	180 - 334	Yes	GEL
Copper	Soil	mg/kg	91.6	88	62 - 114	Yes	GEL
Lead	Soil	mg/kg	80.8	90.9	63.6 - 118.2	Yes	GEL
Mercury	Soil	mg/kg	1.34	0.933	0.653 - 1.213	No	GEL
Nickel	Soil	mg/kg	158	163	114 - 212	Yes	GEL
Selenium	Soil	mg/kg	13.5	14.14	9.90 - 18.38	Yes	GEL
Silver	Soil	mg/kg	46.3	48.7	34.1 - 63.3	Yes	GEL
Thallium	Soil	mg/kg	97.9	108	76 - 140	Yes	GEL
Uranium – total	Soil	mg/kg	16.4	17.69	12.38 - 23.00	Yes	GEL
Vanadium	Soil	mg/kg	182	195	137 - 254	Yes	GEL
Zinc	Soil	mg/kg	354	406	284 - 528	Yes	GEL

GEL - GEL Laboratories, LLC.
[a] MAPEP monitors performance and requests corrective action as required.
[b] "Yes" - Result acceptable.
[c] A sensistivity evaluation tests the laboratory's ability to measure the analyte near the detection limit.

TABLE G-2 (*continued*)
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a]; Study 33; August 2015

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?[b]*	*Analyzed by:*
MAPEP – 15 – MaS33, Soil – Radiological							
Am-241	Soil	Bq/kg	61.7	49.5	34.7 - 64.4	W	GEL
Cs-137	Soil	Bq/kg	861	809	566 - 1052	Yes	GEL
Co-60	Soil	Bq/kg	2.45	1.3	*Sensitivity Evaluation[e]*	Yes	GEL
Pu-238	Soil	Bq/kg	100	97.5	68.3 - 126.8	Yes	GEL
Pu-239/240	Soil	Bq/kg	76.7	80.4	56.3 - 104.5	Yes	GEL
K-40	Soil	Bq/kg	687	599	419 - 779	Yes	GEL
Sr-90	Soil	Bq/kg	403	425	298 - 553	Yes	GEL
Tc-99	Soil	Bq/kg	639	631	442 - 820	Yes	GEL
U-234/233	Soil	Bq/kg	58.6	56	39 - 73	Yes	GEL
U-238	Soil	Bq/kg	208	220	154 - 286	Yes	GEL
MAPEP – 15 – RdV33, Vegetation – Radiological							
Cs-137	Veg	Bq/sample	0.0326	[c]	*False Positive Test[d]*	Yes	GEL
Co-60	Veg	Bq/sample	4.81	4.56	3.19 - 5.93	Yes	GEL
Sr-90	Veg	Bq/sample	1.09	1.30	0.91 - 1.69	Yes	GEL

GEL - GEL Laboratories, LLC.
[a] MAPEP monitors performance and requests corrective action as required.
[b] "Yes" - Result acceptable. "W" - Result acceptable with warning 20% < bias < 30%.
[c] Although no actual reference value or acceptance range was provided, the results were assessed by MAPEP as acceptable.
[d] The false positive test is used to identify laboratory results indicating the presence of an analyte, when, in fact, the analyte is far below the detection limit.
[e] A sensistivity evaluation tests the laboratory's ability to measure the analyte near the detection limit. This sensitivity evaluation reported a statistically zero result.

TABLE G-2 (*continued*)
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a]; Study 33; August 2015

