WEST VALLEY DEMONSTRATION PROJECT

ANNUAL SITE ENVIRONMENTAL REPORT

Calendar Year 2017

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

September 2018
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), represents a single, comprehensive summary of on-site and off-site environmental data collected during calendar year 2017.

CH2M HILL BWXT West Valley, LLC (CHBWV) continued to perform Phase 1 Decommissioning and Facility Disposition activities for DOE during 2017. The term of the Phase 1 Decommissioning and Facility Disposition contract is from August 2011 to March 2020.

Monitoring and surveillance of the WVDP facilities are conducted to verify that public health and safety and the environment are protected. Environmental requirements and pollution prevention are integrated into work planning and execution. The quality assurance requirements applied to the environmental monitoring program by CHBWV and 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. Hazardous and mixed wastes are managed 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 as part of a site-wide environmental monitoring program. The resulting data are evaluated to assess effects of activities at the WVDP on the nearby public and the environment.

The dose to the critical receptor from airborne radiological emissions in 2017 was estimated to be <4.6% of the 10-millirem (mrem) EPA limit. The dose from combined airborne and waterborne radiological releases in 2017 to the same individual was estimated to be <0.47% of the 100-mrem DOE limit, verifying that dose received by off-site residents continues to be minimal.

Safety performance at the WVDP during 2017 continued to be very good. In 2017, the employees achieved over 400 thousand consecutive safe work hours without a lost-time work injury or illness, while accomplishing complex decontamination, demolition, and waste management activities.

If you have any questions or comments about the information in this report, please contact WVDP Communications at (716) 942-4996 or by e-mail at Joseph.Pillittere@chbwv.com. You may also complete and return the enclosed survey.

Sincerely,

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 WVDP Communications at:

telephone: (716) 942-4996
e-mail: Joseph.Pillittere@chbwv.com
mailing address: WEST VALLEY DEMONSTRATION PROJECT
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: ____________________

2. Does the *WVDP Annual Site Environmental Report* contain enough:

a. Useful illustrations and graphs? ☐ Yes ☐ No
b. Project background information? ☐ Yes ☐ No
c. Scientific background information? ☐ Yes ☐ No
Comments: ____________________

3. Is this report: (please check one)

☐ At appropriate technical level?
☐ Too technical? For example: ____________________
☐ Not technical enough? For example: ____________________

4. If you could change this report to make it more readable and useful to you, what would you change?

____

5. What is your affiliation?

☐ U.S. DOE
☐ NYSERDA
☐ Other government office/agency
☐ Public interest group
☐ Elected official
☐ Media
☐ Group: ____________________
☐ Individual: ____________________

6. To help us identify our audience, please indicate your educational background.

☐ 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 2017

Prepared for the U.S. Department of Energy

West Valley Demonstration Project Office

Under: Contract DE-EM0001529

by

CH2M HILL BWXT West Valley, LLC

10282 Rock Springs Road

West Valley, New York 14171-9799

September 2018

Front Cover: The cover photograph was taken at the Felton Bridge surface water sampling location on Cattaraugus Creek looking west. This is the first point of public access to the creek downstream of the site.

This report and previous Annual Site Environmental Reports (ASERs) are available on the DOE-WVDP website http://www.wv.doe.gov. Requests for digital copies of the 2017 ASER and questions regarding the report should be referred to:

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NOTE: This document includes external hot links to internet web pages as well as internal hot links that allow the reader to readily navigate to a reference within this document. Hot links are underlined and in blue font.

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APPENDIX I. WEST VALLEY DEMONSTRATION PROJECT ACT

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 (CY) 2017 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).

Site Location

The WVDP is located on the site of a former commercial nuclear fuel reprocessing plant, which shut down in 1976. The WVDP facility lies within a 152 acre fenced area in Western New York. The primary Project facilities include the Main Plant Process Building (MPPB), the Vitrification Facility (VF), four underground storage tanks, four wastewater treatment lagoons, a buried waste disposal facility and waste storage areas. The WVDP is surrounded by the 3,338-acre Western New York Nuclear Service Center (WNYNSC).

Project Status

In 1980, Congress passed Public Law 96-368 (the WVDP Act), included in its entirety in Appendix I. The first responsibility of the WVDP Act, solidification of the high-level waste (HLW) stored in the underground tanks by vitrification, was completed in September 2002. Removal of the HLW canisters from the MPPB in 2016 and other activities since 2002 address the remaining requirements of the WVDP Act which include waste disposal, and decontamination and decommissioning of the facilities and tanks.

Record of Decision. In April 2010, DOE released a Record of Decision (ROD) for the Final Environmental Impact Statement (Final EIS or FEIS) for the WVDP and the 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 is being conducted in two phases.

During Phase 1 Site Decommissioning, a number of highly contaminated facilities are being removed. Phase 1 also includes soil remediation, soils and facility characterization, 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 (FEIS, 2010). The complete FEIS and the ROD can be viewed on-line 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 the remaining WVDP decisionmaking with its Phase 2 decision in a Supplemental EIS (SEIS) 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.

CY 2017 Update

The majority of the work conducted on the site in CY 2017 was performed under Phase 1 Decommissioning and Facility Disposition by CH2M HILL BWXT West Valley, LLC (CHBWV). The following is a brief update of the site accomplishments under this work scope through the end of CY 2017.

Processing, Shipment and Off-site Disposal of Legacy Waste. Approximately 86% of the legacy low-level waste (LLW) that was stored at the site at the beginning of August 2011 (the beginning of the CHBWV contract)had been shipped off site for disposal by the end of CY 2017. Completion of legacy waste shipping is planned for September 2018.

Demolition and Removal of the Main Plant Process Building (MPPB) and Vitrification Facility (VF). Demolition of the VF began on September 11, 2017 and is expected to be completed in the summer of 2018. Deactivation and decontamination of the MPPB continued throughout CY 2017.

Maintenance and Disposition of the Balance of Site Facilities (BOSF). Managing and maintaining site infrastructure in 2017, included in the BOSF scope, involved completing the installation of the new potable water treatment facility, completing installation of a new communications hub, progress towards installation of a new electrical transformer substation, and planning for improvements in the natural gas system supply.

Safety Success. The radiological and hazardous work environment at the WVDP warrants strict adherence to safety procedures. As of December 31, 2017, CHBWV and its subcontractors achieved over 400 thousand consecutive work hours without a lost-time work accident or illness. CHWBV received the Voluntary Protection Program (VPP) Legacy of Stars Award in 2017 for their consistent robust safety program.

Waste Tank Farm (WTF) Tank and Vault Drying System (T&VDS). The T&VDS, designed to reduce the liquid volumes in the underground HLW tanks, thereby reducing the harmful effects of corrosion, continued to operate effectively during 2017.

Permeable Treatment Wall (PTW) Performance. The full-scale PTW, installed in November 2010, continues to achieve the remedial action objectives defined in the PTW Performance Monitoring Plan.

Nuclear Regulatory Commission (NRC)-Licensed Disposal Area (NDA). Water level data and the reduced water volume required to be pumped from the NDA interceptor trench continue to indicate the cap and slurry wall installed in 2008 are effectively reducing groundwater flow through the NDA.

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. CHBWV prepared for recertification of its EMS under new International Organization for Standardization (ISO) 14001:2015 during 2017. The changes to site operations required for recertification are anticipated to be minor.

Compliance

WVDP management continued to support environmental compliance with applicable state and federal statutes, executive orders, DOE orders, and standards in 2017.

There were:

- no New York State Pollutant Discharge Elimination System (SPDES) permit effluent limit noncompliance events in CY 2017,
- no exceedances of the U.S. Environmental Protection Agency's (EPA's) National Emission Standards for Hazardous Air Pollutants (NESHAP) dose standard in 2017, and
- no exceedances of the dose standard in DOE Order 458.1 "Radiation Protection of the Public and the Environment" in 2017.

Project assessment activities by state and federal regulators showed continued compliance with all applicable environmental and health regulations in 2017.

The WVDP received a Notice of Violation (NOV) from the New York State Department of Environmental Conservation (NYSDEC) for not submitting a water withdrawal permit application that was due in 2017 as a result of changes to New York State water withdrawal regulations. Upon receipt of the NOV, the WVDP submitted an application in January 2018. It is anticipated the required permit will be obtained in 2018 and no further action will be taken by NYSDEC.

The WVDP is repeating whole effluent toxicity (WET) testing on Lagoon 3 discharges in 2018 using modified procedures, after consultation with NYSDEC, as a result of exceeding a chronic toxicity action level twice in 2017. The need for corrective measures will be evaluated based on 2018 results.

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.

- **Airborne Radiological Releases**

  During 2017, radiological releases from the site were measured at four NESHAP permitted emission points, one intermittent emission point (not requiring a permit), and from 15 portable ventilation units (PVUs).

  Off-site ambient air monitoring continued at the 16 ambient air sampling stations that surround the WNYNSC. All measurements demonstrated that airborne releases were within permissible limits.

- **Waterborne Radiological Releases**

  Waterborne radiological releases from the site were measured at two natural streams and one controlled outfall. Off-site surface water was sampled at two downstream locations.

  All measurements demonstrated that waterborne releases to the environment were within permissible limits.