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?*[b]	*Analyzed by:*
MAPEP – 15 – OrW33, Water – Organic Compounds							
Heptachlor	Water	µg/L	3.67	5.31	2.21 - 8.40	Yes	GEL
1,2,4–Trichlorobenzene	Water	µg/L	79.8	96	28 - 164	Yes	GEL
1,2–Dichlorobenzene	Water	µg/L	75.4	89	19 - 158	Yes	GEL
1,3–Dichlorobenzene	Water	µg/L	90.4	110	18 - 208	Yes	GEL
1,4–Dichlorobenzene	Water	µg/L	18.4	21.9	4.6 - 39.3	Yes	GEL
2,4,5–Trichlorophenol	Water	µg/L	<10.0	<10	[c]	Yes	GEL
2,4,6–Trichlorophenol	Water	µg/L	<10.0	<10	[c]	Yes	GEL
2,4–Dichlorophenol	Water	µg/L	123	142	61 - 223	Yes	GEL
2,4–Dimethylphenol	Water	µg/L	49.8	58.9	21.8 - 95.9	Yes	GEL
2,4–Dinitrophenol	Water	µg/L	119	109	16 - 217	Yes	GEL
2,4–Dinitrotoluene	Water	µg/L	67.8	76.7	38.5 - 114.9	Yes	GEL
2,6–Dichlorophenol	Water	µg/L	116	129	51 - 208	Yes	GEL
2,6–Dinitrotoluene	Water	µg/L	45.2	48.7	24.5 - 72.9	Yes	GEL
2–Chloronaphthalene	Water	µg/L	106	126	47 - 205	Yes	GEL
2–Chlorophenol	Water	µg/L	88.4	100	38 - 161	Yes	GEL
2–Methylnaphthalene	Water	µg/L	27.3	28.0	6.4 - 49.6	Yes	GEL
2–Methylphenol	Water	µg/L	89.4	100	33 - 168	Yes	GEL
2–Nitrophenol	Water	µg/L	118	134	60 - 208	Yes	GEL
4–Methylphenol	Water	µg/L	43.8	52.9	7.8 - 102.1	Yes	GEL
4,6–Dinitro–2–methylphenol	Water	µg/L	79.4	84	31 - 137	Yes	GEL
4–Bromophenyl–phenylether	Water	µg/L	<10.0	<10	[c]	Yes	GEL
4–Chloro–3–methylphenol	Water	µg/L	67.3	75.6	35.5 - 115.8	Yes	GEL
4–Chlorophenyl–phenylether	Water	µg/L	<10.0	<10	[c]	Yes	GEL
4–Nitrophenol	Water	µg/L	57.8	65	12 - 160	Yes	GEL
Acenaphthene	Water	µg/L	30.0	32.5	14.7 - 50.4	Yes	GEL
Acenaphthylene	Water	µg/L	110	123	54 - 192	Yes	GEL
Anthracene	Water	µg/L	33.1	40.6	20.5 - 60.7	Yes	GEL
Benzo(a)anthracene	Water	µg/L	131	160	92 - 228	Yes	GEL
Benzo(a)pyrene	Water	µg/L	93.3	108	48 - 168	Yes	GEL
Benzo(b)fluoranthene	Water	µg/L	47.8	52.9	24.1 - 81.6	Yes	GEL
Benzo(g,h,i)perylene	Water	µg/L	28.4	33.3	15.3 - 51.3	Yes	GEL
Benzo(k)fluoranthene	Water	µg/L	111	130	40 - 221	Yes	GEL
bis(2–chloroethoxy)methane	Water	µg/L	<10.0	<10	[c]	Yes	GEL
bis(2–chloroethyl)ether	Water	µg/L	<10.0	<10	[c]	Yes	GEL
bis(2–chloroisopropyl)ether	Water	µg/L	<10.0	<10	[c]	Yes	GEL
Bis(2–ethylhexyl)phthalate	Water	µg/L	<10.0	<10	[c]	Yes	GEL
Butylbenzylphthalate	Water	µg/L	<10.0	<10	[c]	Yes	GEL

GEL - GEL Laboratories, LLC.
[a] MAPEP monitors performance and requests corrective action as required.
[b] "Yes" - Result acceptable.
[c] Although no actual value or acceptance range was provided, the results were assessed by MAPEP as acceptable.

TABLE G-2 (*concluded*)
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a]; Study 33; August 2015

Analyte	Matrix	Units	Reported Value	Reference Value	Acceptance Range	Accept? [b]	Analyzed by:
MAPEP – 15 – OrW33, Water – Organic Compounds							
Chrysene	Water	µg/L	80.5	89	45 - 133	Yes	GEL
Di–n–butylphthalate	Water	µg/L	<10.0	<10	[c]	Yes	GEL
Di–n–octylphthalate	Water	µg/L	<10.0	<10	[c]	Yes	GEL
Dibenzo(a,h)anthracene	Water	µg/L	30.7	39.6	16.3 - 62.8	Yes	GEL
Dibenzofuran	Water	µg/L	118	147	76 - 216	Yes	GEL
Diethylphthalate	Water	µg/L	<10.0	<10	[c]	Yes	GEL
Dimethylphthalate	Water	µg/L	<10.0	<10	[c]	Yes	GEL
Fluoranthene	Water	µg/L	35.9	44.1	24.5 - 63.6	Yes	GEL
Fluorene	Water	µg/L	47.6	52.3	26.9 - 77.7	Yes	GEL
Hexachlorobenzene	Water	µg/L	91.5	116	63 - 169	Yes	GEL
Hexachlorobutadiene	Water	µg/L	33.5	55.1	8.9 - 101.4	Yes	GEL
Hexachlorocyclopentadiene	Water	µg/L	27.8	44.8	7.9 - 106.5	Yes	GEL
Hexachloroethane	Water	µg/L	84.7	102	17 - 188	Yes	GEL
Indeno(1,2,3–c,d)pyrene	Water	µg/L	116	135	52 - 218	Yes	GEL
Isophorone	Water	µg/L	40.7	45.1	20.2 - 69.9	Yes	GEL
N-Nitroso-di-n-propylamine	Water	µg/L	<10.0	<10	[c]	Yes	GEL
N-Nitrosodimethylamine	Water	µg/L	<10.0	<10	[c]	Yes	GEL
N-Nitrosodiphenylamine	Water	µg/L	<10.0	<10	[c]	Yes	GEL
Napthalene	Water	µg/L	74.4	81	28 - 135	Yes	GEL
Nitrobenzene	Water	µg/L	117	129	56 - 202	Yes	GEL
Pentachlorophenol	Water	µg/L	98.8	99	39 - 159	Yes	GEL
Phenanthrene	Water	µg/L	59.0	71.8	40.3 - 103.4	Yes	GEL
Phenol	Water	µg/L	66.6	106	19 - 254	Yes	GEL
Pyrene	Water	µg/L	50.6	52.0	24.9 - 79.0	Yes	GEL

GEL - GEL Laboratories, LLC.
[a] MAPEP monitors performance and requests corrective action as required.
[b] "Yes" - Result acceptable.
[c] Although no actual value or acceptance range was provided, the results were assessed by MAPEP as acceptable.

TABLE G-3
Comparisons of Results From Crosscheck Samples Analyzed for Water Quality Parameters as Part of the EPA's 2015 Discharge Monitoring Report - Quality Assurance (DMR-QA) Study 35; (2015) for the National Pollutant Discharge Elimination System (NPDES)