- **Estimated Dose**

  In CY 2017, no radioisotopic activity was measured above the method detection concentrations at the ambient air samplers from potential man-made sources, indicating there was no measurable dose off site from radioactivity that could have originated at the site.

  The estimated maximum potential dose from airborne emissions from the WVDP in 2017 was less than the detection limit of 0.46 millirem (mrem) (<0.0046 millisievert [mSv]) which is well below the 10-mrem (0.1 mSv) limit established by EPA.

  The estimated dose from waterborne sources in 2017 was 0.016 mrem (0.00016 mSv).

  The total estimated maximum potential dose from both airborne and waterborne sources in 2017 was <0.47 mrem (<0.0047 mSv), which is well below the annual 100-mrem limit established by DOE Order 458.1.

  In comparison, the average dose to a member of the public from natural background sources is 310 mrem per year.

- **Dose to Biota**

  The dose to biota evaluation for CY 2017 once again concluded that aquatic and terrestrial biota populations (both plants and animals) were not exposed to doses in excess of the DOE biota dose standard of 1 rad/day for aquatic animals and terrestrial plants, and 0.1 rad/day for riparian and terrestrial animals.

- **Nonradiological Releases**

  Nonradiological releases at the Project wastewater and storm water monitoring points were within compliance limits throughout 2017.

Quality Assurance (QA)

The data presented in this report is validated in accordance with strict QA procedures. The WVDP QA program includes evaluations of the performance of subcontract laboratories and routine assessments of the environmental and regulatory compliance programs. 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 195 performance evaluation analyses conducted for the WVDP, 99% were within acceptance limits.

Other Environmental Activities

Phase 1 Studies. During 2017, progress on the Phase 1 Studies included an evaluation of exhumation methods applied at other sites and their potential applicability to waste exhumation at West Valley, as well as infiltration and erodibility studies. Phase 1 Studies reports are available at: www.westvalleyphaseonestudies.org.

Vitrification Facility (VF) Demolition Study. EPA's approval of the VF Demolition Plan required that measured emissions during actual VF demolition be used to validate that the emissions predicted by the VF demolition model were not underestimated. Special demolition study samplers began collecting background data in late 2016 and continued to collect data throughout 2017 including during the beginning months of VF demolition.

Conclusion

In addition to demonstrating compliance with environmental regulations and directives, evaluation of data collected in 2017 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 (Figure 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. An aerial photo of the WVDP is presented in Figure INT-2.

General Environmental Setting

Climate. Although extremes of 99°F (37°C) and -20°F (-29°C) have been recorded in western New York (NY), the climate is moderate, with an average annual temperature of 47.4°F (8.6°C) (National Oceanic and Atmospheric Administration Climatic Data Center [Official Record] for 1895 to 2017, 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 2007 to 2016, the recent 10-year average annual precipitation at the WVDP was 40.6 inches/year. Total precipitation in 2017 was 44.5 inches, almost four inches above the 10-year average. Regional winds are generally from the west and south, averaging 7.8 miles per hour in 2017 (3.5 meters/second), based on site data.

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.

Project History. A historic timeline describing the significant events impacting the WVDP is provided in the "Useful Information" section of this report.

2017 Accomplishments

The work currently being performed at the WVDP is focused on Phase 1 decommissioning and removal actions as described in the Record of Decision (ROD) and Final Environmental Impact Statement (Final EIS or FEIS) for the WVDP and the 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).

WVDP Phase 1 Decommissioning and Facility Disposition activities began in August 2011 with the award of the Phase 1 Decommissioning and Facility Disposition Contract to CH2M HILL BWXT, West Valley, LLC (CHBWV).

The scope of the contract is divided into four primary activities. The following provides the status at the end of Calendar Year (CY) 2017 for each of these activities:

Complete relocation of the canisters of vitrified High-Level Waste (HLW) at the WVDP:

Physical relocation of the canisters of vitrified HLW was completed in November 2016, with all associated activities completed in February 2017. The successful and safe loading and relocation of the canisters from inside the Main Plant Process Building (MPPB) to the on-site HLW Cask Storage Pad was a major accomplishment paving the way for MPPB demolition.

Canisters stored in Vertical Storage Casks (VSCs) relocated from within the MPPB

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):

At the end of 2017, approximately 86% of the legacy low-level waste (LLW) that was stored at the site at the beginning of August 2011 had been shipped off site for disposal. It was anticipated that 30 more shipments were required to complete this task. Legacy waste processing and disposal is planned to be completed by September 2018.

Shipment of legacy LLW off site

The legacy waste accomplishments in CY 2017 included:

- moving the last of the 241 drums of non-HLW from the former MPPB Chemical Process Cell (CPC) into alternate storage in September 2017 so that deactivation and decontamination of this room could begin in preparation for MPPB demolition;
- completion of over 45 legacy waste shipments to off-site waste disposal facilities;
- processing and disposal of 27 empty concrete SUREPAK containers that were previously used to store LLW;
- re-startup of the Waste Processing Area (WPA) inside the Lag Storage Area (LSA) #4 storage facility to be used for processing legacy transuranic (TRU) waste containers; and
- continued waste removal from the Chemical Process Cell - Waste Storage Area (CPC-WSA) (only three large vessels remained as of December 31, 2017) in preparation for decommissioning this storage building.

Demolition and removal of the Main Plant Process Building (MPPB) and the Vitrification Facility (VF):

Preparations for demolition of the VF including characterization of high-hazard areas, isolation of utility lines, and removal of tanks/vessels, piping, ceiling grids, lighting, equipment, and asbestos were completed in the summer of 2017 enabling demolition of the VF to begin in September 2017. Phase 1 of the VF demolition, which included removal of the outer aisles, was completed in November 2017. Demolition of the vitrification (VIT) cell began in December 2017.

VF demolition in progress

Over 100 intermodals loaded with VF demolition debris have been shipped to an off-site disposal facility. The site celebrated the start of VF demolition and recertification as a Department of Energy (DOE)-Voluntary Protection Plan (VPP) Star site in September 2017 with an award presentation by Stacy Charboneau, Associate Principal Deputy Assistant Secretary of Field Operations of the DOE Environmental Management Office.

Preparations for demolition of the MPPB continued throughout CY 2017 with the following hazard reduction activities:

- continued removal of piping, miscellaneous equipment, and debris completing deactivation of several high contamination areas including the extraction cells (XC-1, XC-2 and XC-3), the Liquid Waste Cell (LWC), the Uranium Process Cell, Acid Recovery Pump Room, Off-Gas Cell Blower Room, and Head End Ventilation (HEV);
- continued asbestos abatement, particularly in the Utility Room (UR) and third floor of the MPPB; and
- removal of highly contaminated filters from the Ventilation Exhaust Cell (VEC).

Many of these activities were performed remotely or semi-remotely using long-reach tools deployed through ceiling hatches. The MPPB was considered 79% deactivated by the end of CY 2017.

Disposition of the Balance of Site Facilities (BOSF):

The BOSF work scope involves removing facilities that are no longer needed. In 2017, the emergency vehicle shelter pad was added to the BOSF completed list. Nineteen of 47 BOSF structures slated for removal were demolished and the areas restored as of the end of CY 2017. Included in this list are the 01-14 building, the environmental laboratory, the vehicle maintenance shop, and other structures.

Balance of site activities also include continued safe operation of the site through:

- managing and maintaining site infrastructure;
- maintaining the lagoon system for processing wastewater managed through the site;
- conducting environmental monitoring, and maintaining compliance with WVDP regulatory and permit requirements; and
- maintaining the waste tank farm (WTF), the U.S. Nuclear Regulatory Commission (NRC) licensed-disposal area (NDA), and the north plateau Permeable Treatment Wall (PTW).

The site infrastructure was considerably enhanced during 2017 by completing installation of a new potable water treatment facility, installation of a new communications hub, design and progress towards installation of a new electrical transformer substation on site, and planning for improvements in the natural gas system supply. Upgrades to the water, electrical, and gas supply systems will allow for demolition of the UR and UR extension (URE). These activities are also required to maintain basic functions on the site until completion of all of the Phase 1 and Phase 2 site decommissioning work.

Supplemental EIS (SEIS). The DOE began work on the Supplemental EIS (SEIS) in CY 2017 after the contract was awarded in April 2017. The SEIS will use the 2010 FEIS as a starting point and will be updated for completed Phase 1 work. An explanation of Phase 1 and Phase 2 decommissioning work scope and a progress update for each of the SEIS study areas is reported in the "Environmental Compliance Summary" (ECS) in this report.