Analyte	*Units*	*Reference Value*	*Reported Value*	*Acceptance Range* [a]	*Accept?* [b]	*Analyzed by:*
Aluminum	µg/L	1,340	1,480	1100 - 1550	Yes	TestAmerica
Aluminum	µg/L	944	984	770 - 1100	Yes	GEL
Ammonia (as N)	mg/L	17.1	16.7	13.7 - 20.3	Yes	TestAmerica
Antimony	µg/L	307	296	240 - 364	Yes	TestAmerica
Arsenic (EPA 200.7)	µg/L	734	707	621 - 838	Yes	TestAmerica
Arsenic (EPA 200.8)	µg/L	453	479	378 - 524	Yes	TestAmerica
Barium	µg/L	1,630	1,680	1390 - 1880	Yes	TestAmerica
Biochemical oxygen demand	mg/L	39.4	22.5	12.3 - 43.3	Yes	TestAmerica
Biochemical oxygen demand	mg/L	45.8	44.3	23.7 - 67.9	Yes	GEL
Cadmium	µg/L	326	312	277 - 375	Yes	TestAmerica
Chlorine (total residual)	µg/L	144	130	84.0 - 204	Yes	WWTF
Chromium (total)	µg/L	823	830	700 - 946	Yes	TestAmerica
Chromium (hexavalent)	µg/L	400	420	334 - 462	Yes	TestAmerica
Cobalt	µg/L	199	187	169 - 229	Yes	TestAmerica
Copper (EPA 200.7)	µg/L	681	713	579 - 783	Yes	TestAmerica
Copper (EPA 200.8)	µg/L	151	167	128 - 174	Yes	GEL
Cyanide, total	mg/L	0.295	0.286	0.192 - 0.398	Yes	TestAmerica
Iron	µg/L	559	577	475 - 643	Yes	TestAmerica
Iron	µg/L	2,140	2,180	1820 - 2460	Yes	GEL
Lead (EPA 200.7)	µg/L	827	787	703 - 951	Yes	TestAmerica
Lead (EPA 200.8)	µg/L	876	935	745 - 1010	Yes	TestAmerica
Lead (EPA 200.8)	µg/L	286	279	243 - 329	Yes	GEL
Manganese	µg/L	1,290	1,330	1100 - 1480	Yes	TestAmerica
Mercury (EPA 1631E)	µg/L	11.7	10.3	8.19 - 15.2	Yes	GEL
Nickel	µg/L	1,500	1,470	1330 - 1690	Yes	TestAmerica
Nitrate (as N)	mg/L	20.9	20.4	17.5 - 24.2	Yes	TestAmerica
Nitrite (as N)	mg/L	3.16	3.38	2.73 - 3.60	Yes	TestAmerica
Oil & Grease (Gravimetric)	mg/L	53.5	57.3	34.9 - 64.9	Yes	TestAmerica
Oil & Grease (Gravimetric)	mg/L	75.0	72.4	51.6 - 88.6	Yes	GEL
pH	SU	6.43	6.43	6.23 - 6.63	Yes	ES
Phosphorus (total, as P)	mg/L	6.79	6.17	5.64 - 7.86	Yes	TestAmerica
Phosphorus (total, as P)	mg/L	3.34	3	2.74 - 3.91	Yes	GEL
Selenium (EPA 200.7)	µg/L	503	483	428 - 579	Yes	TestAmerica
Selenium (EPA 200.8)	µg/L	353	376	300 - 405	Yes	TestAmerica
Sulfate	mg/L	43.8	40.5	35.8 - 50.3	Yes	TestAmerica
Settleable solids	mL/L	13.9	14.2	10.7 - 18.4	Yes	TestAmerica
Suspended solids (total)	mg/L	63.5	57.6	50.7 - 71.5	Yes	TestAmerica
Suspended solids (total)	mg/L	71.7	63	57.9 - 80.3	Yes	GEL
Total dissolved solids	mg/L	574	563	517 - 632	Yes	TestAmerica
Total dissolved solids	mg/L	383	363	338 - 428	Yes	GEL
Total Kjeldahl nitrogen (as N)	mg/L	5.84	5.72	4.13 - 7.65	Yes	TestAmerica
Vanadium	µg/L	1370	1410	1160 - 1570	Yes	TestAmerica
Zinc	µg/L	1,810	1,790	1540 - 2080	Yes	TestAmerica
Zinc	µg/L	1,710	1,690	1450 - 1970	Yes	GEL

Samples provided by Environmental Resource Associates (ERA) and Phenova.
ES - WVDP Environmental Services
GEL - GEL Laboratories, LLC.
TestAmerica - TestAmerica Laboratories, Inc., Buffalo.
WWTF - WVDP Waste Water Treatment Facility.
[a] Acceptance limits are determined by ERA or Phenova.
[b] "Yes" - Result acceptable; "No" - Result not acceptable.

APPENDIX H

West Valley Demonstration Project Act

West Valley Demonstration Project Act
(Public Law 96-368 [S.2443]; October 1, 1980)

(As presented in Exhibit G of the Cooperative Agreement between United States Department of Energy and New York State Energy Research and Development Authority on the Western New York Nuclear Service Center at West Valley, New York; Effective October 1, 1980 as amended September 18, 1981.)

EXHIBIT G

WEST VALLEY PROJECT DEMONSTRATION ACT

PUBLIC LAW 96–368 [S. 2443]; October 1, 1980

WEST VALLEY DEMONSTRATION PROJECT ACT

For Legislative History of this and other Laws, see Table 1, Public Laws and Legislative History, at end of final volume

An Act to authorize the Department of Energy to carry out a high-level liquid nuclear waste management demonstration project at the Western New York Service Center in West Valley, New York.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. This Act may be cited as the "West Valley Demonstration Project Act". West Valley Demonstration Project Act. 42 USC 2021a note.