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

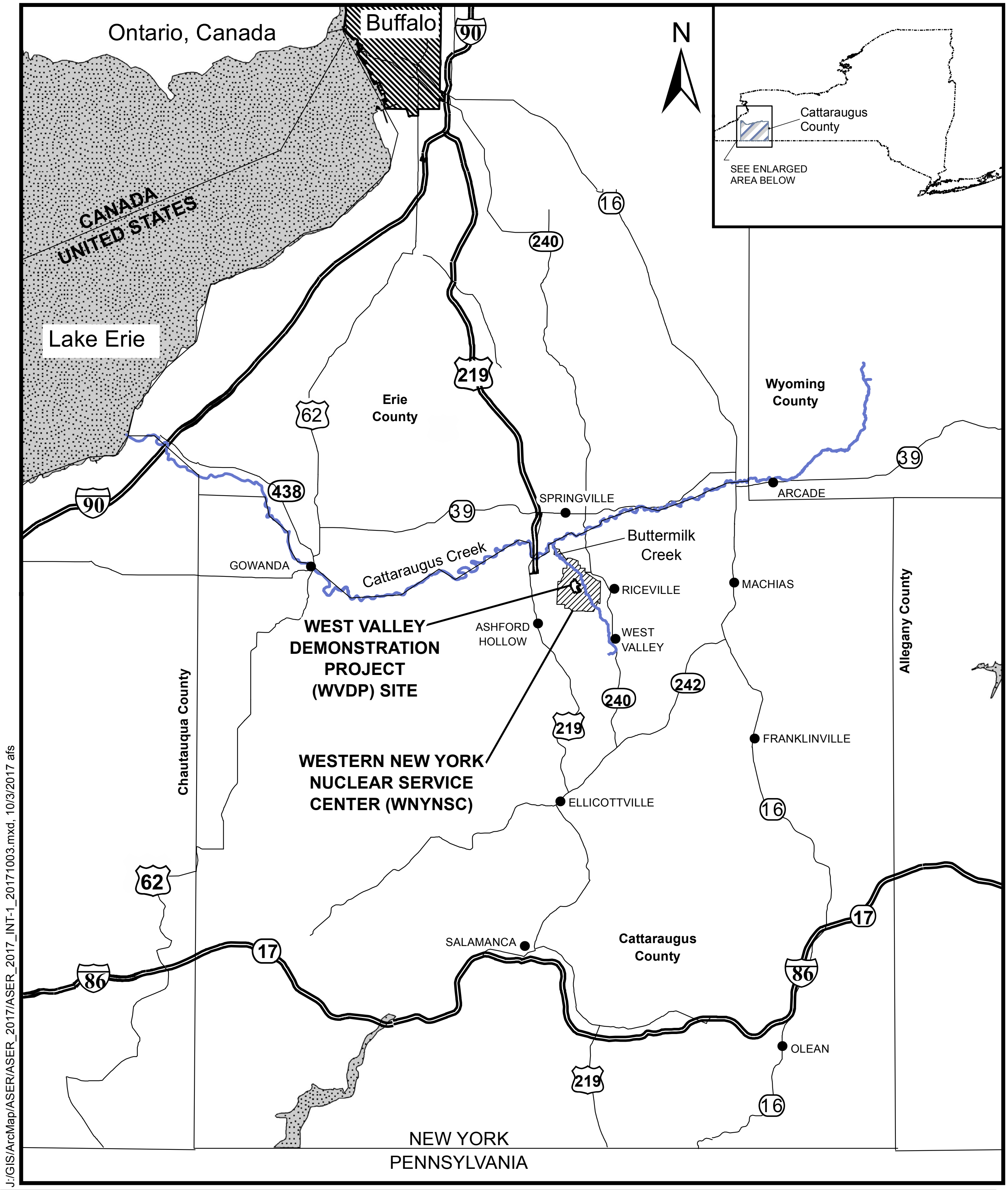

FIGURE INT-2
Aerial Photo of the West Valley Demonstration Project

Overlay showing major site features at the end of CY 2017.
(Underlying aerial survey dated 2015).

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ENVIRONMENTAL COMPLIANCE SUMMARY

Activities at the WVDP are regulated by various federal, state, public, worker, and environmental protection laws. These laws are administered primarily by the Environmental Protection Agency (EPA), DOE, NRC, the United States (U.S.) Fish and Wildlife Service, the U.S. Army Corps of Engineers (USACE), New York State Department of Environmental Conservation (NYSDEC), New York State Department of Health (NYSDOH), and New York State Department of Labor (NYSDOL).

2017 Highlights

Radiation Protection of the Public and the Environment (DOE Order 458.1): The dose estimated from 2017 air emissions and water discharges containing radionuclides was well below the DOE public dose limit of 100 millirem (mrem) per year from all pathways.

Air Emissions: Decontamination and deactivation of facilities continued throughout 2017. Open air demolition of the VF began in September 2017. The off-site ambient air sampling data indicated there were no exceedances in 2017 of the 10 mrem per year EPA compliance limit for air emissions.

Water Releases: There were no exceedances of the State Pollutant Discharge Elimination System (SPDES) permit effluent limits in 2017. The WVDP is continuing whole effluent toxicity (WET) testing in 2018 as a result of triggering a SPDES permit action level twice in 2017.

Waste Management: All waste management activities in 2017 were performed in a compliant and safe manner.

National Environmental Policy Act (NEPA): Work began on the SEIS for the WVDP and WNYNSC in April 2017.

Water Withdrawal Permit: Although the source and volume of water routinely used at the WVDP did not change in 2017, a Notice of Violation (NOV) was received from NYSDEC due to a legislative change requiring existing facilities previously required only to register, to submit permit applications. The WVDP did not submit a timely application. In response to the NOV, a permit application was submitted to NYSDEC in January 2018.

Compliance Program

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 approval 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.

A summary of the WVDP's current year compliance status with applicable environmental statutes, DOE directives, executive orders (EOs), and state laws and regulations applicable to the Project activities, and a list of the current WVDP environmental permits are included at the end of this chapter.

Air Emissions

The Clean Air Act (CAA), administered through EPA, requires compliance with the National Emission Standards for Hazardous Air Pollutants (NESHAP) under Title 40 Code of Federal Regulations (CFR) Part 61, Subpart H.

Sources of radioactive discharges to the atmosphere are regulated directly by the EPA. In NYS, the EPA has delegated to NYSDEC the authority to regulate nonradiological emissions to the atmosphere.

Radiological Releases. The NESHAP standard, for which compliance is to be demonstrated at the WVDP, is that no member of the public may receive an Effective Dose Equivalent (EDE) greater than 10 mrem (0.1 mSv) per year resulting from radionuclide emissions to the atmosphere.

NESHAP regulations allow for the 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 and evaluating dose at the critical receptor. 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 EPA 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.

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 ambient air monitoring network data has been used to demonstrate NESHAP compliance since CY 2014.

Routine ambient air network sampling results are discussed in Chapter 2, "Environmental Monitoring," and are tabulated in Appendix C. These data are used in estimating dose for NESHAP Compliance as described in Chapter 3, "Dose Assessment".

Nonradiological Releases. The WVDP currently has an Air Facility Registration Certificate for nonradiological emission sources. All potential nonradiological point sources of air emissions were evaluated against permitting requirements in CY 2017 and determined to be exempt or below permitting release limits.

Asbestos releases are regulated separately under NESHAP and NYS Department of Labor (NYSDOL) regulations. The asbestos NESHAP regulations specify work practices for asbestos to be followed during demolition and renovations of structures/buildings. The site demolition subcontractor, American DnD, adheres to these safe work practices. Notifications to NYSDOL and EPA are required by the WVDP before any demolition that could contain a certain threshold amount of asbestos or asbestos-containing material (ACM). (https://www.epa.gov/asbestos/asbestos-laws-and-regulations)

NESHAP Compliance Update for 2017

All airborne releases of radiological constituents from the WVDP in 2017 were within permissible limits. The estimated maximum potential dose to any off-site resident in 2017 was below the NESHAP compliance limit based on all nondetect results at the ambient air samplers.

There were no radiological or nonradiological air quality noncompliance episodes in 2017 as summarized in Table ECS-1 below.

TABLE ECS-1
WVDP 2017 Air Quality Noncompliance Episodes

Air Release Type	*Regulated by*	*Date(s) Exceeded*	*Description/ Solutions*
Radiological	EPA	None	None
Nonradiological	NYSDEC, NYSDOL and EPA	None	None

Study of Air Emissions during Demolition. In preparation for WVDP demolition activities, DOE and its subcontractors developed an alternative radiological source term calculation methodology to estimate potential emissions from planned demolition activities as allowed for by 40 CFR Part 61.96(b). The WVDP received conditional approval from EPA in May 2016 for use of this methodology to support VF demolition with a condition that a study be performed during VF demolition to demonstrate that the alternate source term calculation methodology does not underestimate airborne emissions. Two air samplers located within 200 feet of the VF collect data for this study. Sampling at these locations began in October 2016, almost a year before VF demolition began on September 11, 2017 in order to generate baseline data. This study is ongoing.

Surface Water Releases and the WVDP State Pollutant Discharge Elimination System (SPDES) Permit

The Clean Water Act (CWA), administered in NYS by NYSDEC through EPA delegated authority, requires that all process water discharges from the site be in compliance with the WVDP SPDES permit. Storm water is also managed under this permit. The current site permit was issued in 2010 and regulates nonradiological liquid discharges through the site's monitored wastewater treatment system outfall and storm water outfalls. Monthly SPDES Discharge Monitoring Reports (DMRs) are available for public review at:

http://www.chbwv.com/Public_Reading_Room.htm.

Releases of radiological constituents in water effluents 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 ("DOE Standard, Derived Concentration Technical Standard"). DOE Order 458.1, requires environmental monitoring of the air, water, groundwater and biota in order to ensure that the maximum potential public radiation dose from all pathways remains under 100 mrem/year. DOE-STD-1196-2011 established Derived Concentration Standards (DCSs) to be used in the design and conduct of radiological environmental programs at DOE facilities. Compliance for process water and non-process waterborne releases to the environment is based on dose and is discussed in Chapter 3, "Dose Assessment."

Surface Water, SPDES, and Storm Water Update for 2017

All waterborne releases of radiological constituents from the WVDP in 2017 were within permissible limits. All SPDES discharges were within applicable SPDES permit limits as shown by the Table ECS-2 below. However, action levels were triggered for the whole effluent toxicity (WET) tests which are required every five years. The reason why the action levels were triggered was not known. Therefore, NYSDEC and DOE agreed to modify the testing protocols and continue to perform toxicity tests in 2018. (See Chapter 2, pages 2-9 and 2-10 for additional details.)

Storm water was monitored biannually as required by the SPDES permit. No SPDES exceedances of storm water compliance limits occurred in 2017.

The total estimated dose from the waterborne release pathway was well below the DOE 100 mrem/year limit.

TABLE ECS-2

WVDP SPDES[a] Permit Limit Exceedances in 2017

Permit Type	*Outfall(s)*	*Parameter*	*No. of Permit Exceptions*	*No. of Samples Taken*	*No. of Compliant Samples*	*Percent Compliant Samples*
SPDES	All	All	0	753	753	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.) Toxicity testing was performed in 2017 and will be performed again in 2018.

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.

Water Withdrawal

NYS, as one of the participating states in the Great Lakes - St. Lawrence River Basin Water Resources Compact, regulates water withdrawals equaling or exceeding a threshold volume. NYSDEC manages this water withdrawal and reporting program under the NYS Environmental Conservation Law (NYS ECL) Article 15. The WVDP has reported potable and industrial water withdrawals to the NYSDEC annually since 2010 under this program, and in August 2011, the WVDP submitted a Great Lakes water withdrawal registration to NYSDEC. As a result of legislative changes that became effective in 2017, the WVDP was required to obtain a water withdrawal permit to continue the activities that were previously conducted under the registration.

The WVDP also maintains a drinking water (potable water) permit with Cattaraugus County. Potable and industrial water has been supplied by groundwater wells located on the site since 2014. Prior to this, water was supplied by two reservoirs immediately south of the site. The reservoirs currently provide SPDES discharge flow augmentation water for the WVDP and backup fire-suppression water.

Water Withdrawal Update for 2017

The 2017 Water Withdrawal Report for the WVDP was submitted to NYSDEC in March 2018. There were no major changes in the volume of water used. However, the WVDP failed to submit a timely water withdrawal permit application and received an Notice of Violation (NOV) from NYSDEC in November 2017. The required permit application was submitted in January 2018. It is anticipated the permit will be obtained and no further action will be taken by NYSDEC.

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.

The WVDP has operated according to the 6 NYCRR Part 373-3, Part A (Interim Status) RCRA Hazardous Waste Generator Permit Application since 1990 and the RCRA §3008(h) Administrative Order on Consent (Consent Order) since 1992. Although NYSDEC called for a Final Status Permit application in 2003, they later decided to suspend further action relative to this permit. The WVDP also operates under the RCRA §3008(h) Administrative Order on Consent (Consent Order). Section §3008(h) of RCRA authorizes EPA to issue an order requiring corrective action to protect human health and the environment from a release of hazardous waste or hazardous constituents to the environment from a Solid Waste Management Unit (SWMU).

Routine Reporting Required under RCRA

Quarterly Status Reports, RCRA §3008(h) Consent Order. Per the Consent Order, DOE transmits two quarterly reports to EPA and NYSDEC, (1) a progress report summarizing all Consent Order activities at the WVDP for the previous quarter, and (2) a groundwater exception report, summarizing RCRA groundwater monitoring results that exceed established trigger levels. The RCRA §3008(h) progress report includes recent accomplishments, contacts with local community interest groups and regulatory agencies, and an inventory of mixed waste generated from decontamination activities during the reporting period. The groundwater exception report also includes an update on the performance of the NDA interceptor trench, cap, and slurry wall.

Hazardous Waste Management. 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. A Hazardous Waste Reduction Plan is also submitted each year to document efforts to reduce the types and amounts of hazardous wastes generated at the WVDP.

Mixed Waste Management. Mixed wastes that cannot be treated or disposed of within one year are managed according to the Site Treatment Plan (STP), prepared by the WVDP under requirements of the Federal Facilities Compliance Act (FFCA) (an amendment to RCRA), in accordance with a Consent Order. The annually updated plan describes the development of treatment capabilities and technologies for treating mixed waste and updates the mixed waste inventory.

Nonhazardous, Regulated Waste Management. Nonradioactive, nonhazardous material is also shipped off site to solid waste management facilities. Certain components of this waste (lead-acid batteries and spent lamps [i.e., universal wastes]) are reclaimed or recycled at off-site, authorized reclamation and recycling facilities. Sanitary wastewaters are shipped to the Buffalo Sewer Authority, to the Gowanda Sewage Treatment Plant, or to the Arcade Sewage Treatment Plant for treatment and disposal. RCRA operating records are maintained for this waste management, but no routine reporting is required.

RCRA Update for 2017

Routine RCRA reporting and RCRA compliant management of hazardous waste continued throughout 2017. The WVDP maintained open communications with the NYSDEC and the EPA through monthly RCRA teleconferences. The site is continuing 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.

Some of the highlights of the RCRA work performed in 2017 are listed below:

- Updates were made to several RCRA closure plans for treatment and storage units located at the WVDP to be consistent with current plans for operation and/or closure of these units.
- Per the Consent Order requirements, quarterly progress reports were submitted to DOE and NYSERDA, documenting progress on decontamination activities for SWMUs and waste generation activities.
- Groundwater monitoring, as recommended in the RCRA Facility Investigation (RFI) reports and approved by EPA and NYSDEC, continued during 2017 per the Consent Order requirements. This included submitting the quarterly RCRA groundwater exception reports to EPA and NYSDEC. The groundwater program and monitoring results at the WVDP are discussed in Chapter 4, "Groundwater Protection Program."

NRC Licensed Disposal Area (NDA) and New York State - Licensed Disposal Area (SDA)

- The Interim Measures (IMs) implemented at the NDA to help contain the waste buried there continued to operate as designed, with no tributyl phosphate (TBP) or organic constituents detected in the groundwater collected in the NDA interceptor trench in 2017 and reduced water levels. The first NDA IM included installation of a Liquid Pretreatment System (LPS) in 1992 to remove organic contaminants should they be detected. Liquid organic material has not been observed to have migrated to the interceptor trench over the past 25 years and is not anticipated. Planning is in progress for removal of the unused system. The volume of water pumped from the NDA interceptor trench decreased to 69,603 gal (263,476 liter [L]) in CY 2017, compared with pre-IM volumes of over seven hundred thousand gallons per year.
- In August 2017, the entire NDA cap system was inspected, including storm water basins, walkways, ballast tubes, field seams, pipe penetrations, and the anchor trench. Overall cap condition was good, with no general deterioration of the geomembrane noted.
- The Annual Hazardous Waste Report for 2017 was submitted to NYSDEC in February 2018. The reported quantities generated, treated and shipped are shown on Table ECS-3. (This table also includes a summary of non-RCRA regulated waste as required to be reported in the ASER in compliance with DOE Order 435.1, "Radioactive Waste Management.")

- The Hazardous Waste Reduction Plan Annual Status Report for CY 2017 was submitted to NYSDEC in June 2018.

- Disposal off site of the liquid Mixed LLW (MLLW) drained from two tanks in the MPPB was completed in 2017, successfully meeting one of the two milestone objectives of the fiscal year (FY) 2017 WVDP STP. Progress was also made on the second STP milestone which required development of a plan for disposition of the high activity waste in tank 8D-4.

- As of September 2017, when the STP was last updated, there were 85 cubic meters (m^3) of mixed waste stored at the WVDP for which treatment and/or disposal options are not currently available.

- The RCRA report "Sealed Rooms Paper Characterization" that presents historical hazardous waste information from sealed rooms in the MPPB was resubmitted to NYSDEC with revisions describing identification and removal of hazardous liquids in the HEV cell.

- The Tank and Vault Drying System (T&VDS) installed in the WTF in 2010 to maintain the tanks and control corrosion until the final Phase 2 decision is made, continued to operate effectively during 2017. The system maintained dry conditions in tanks 8D-1, 8D-2 and 8D-3, and reduced the residual liquid in tank 8D-4 by 72 gal (273 L). At the end of CY 2017, 4,470 gal (16,921 L) remained in tank 8D-4. The system also continued to maintain the dry condition of the vaults to below liquid level indicators. The T&VDS is operated and monitored as a RCRA hazardous waste treatment system.