SEC. 2. (a) The Secretary shall carry out, in accordance with this Act, a high level radioactive waste management demonstration project at the Western New York Service Center in West Valley, New York, for the purpose of demonstrating solidification techniques which can be used for preparing high level radioactive waste for disposal. Under the project the Secretary shall carry out the following activities: 42 USC 2021a note. Activities.

(1) The Secretary shall solidify, in a form suitable for transportation and disposal, the high level radioactive waste at the Center by vitrification or by such other technology which the Secretary determines to be the most effective for solidification.

(2) The Secretary shall develop containers suitable for the permanent disposal of the high level radioactive waste solidified at the Center.

(3) The Secretary shall, as soon as feasible, transport, in accordance with applicable provisions of law, the waste solidified at the Center to an appropriate Federal repository for permanent disposal.

(4) The Secretary shall, in accordance with applicable licensing requirements, dispose of low level radioactive waste and transuranic waste produced by the solidification of the high level radioactive waste under the project.

(5) The Secretary shall decontaminate and decommission—

(A) the tanks and other facilities of the Center in which the high level radioactive waste solidified under the project was stored,

(B) the facilities used in the solidification of the waste, and

(C) any material and hardware used in connection with the project,

in accordance with such requirements as the Commission may prescribe.

(b) Before undertaking the project and during the fiscal year ending September 30, 1981, the Secretary shall carry out the following:

(1) The Secretary shall hold in the vicinity of the Center public hearings to inform the residents of the area in which the Center is located of the activities proposed to be undertaken under the project and to receive their comments on the project. Hearings.

(2) The Secretary shall consider the various technologies available for the solidification and handling of high level radioactive waste taking into account the unique characteristics of such waste at the Center.

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(3) The Secretary shall—
(A) undertake detailed engineering and cost estimates for the project,
(B) prepare a plan for the safe removal of the high level radioactive waste at the Center for the purposes of solidification and include in the plan provisions respecting the safe breaching of the tanks in which the waste is stored, operating equipment to accomplish the removal, and sluicing techniques,
(C) conduct appropriate safety analyses of the project, and
(D) prepare required environmental impact analyses of the project.

(4) The Secretary shall enter into a cooperative agreement with the State in accordance with the Federal Grant and Cooperative Agreement Act of 1977 under which the State will carry out the following:

41 USC 501 note.

(A) The State will make available to the Secretary the facilities of the Center and the high level radioactive waste at the Center which are necessary for the completion of the project. The facilities and the waste shall be made available without the transfer of title and for such period as may be required for completion of the project.
(B) The Secretary shall provide technical assistance in securing required license amendments.

State costs, percentage.

(C) The State shall pay 10 per centum of the costs of the project, as determined by the Secretary. In determining the costs of the project, the Secretary shall consider the value of the use of the Center for the project. The State may not use Federal funds to pay its share of the cost of the project, but may use the perpetual care fund to pay such share.

Licensing amendment application.

(D) Submission jointly by the Department of Energy and the State of New York of an application for a licensing amendment as soon as possible with the Nuclear Regulatory Commission providing for the demonstration.

(c) Within one year from the date of the enactment of this Act, the Secretary shall enter into an agreement with the Commission to establish arrangements for review and consultation by the Commission with respect to the project: *Provided*, That review and consultation by the Commission pursuant to this subsection shall be conducted informally by the Commission and shall not include nor require formal procedures or actions by the Commission pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, as amended, or any other law. The agreement shall provide for the following:

42 USC 2011 note. 42 USC 5801 note.

(1) The Secretary shall submit to the Commission, for its review and comment, a plan for the solidification of the high level radioactive waste at the Center, the removal of the waste for purposes of its solidification, the preparation of the waste for disposal, and the decontamination of the facilities to be used in solidifying the waste. In preparing its comments on the plan, the Commission shall specify with precision its objections to any provision of the plan. Upon submission of a plan to the Commission, the Secretary shall publish a notice in the Federal Register of the submission of the plan and of its availability for public inspection, and, upon receipt of the comments of the Commission respecting a plan, the Secretary shall publish a notice in the Federal Register of the receipt of the comments and of the availability of the comments for public inspection. If the Secre-

Publications in Federal Register.

tary does not revise the plan to meet objections specified in the comments of the Commission, the Secretary shall publish in the Federal Register a detailed statement for not so revising the plan.