Vitrification Facility (VF) and Main Plant Process Building (MPPB)

TABLE ECS-3
Summary of Waste Generated at the WVDP During 2017

Waste Description/ Facility	***Type of Project Generating Waste***	***Quantity in 2017***	***Discussion***
LLW	Includes all sources of LLW	188,885 cubic feet (ft^3) (5,349 cubic meters [m^3])	Large increase in volume of LLW generated is due to LLW from VF demolition.
TRU waste	TRU waste processing	1,104 cubic Feet (ft^3) (31 cubic meters [m^3])	TRU waste from decontamination and deactivation activities.
Hazardous and Mixed LLW	Primary source of generation was decomissioning activites and legacy waste shipments	Generated: 27,533 lbs (13.77 tons) Shipped: 129,621 lbs (64.81 tons)	Total waste shipped during 2017 includes over 50 tons of prior year generated waste.
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 7,352,480 gallons (27,832,000 L)	During 2017, four 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 have been terminated.	0 gallons	Discharges through outfall 007 were discontinued in November 2014.
Sanitary wastewaters	All sanitary wastewaters are containerized and shipped off site.	Approximately 1,289,367 gallons (4,880,785 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 2017.
NDA interceptor trench	Interceptor trench (WNNDATR) and groundwater pre-treatment	Approximately 69,603 gallons (263,476 L)	Groundwater was pumped and transferred to the LLW2. No organics or TBP were encountered in 2017. No pre-treatment was necessary.
Asbestos	Asbestos management and abatement	8,358 square feet (ft^2) of friable tank/duct/wall insulation 129 linear feet (39 meters) of friable pipe insulation 400 square feet (ft^2) of non-friable floor tile/transite panels	Friable asbestos continued to be removed from the MPPB and Utility Room as a pre-demolition activity during 2017.
Universal waste	Spent bulbs/spent batteries	Bulbs - 382 lbs (0.19 ton) Batteries - 2,435 lbs (1.22 ton)	Waste disposed of as universal waste.

RCRA Permit and §3008(h) Consent Order History at the WVDP

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 revision to the RCRA Part A Permit Application was submitted to NYSDEC on April 27, 2011 and was 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 is performed, and data is evaluated and presented to NYSDEC in a closure certification report.

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, which was transmitted to NYSDEC in December 2004. On April 16, 2009, NYSDEC requested the submittal of a revised Part B Permit Application for the WVDP, which was submitted to NYSDEC on September 30, 2010. On March 22, 2012, NYSDEC notified NYSERDA and DOE that they had reassessed the WVDP RCRA regulatory program and that the processing of the September 30, 2010 permit application, including revisions, would be deferred.

RCRA §3008(h) Consent Order. Consent Order activities performed at the WVDP to date include the following:

- The RCRA Facility Investigation (RFI) evaluated potential releases of RCRA-regulated hazardous constituents from SWMUs. Final RFI reports were submitted in 1997, with no corrective actions required with the exception of groundwater monitoring as outlined in the RFI and approved by EPA and NYSDEC.

- The Current Conditions Report, originally submitted in 2004 and updated in 2010, summarized the historic activities at each SWMU and provided environmental monitoring data and an update of activities performed since the RFI reports were submitted.

- The Corrective Measures Studies (CMSs) for six SWMUs (the NDA Burial Area, NDA Interceptor Trench, Demineralizer Sludge Ponds, Lagoon 1, the Construction and Demolition Debris Landfill (CDDL) and the Low-Level Waste Treatment Facility (LLWTF), provided corrective measures evaluations. The CMSs were requested in 2004. They were submitted to NYSDEC and EPA in 2010 after revisions to be consistent with the EIS and ROD.

- The 1990 and 2008 IMs for the NDA were implemented to intercept and collect groundwater within the NDA contaminated with a mixture of n-dodecane and TBP and to minimize water infiltration into the NDA and groundwater flow through the NDA to minimize the potential release of impacted groundwater until the final disposition of the NDA is determined.

National Environmental Policy Act (NEPA) Overview

NEPA requires DOE to consider the overall environmental effects of its proposed actions. Evaluations are performed to assess 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.

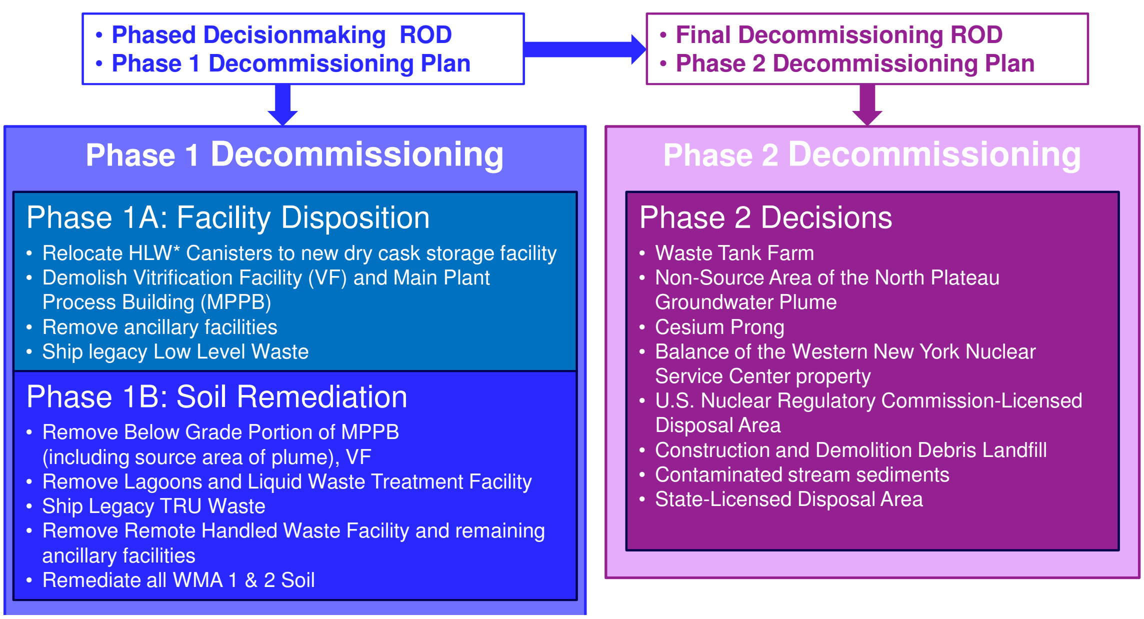
The categories of documentation include categorical exclusion (CX), environmental assessment (EA), and environmental impact statement (EIS). Categorical Exclusions (CXs) describe actions that will not have a significant effect on the environment. EAs are used to evaluate the extent to which a proposed 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 documents is included in the Useful Information section of this report in Table UI-6. WVDP CXs, EAs, and EISs can be found on the DOE-WVDP website under the documents index (www.wv.doe.gov/index.html). The 2010 FEIS provides the blueprint for all the activities currently underway at the WVDP.

Final Decommissioning Environmental Impact Statement (FEIS) Issued. In January 2010, DOE issued the "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. 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.

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



*The WVDP Act requires the Department of Energy Secretary, as soon as feasible, to transport in accordance with applicable provisions of the law, to an appropriate federal repository for permanent disposal.

Record of Decision. On April 14, 2010, DOE issued the ROD for the FEIS, selecting the phased decisionmaking alternative. During Phase 1 Site Decommissioning, a number of highly contaminated facilities will be removed under a facilities disposition contract awarded in 2011. Decommissioning the MPPB and the VF is part of the Phase 1 EIS work. DOE will also decommission the RHWF, the wastewater treatment lagoons, and a number of other facilities during Phase 1. (See Figure ECS-1.) No decommissioning actions will be taken on the WTF or the NDA, during Phase 1 and the canisters of vitrified HLW will remain safely stored on site. NYSERDA will manage the SDA. Phase 1 also includes soil characterization work and focused studies (Phase 1 studies) that will facilitate interagency consensus on decommissioning decisions for the remaining facilities. The original estimated cost for all of the Phase 1 work was approximately $1.2 billion (FEIS, 2010). 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 EIS ROD indicates that the Phase 2 decision, which involves determining the decommissioning approach for the remaining facilities, will be made within 10 years of issuance of the EIS ROD. Phase 2 will address the 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 in a Supplemental EIS (SEIS) 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. The complete FEIS and the ROD can be viewed on-line at the DOE-WVDP website at www.wv.doe.gov.

Supplemental EIS (SEIS). In April 2017, DOE awarded a contract to SC&A, Inc. that includes preparation of the SEIS to support the Phase 2 decisions for the WVDP and WNYNSC including the underground storage tanks, the NDA and SDA disposal areas, and the non-source area of the strontium-90 groundwater plume. Decommissioning Plan documents that are consistent with the preferred alternative in the SEIS ROD and NYSERDA Findings Statement will also be prepared under this contract.

Phase 1 Activities

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 [FR] 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 (TER) 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 Studies. Phase 1 studies are additional scientific studies conducted to facilitate interagency consensus necessary to complete decommissioning of the remaining facilities following completion of Phase 1.

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.

2017 Update in Support of SEIS Preparation

The 2010 EIS provides the blueprint for all activities currently underway at the WVDP. No new major NEPA documents were initiated in 2017. The following is a summary of work activities completed in 2017 consistent with the 2010 FEIS/ROD and Phase 1 DP.

WVDP Phase 1 Decommissioning Work. The current work performed under Phase 1 of the Decommissioning EIS includes the demolition of the VF, which began in September 2017, and continued deactivation of the MPPB in preparation for demolition.

The Phase 1 DP, written in 2010 required preparation of work plans for the decommissioning and demolition of the VF and the MPPB. These plans are used to define the requirements and sequencing of the demolition work. Work instruction packages (WIPs) that are based on these decommissioning plans provide the full details needed to complete the demolition of these facilities.

Demolition work on the VF is being performed in compliance with the VF decommissioning and demolition plan and associated WIPs. The NRC reviewed and commented on the VF decommissioning and demolition plan in September 2016. After receiving responses and a revised plan from the WVDP in June 2017, NRC indicated that they had no further comments on the plan.

Phase 1 Studies. One of three areas of study conducted by the Exhumation Working Group (EXWG) involved the identification and evaluation of exhumation methods applied at other sites and their potential applicability to waste exhumation at West Valley. In 2017, the EXWG issued a revised report to consolidate the findings of this study and the overall EXWG's Phase 1 studies into an evaluation of exhumation-related methods and technologies as they apply to specific categories of exhumation scenarios for the SDA, NDA, and the WTF.

Infiltration and erodibility studies were performed in trenches dug by the Erosion Work Group (EWG) in support of "Study 1 - Terrain Analysis, Age Dating, and Paleoclimate." Pebble counts were also conducted in several streams near the facility to provide improved environmental input parameters for use in predictive erosion models for the site. In 2017, the EWG completed a report which summarized these field activities and tabulated and interpreted all data collected. For more information on the Phase 1 Studies see: https://www.westvalleyphaseonestudies.org/.

Probabilistic Performance Assessment (PPA). DOE and NYSERDA decided to perform a long-term probabilistic performance assessment (PPA) for the West Valley Site. The PPA model is currently being developed in the GoldSim probabilistic modeling platform and will be supported by several process-level models, including a surface water/sediment transport model, a three-dimensional groundwater flow model, and an erosion model. The PPA will be used to evaluate the performance of a range of alternatives in the SEIS. As such, the new information developed by the PPA and component models will inform the Phase 2 decisions.

Emergency Planning and Community Right-to-Know Act (EPCRA)

The Emergency Planning and Community Right-to-Know Act (EPCRA), also known as Superfund Amendments Reauthorization Act (SARA) Title III, is a federal law passed in 1986 to inform the public of potential environmental and safety hazards posed by the storage and handling of toxic chemicals at facilities in their communities.

Required reporting is based on the types and quantities of potentially hazardous chemicals stored on the site. Currently the WVDP is required to maintain Safety Data Sheets (SDSs) that describe the properties and health effects of all chemicals used on site and to submit an annual inventory of these chemicals to state and local officials and local fire departments.

EPCRA Update for 2017

As shown by Table ECS-4, in 2017 the WVDP was only required to report under EPCRA section 312, for hazardous chemical inventory. The 2017 inventory reported to the EPA is provided in Table ECS-5.

TABLE ECS-4
Status of EPCRA (SARA Title III) Reporting at the WVDP for 2017

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 (MSDS) or Safety data Sheet (SDS)	No
EPCRA 312	Hazardous Chemical Inventory	Yes
EPCRA 313	Toxic Chemical Release Inventory Reporting	No

TABLE ECS-5
Reportable Chemicals Above EPCRA 312 (SARA Title III) Threshold Planning Quantities Stored at the WVDP in 2017

Chemicals Stored at the WVDP Above the Threshold Planning Quantities
Diesel fuel/No. 2 Fuel Oil
Unleaded Gasoline
Lead-acid batteries
Sulfuric acid
Potassium Acetate (Alpine Ice-Melt)

Migratory Bird Treaty Act

The Migratory Bird Treaty Act provides for the protection of migratory birds, their nests and their eggs. The DOE maintains a Bird Depredation permit and a registration for the WVDP. The permit allows bird nests to be removed from areas where they would be impacted by site operations and the registration allows removal or destruction of Canada geese nests and/or goose eggs.

Table ECS-6 summarizes the migratory bird activities conducted during the current year.

Canada Goose

TABLE ECS-6
WVDP Migratory Bird Nest Depredation Activities in 2017

Permit/License Type	***Parameter***	***Permit Limit***	***2017 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	Canada Goose Egg Nests Destroyed	NA	3 nests

NA - Not applicable

Other Compliance Related Updates

Permeable Treatment Wall (PTW) Performance. The PTW was installed in November 2010 to mitigate and maintain the non-source area of the plume until the final Phase 2 decisions could be made. By the end of 2017, the full-scale PTW had been monitored for seven years. Performance monitoring data collected to date, including the comprehensive data collected in 2016 for the five-year monitoring event, continue to indicate groundwater treatment by ion exchange is occurring, and 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. (Additional discussion of the PTW is provided in Chapter 4, "Groundwater Protection Program.")

PTW Monitoring Wells

Project Assessment

Project assessments are conducted through the Integrated Assessment Program (IAP) at the WVDP. This program effectively complies with applicable DOE directives, regulations, and standards, and 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.

Project Assessment Activities in 2017

Overall assessment results reflected continuing, well-managed environmental programs at the WVDP. Project assessment activities related to regulatory compliance conducted in 2017 included:

- A readiness assessment for VF demolition,
- Routine RCRA facility assessments and Project oversight by CHBWV, NYSDEC and EPA,
- A Consolidated Multi-Media inspection by EPA, with a focus on RCRA hazardous waste operations, and underground storage tanks (USTs),
- A DOE surveillance and CHBWV self-assessments of waste management operations,
- Routine inspections of the CDDL and PTW, and
- Safety inspections of the dams.

VF Demolition Readiness and the EMS. Planning for the demolition of the VF involved completion of a "Demolition Readiness Checklist" and a "Self-Assessment Checklist" that, among other items, evaluated the relevant environmental aspects that could be encountered during the demolition and indicated that associated requirements were completed prior to demolition.

RCRA Facility Assessments. During February 2017, the DOE conducted a surveillance on the waste management of the mercury abatement system. In March 2017, CHBWV conducted a self-assessment of mixed waste storage and in September 2017 EPA performed an unscheduled consolidated multi-media inspection which included RCRA. CHBWV also performs annual inspections of all RCRA units. NYSDEC visited the site to oversee routine groundwater monitoring of RCRA wells in 2017. There were no findings or concerns from these evaluations of the RCRA program in 2017.

Construction and Demolition Debris Landfill (CDDL) and PTW Inspections. The overall condition of the CDDL grounds were inspected in 2017, with no concerns noted. The CDDL has been closed since 1986 under a NYSDEC-approved closure plan for a nonradioactive solid waste disposal facility. 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. Additional discussion of the PTW is provided in Chapter 4 of this report.

Safety Inspections of the WNYNSC Dams. In response to a NYSDEC request, the DOE-WVDP submitted an updated proposed long-term plan for the reservoirs, dams, and spillway in September 2017. This plan involves a phased withdrawal from the reservoirs once the reservoirs are no longer needed. The two dams located on the WNYNSC property are maintained to provide SPDES discharge flow augmentation water for the WVDP and backup fire-suppression water.

The WVDP rail spur and an access roadway are located parallel to the lakes and run along the crest of both dams. Repairs of the spillway and dams have occurred several times since the establishment of the WVDP, with the most recent major repair being completed in 2014. The DOE continued to perform routine maintenance of the reservoir system throughout 2017, and will continue to maintain the reservoir system in a safe configuration while the final disposition is being determined.

TABLE ECS-7
Compliance Status Summary for the WVDP in 2017

Citation	*Environmental Statute, DOE Directive, EO, Agreement*	*WVDP Compliance Status*
42 United States Code (USC) §2011 et seq.	The Atomic Energy Act (**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 below.
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.	**2017 Update:** DOE work in 2017 focused 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. The DOE ROD for the FEIS was issued in April 2010 for the WVDP. **2017 Update:** In accordance with the second supplemental agreement, Phase 1 studies continued in 2017.
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.	**2017 Update:** NRC conducted monitoring visits at the WVDP in August and October 2017. The NRC reviewed the WVDP VF decommissioning and demolition plan in August 2017.
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)*	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. **2017 Update:** The 2017 ASER will be submitted to DOE by October 1, 2018.

TABLE ECS-7 *(continued)*
Compliance Status Summary for the WVDP in 2017

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** 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. **2017 Update:** Estimated doses from combined airborne and waterborne releases to the MEOSI were <0.47% of the DOE Order 458.1 100-millirem (mrem) standard in 2017.
DOE Order 435.1	DOE Order 435.1, **Radioactive Waste Management** 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. **2017 Update:** Waste management was conducted in accordance with the following plans in 2017: HLW - "WVDP Waste Acceptance Manual;" TRU - "TRU Waste Management Program Plan;" LLW -"LLW Management Program Plan;" and the radioactive component of mixed LLW - "Site Treatment Plan (STP) FY 2017 Update."