(2) The Secretary shall consult with the Commission with respect to the form in which the high level radioactive waste at the Center shall be solidified and the containers to be used in the permanent disposal of such waste.

(3) The Secretary shall submit to the Commission safety analysis reports and such other information as the Commission may require to identify any danger to the public health and safety which may be presented by the project.

Reports and other information to Commission.

(4) The Secretary shall afford the Commission access to the Center to enable the Commission to monitor the activities under the project for the purpose of assuring the public health and safety.

(d) In carrying out the project, the Secretary shall consult with the Administrator of the Environmental Protection Agency, the Secretary of Transportation, the Director of the Geological Survey, and the commercial operator of the Center.

Consultation with EPA and others.

SEC. 3. (a) There are authorized to be appropriated to the Secretary for the project not more than $5,000,000 for the fiscal year ending September 30, 1981.

Appropriation authorization. 42 USC 2021a note.

(b) The total amount obligated for the project by the Secretary shall be 90 per centum of the costs of the project.

(c) The authority of the Secretary to enter into contracts under this Act shall be effective for any fiscal year only to such extent or in such amounts as are provided in advance by appropriation Acts.

SEC. 4. Not later than February 1, 1981, and on February 1 of each calendar year thereafter during the term of the project, the Secretary shall transmit to the Speaker of the House of Representatives and the President pro tempore of the Senate an up-to-date report containing a detailed description of the activities of the Secretary in carrying out the project, including agreements entered into and the costs incurred during the period reported on and the activities to be undertaken in the next fiscal year and the estimated costs thereof.

Report to Speaker of the House and President pro tempore of the Senate. 42 USC 2021a note.

SEC. 5. (a) Other than the costs and responsibilities established by this Act for the project, nothing in this Act shall be construed as affecting any rights, obligations, or liabilities of the commercial operator of the Center, the State, or any person, as is appropriate, arising under the Atomic Energy Act of 1954 or under any other law, contract, or agreement for the operation, maintenance, or decontamination of any facility or property at the Center or for any wastes at the Center. Nothing in this Act shall be construed as affecting any applicable licensing requirement of the Atomic Energy Act of 1954 or the Energy Reorganization Act of 1974. This Act shall not apply or be extended to any facility or property at the Center which is not used in conducting the project. This Act may not be construed to expand or diminish the rights of the Federal Government.

42 USC 2021a note.

42 USC 2011 note.

42 USC 5801 note.

(b) This Act does not authorize the Federal Government to acquire title to any high level radioactive waste at the Center or to the Center or any portion thereof.

SEC. 6. For purposes of this Act:

Definitions. 42 USC 2021a note.

(1) The term "Secretary" means the Secretary of Energy.

(2) The term "Commission" means the Nuclear Regulatory Commission.

(3) The term "State" means the State of New York.

(4) The term "high level radioactive waste" means the high level radioactive waste which was produced by the reprocessing at the Center of spent nuclear fuel. Such term includes both liquid wastes which are produced directly in reprocessing, dry solid material derived from such liquid waste, and such other material as the Commission designates as high level radioactive waste for purposes of protecting the public health and safety.

(5) The term "transuranic waste" means material contaminated with elements which have an atomic number greater than 92, including neptunium, plutonium, americium, and curium, and which are in concentrations greater than 10 nanocuries per gram, or in such other concentrations as the Commission may prescribe to protect the public health and safety.

(6) The term "low level radioactive waste" means radioactive waste not classified as high level radioactive waste, transuranic waste, or byproduct material as defined in section 11 e. (2) of the
42 USC 2014. Atomic Energy Act of 1954.

(7) The term "project" means the project prescribed by section 2(a).

(8) The term "Center" means the Western New York Service Center in West Valley, New York.

Approved October 1, 1980.