TABLE ECS-7 *(continued)*
Compliance Status Summary for the WVDP in 2017

Citation	***Environmental Statute, DOE Directive, EO, Agreement***	***WVDP Compliance Status***
DOE Order 436.1, and EO 13693	DOE Order 436.1, **Departmental Sustainability** provides 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.	**2017 Update:** In December 2017, DOE-WVDP submitted the "WVDP FY 2018 Site Sustainability Plan" to DOE-HQ, which outlined performance status and planned goals to support DOE's sustainability mission. The WVDP EMS continued to support DOE sustainability objectives. The EMS was audited in May 2017 and approved for continued certification. Preparations were made in 2017 to convert to ISO 14001:2015.
Title 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.	**2017 Update:** 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 2017, the WVDP updated the QA program to keep it consistent with current site conditions and the status of decommissioning activities. The environmental monitoring QA plan was also revised to be consistent with the overall QA program.
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. **2017 Update:** The NEPA environmental checklist prepared for routine WVDP maintenance activities, concluded that no routine activities would have a significant impact on the human environment in CY 2017.

TABLE ECS-7 *(continued)*
Compliance Status Summary for the WVDP in 2017

Citation	***Environmental Statute, DOE Directive, EO, Agreement***	***WVDP Compliance Status***
Environmental Conservation Law (ECL), 6 NYCRR Part 617 NYS	The NY **State Environmental Quality Review** (**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.	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. **2017 Update:** No SEQR activities were performed in 2017.
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. **2017 Update:** The WVDP performed a RCRA self-assessment and EPA performed a RCRA inspection in September 2017. No findings, issues, or concerns were identified from either RCRA evaluation.
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. **2017 Update:** The WVDP STP for FY 2017 was submitted to NYSDEC in February 2018.
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 WVDP SWMUs (under DOE jurisdiction) and WNYNSC SWMUs (under NYSERDA jurisdiction).	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. **2017 Update**: Quarterly RCRA §3008(h) reports were submitted to EPA and NYSDEC in 2017.

TABLE ECS-7 *(continued)*
Compliance Status Summary for the WVDP in 2017

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 in even years. **2017 Update:** A RCRA 3016 Biennial Report was not required for Fiscal Year 2017.
42 USC §7401 et seq.; 40 CFR 61, Subpart H; and 6 NYCRR Chapter 3, Air Resources	The **Clean Air Act (CAA)** of 1970 and the **NYS ECL** regulate the release of air pollutants through permits, approvals, 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 regulated under 6 NYCRR Part 201-4 (Minor Facility Registrations).	DOE has EPA approval to release radiological emissions from four active stacks and 15 PVUs. DOE also maintains a NYS Air Facility Registration Certificate for nonradiological sources. **2017 Update:** The CY 2017 annual NESHAP Report summarizing radiological emissions and estimated dose was submitted to the EPA in June 2018. Estimated dose to the critical receptor from radiological air emissions during 2017 was <0.46 mrem, far below the 10 mrem Subpart H standard. All nonradiological sources have been exempted from reporting requirements.
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.	NYSDEC granted an extension to continue operating under the current SPDES permit that expired in 2016 while it undergoes NYSDEC technical review. **2017 Update:** All SPDES discharge monitoring results and storm water run-off monitoring results were within the limits specified in the SPDES permit. SPDES Discharge Monitoring Reports (DMRs) were submitted to NYSDEC monthly throughout 2017 as required. SPDES-permitted storm water monitoring results were reported with the June and December DMRs.
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.	**2017 Update:** No construction activities were undertaken in CY 2017 that would require new storm water pollution prevention plans or storm water permits related to construction.

TABLE ECS-7 *(continued)*
Compliance Status Summary for the WVDP in 2017

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 gallons and is cleaned up within two hours of discovery.	The WVDP has nine registered PBS tanks (eight aboveground storage tanks [ASTs] and one underground storage tank [UST]). They are periodically inspected and maintained. Spills are reported and cleaned up in accordance with WVDP policies and procedures. **2017 Update:** There were six minor petroleum spills (less than five gallons each) in 2017. They were reported to NYSDEC in routine 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 affect 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.	The most recent site-wide WVDP wetlands survey was performed in 2003 and approved by USACE in March 2006. 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 NDA in May 2013. **2017 Update:** No new wetland delineations were performed in 2017. The WVDP applied for a joint permit to USACE and NYSDEC to work within wetland W-HLW-6 for the drainage ditch maintenance and improvement project in 2017.
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. If a hazardous substance spill exceeds a reportable quantity, CERCLA reporting requirements are triggered.	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. **2017 Update:** There were no CERCLA activities in 2017.
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.	**2017 Update:** Chemical inventories for the WVDP in 2017 were reported quarterly under EPCRA, as appropriate. Refer to Tables ECS-4 and ECS-5.

TABLE ECS-7 *(continued)*
Compliance Status Summary for the WVDP in 2017

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. 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. **2017 Update:** All of the current year results from analyses of drinking water were reported to be within limits to the CCHD.
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. **2017 Update**: WVDP-585, the "WVDP Worker Safety and Health Plan" was evaluated in 2017 and no major 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. **2017 Update:** Radiological operations in 2017 were performed in compliance with WVDP-477.
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 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 are managed in accordance with the site "Asbestos Management Plan". PCBs are managed in accordance with the site "PCB and PCB-Contaminated Material Management Plan", and PCB use and changes in storage and disposal status are documented in an annual log. **2017 Update:** All ACM activities were completed according to the site plan by personnel certified by NYSDOL. Table ECS-3 provides a summary of 2017 asbestos quantities managed.

TABLE ECS-7 *(continued)*
Compliance Status Summary for the WVDP in 2017

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. **2017 Update:** Herbicides were not used at the WVDP during 2017.
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. **2017 Update**: Routine inspections of the dams continued to be performed in 2017. In response to a NYSDEC request, in September 2017, the DOE submitted a revised long term plan to phase out the reservoir system.
NYS ECL Article 15, Title 33, Part 675 and Title 15, Part 601	**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. Modifications to the law that became effective in 2017 require a water withdrawal permit for all water withdrawal systems with a potential to withdraw 100,000 gallons per day or more.	**2017 Update:** New legislation required submittal of a Water Withdrawal Permit application by February 2017. The WVDP missed this date and received an NOV. The permit application was submitted in January 2018. No further NYSDEC action is anticipated as a result of the NOV. The WVDP continues to submit the annual water withdrawal report to NYSDEC. The 2017 report was submitted in March 2018. Although the WVDP has the potential to withdraw more than 100,000, the WVDP withdrew an average of 43,424 gal/day (164,378 L/day) in 2017 from the water supply wells and from the reservoirs.
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.	Medical services generate potentially infectious medical wastes. **2017 Update:** All medical waste was securely stored in approved biohazard containers, and handled and controlled by authorized personnel.

TABLE ECS-7 *(concluded)*
Compliance Status Summary for the WVDP in 2017

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. **2017 Update:** Migratory bird nest depredation activities for the current year are summarized in Table ECS-6.
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. **2017 Update:** No known endangered species resided at the WNYNSC in 2017.
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. **2017 Update:** No protected historical sites were impacted by site activities in 2017.
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.	**2017 Update:** No activities were performed during 2017 at the WVDP that would develop new floodplains or be adversely impacted by the existing 100-year floodplain within the premises.
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. **2017 Update:** As required by the plan, the CDDL cover was inspected in 2017 and was found to be in good condition.

TABLE ECS-8
WVDP Environmental Permits, Approvals, and Registrations

Permit Description	*Permit Status and System Updates*
Hazardous Waste Management (NYSDEC)	
WVDP RCRA Part A Interim Status Permit Application (EPA ID #NYD980779540)	
RCRA permit that provides interim status 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 from WVES to CHBWV as co-operator of the WVDP along with DOE. For all of the Part A HWSUs, closure plans are updated and maintained on site, as required by RCRA.
RCRA Final Status Permit (6 NYCRR Part 373-2 (Rev. 1) - *INDEFINITELY SUSPENDED*	
RCRA permit that provides final status for treatment and storage of hazardous waste.	DOE submitted a revised RCRA Final Status permit 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 Final Status until completion of Phase 1 work.
Effluent Water (NYSDEC)	
SPDES (NY0000973)	
Permit to discharge to surface waters from various on-site sources with associated monitoring requirements.	<u>**Permit**</u>: The current SPDES permit was issued by NYSDEC, effective July 1, 2011. It was modified in July 2015 for the relocation of the S09 storm water outfall. The permit expired on June 30, 2016. <u>**System**</u>: NYSDEC is allowing discharges to continue under the existing permit while they conduct a technical review of the current permit. Per NYSDEC request, the WVDP submitted a "SPDES Notice/Renewal Application and Questionnaire" to NYSDEC on November 5, 2015.
Drinking Water (NYSDOH and CCHD)	
Public Water System (ID #NY0417557)	
Permit to operate the WVDP nontransient noncommunity public drinking water system.	<u>**Permit**</u>: The WVDP drinking water system operates under a NYSDOH permit. The permit has no expiration date. <u>**System**</u>: The drinking water supply was changed from a surface water source to a groundwater source in 2014. A replacement treatment system was built in 2017 to allow for demolition of the utility room.
Flood Protection and Dam Safety (NYSDEC)	
NYS Atomic Development Dam #1 and Dam #2 (Reg. ID #019-3149 and Reg. ID #019-3150)	
Permit to operate and maintain two Class A Low-Hazard Dams on the WNYNSC property.	<u>**Permit**</u>: The dam permits were issued for operation and routine maintenance of the dams and lakes. <u>**System**</u>: The reservoirs supply water for SPDES discharge augmentation and fire suppression. The dams and lakes are inspected monthly.

Note: Permit, approval, and license expiration dates are current as of September 2018.

TABLE ECS-8 *(continued)*
WVDP Environmental Permits, Approvals, and Registrations

Permit Description	*Permit Status and System Updates*
Wildlife (U.S. Fish and Wildlife Service)	
Bird Depredation Permit (MB747595-0)	
Federal permit for the limited taking of migratory birds and active bird nests.	Permit: A bird depredation permit renewal application must be submitted annually every July. The current permit was renewed in September 2017 and expires August 31, 2018.
Air Emissions - Radiological (EPA)	
MPPB Ventilation (WVDP-687-01)	
EPA approval for MPPB ventilation radionuclide emissions (originally permitted to ventilate the LWTS).	**Approval:** The original EPA approval was obtained on December 22, 1987. Modified on May 25, 1989 to include the laboratories, and modified again on February 18, 1997 to include the slurry-fed ceramic melter. The approval has no expiration date. **System:** MPPB stack ventilation is still operating under the original approval. 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 the Replacement Ventilation Units (RVUs) that became operable in August 2015.
Replacement Ventilation System (RVS) (WVDP-RVS-MPPB-New-001)	
EPA approval for RVS radionuclide emissions.	Approval: The RVS approval by EPA was obtained on March 25, 2015 and has no expiration date. System: The RVS is a MPPB emission system installed to replace the HEV. It ventilates the MPPB together with the MPPB stack. The RVS includes two RVUs that discharge through one emission point. It became operational in August 2015.
VF Heating, Ventilation, and Air-Conditioning (HVAC) System - *DEMOLITION IN PROGRESS*	
EPA approval for VF Heating, Ventilation, and Air-Conditioning (HVAC) system for radionuclide emissions.	**Approval:** The original VF approval was obtained on February 18, 1997 with no expiration date. System: The VF ventilation system was shut down in July 2016 and demolition of the facility began on September 11, 2017.
Contact Size-Reduction Facility (CSRF) (WVDP-287-01) - *DEMOLITION IN PROGRESS*	
EPA approval for CSRF radionuclide emissions.	Approval: The original CSRF approval was obtained on October 5, 1987 with no expiration date. System: Portions of this building were demolished in 2017. The CSRF stack ventilation system has not been in service since 2005. A Portable Ventilation Unit (PVU) was used for ventilation in May 2017 during pre-demolition cleanout
Supernatant Treatment System (STS) /PVU (WVDP-387-01)	
EPA approval for STS ventilation for radio-nuclide emissions.	**Approval:** The original STS ventilation system was approved on October 5, 1987. After modifications, it was re-approved on May 4, 1998 for full-time ventilation of the WTF. The approval has no expiration date. System: The ventilation system receives air ventilated from the T&VDS.

Note: Permit, approval, and license expiration dates are current as of September 2018.

TABLE ECS-8 *(concluded)*
WVDP Environmental Permits*, Approvals, and Registrations*

Description	*Status and System Updates*
Air Emissions - Radiological (EPA) (continued)	
RHWF (WVDP-RHWF Mod-001)	
EPA approval for RHWF ventilation for radionuclide emissions.	**Approval**: The original RHWF approval was issued to allow use of plasma arc cutting techniques in the RHWF. It was approved on April 18, 2012 with no expiration date. **System**: RHWF was used for repackaging and waste size reduction in 2017.
Outdoor Ventilated Enclosures/ PVUs (WVDP-587-01)	
EPA approval for 15 PVUs for ventilation and removal of radionuclides.	**Approval**: The original approval for the use of 10 PVUs was obtained on December 22, 1987 and modified on December 10, 2007 to expand usage of PVUs from 10 to 15 units. The approval has no expiration date. **System**: DOE tracks PVU usage on the basis of annual cumulative estimated dose.
Air Emissions - Nonradiological (NYSDEC and NYSDOL)	
Air Facility Registration Certificate (9-0422-00005/00099) - NYSDEC	
Certificate identifies non-exempt sources of nonradiological emissions that do not require a permit.	**Registration**: The current registration certificate is effective from September 1, 2016 to August 31, 2026.
Asbestos-Handling License (CHBWV #61646) - NYSDOL	
Asbestos contractor license.	**License**: The current license was renewed in September 2017 and expires on September 30, 2018.
Petroleum Bulk Storage (PBS) (NYSDEC)	
PBS Registration (#9-008885)	
Registration of bulk storage tanks used for petroleum.	**Registration**: The PBS registration expires September 2, 2021. **System**: The WVDP stores gasoline and diesel fuel on site for site vehicle and equipment use.
Wildlife (U.S. Fish and Wildlife Service)	
Resident Canadian Goose Nest and Egg Registration	
Federal registration for management of goose nests and eggs.	**Registration**: This annual registration was last completed on April 12, 2018.
Groundwater (EPA)	
Underground Injection Control Program Regulation (UICID: 11NY00906001)	
Approval to use PTW wells to inject sodium bromide tracer solution to estimate groundwater flow velocities.	**Approval**: EPA authorized operation of injection wells at the WVDP on November 18, 2010. Tracer testing at these wells was performed in 2011 and 2016, and is scheduled to be performed every 5 years.

Note: Permit, approval, and license expiration dates are current as of September 2018.

CHAPTER 1

ENVIRONMENTAL MANAGEMENT SYSTEM

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 Environmental Management System (EMS) is a program the WVDP utilizes to manage the impacts its operations have on the environment, and to systematically improve its environmental stewardship practices. The EMS is a key component of the Integrated Safety Management Program.

2017 Highlights

CHBWV reviewed site EMS procedures in anticipation of applying for a Certificate of Registration under the new ISO 14001:2015 standard in 2018 by performing self assessments and conducting a third party gap analysis in November 2017. It is anticipated that the changes to site operations required to obtain the new certification will be minor.

CHBWV received the Voluntary Protection Program (VPP) Legacy of Stars award for implementing a consistent robust safety program. The WVDP was recertified as a DOE VPP Star site in 2017.

CHBWV and its subcontractors achieved over 400 thousand consecutive work hours without a job related lost time work injury or illness.

The EMS is incorporated into all planned work activities. MPPB D&D and VF demolition were carried out during 2017 with no environmental consequences due to integration of the EMS into work plans.

The EMS scored "green" on the federal EMS performance metrics scorecard for 2017, indicating the site has a robust and compliant EMS.

DOE sustainability goals for reductions in energy, water, vehicle fuel use, and for pollution prevention and waste minimization are incorporated into the WVDP Annual Site Sustainability Plan. The most significant contribution the WVDP is currently making towards DOE sustainability goals is reducing energy consumption through removal of facilities.

CHBWV receiving the Voluntary Protection Program (VPP) 2017 Legacy of Stars award from the DOE Office of Worker Safety and Health Assistance

Environmental Management System (EMS)

An EMS is a management practice that allows an organization to conduct work in a systematic manner in order to minimize the impacts of its operations on the environment. An EMS ensures that potential environmental issues are identified, controlled, and monitored, and it provides mechanisms for reinforcing continual improvement in work performance with respect to environmental impacts. 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 revised standard has been developed which the WVDP is required to implement by July 7, 2018. Progress in CY 2017 towards transitioning to the revised ISO 14001:2015 standard included conducting a routine maintenance audit of the existing EMS in May 2017 and a third party desktop gap analysis of existing operations in November 2017 to determine any areas where changes are needed in the way work is conducted at the WVDP to ensure compliance with the new standard. Meeting the objectives for improved protection of the environment in the new standard:

- requires greater accountability from the leadership with respect to the environmental consequences of work that is performed at the site,
- involves more proactive environmental initiatives that include life-cycle thinking with respect to waste generated,
- expects improved communications both internally and with the public, and
- entails more rigorous environmental risk evaluations.

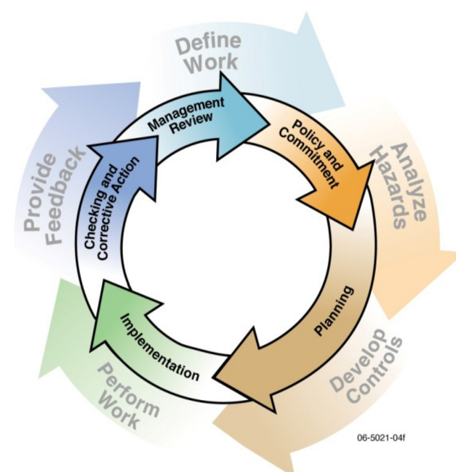
A third-party registration audit of the EMS for the new ISO 14001:2015 standard was conducted in March 2018 to ensure the enhanced core EMS elements are observed to be fully implemented, meeting the ISO 14001:2015 requirements. It is anticipated that the changes to site operations required for recertification will be minor.

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 received the VPP Legacy of Stars award for their robust safety program from the DOE Office of Worker Safety and Health Assistance in September 2017. The WVDP first earned DOE VPP Star site certification in 1999 and was recertified as a Star site in 2017. The WVDP received the VPP Legacy of Stars award for 4 years of continuous VPP Star status, an award that has not been frequently received at other DOE sites.

Safety performance during 2017 continued to be good, with CHBWV and its subcontractors achieving 405,869 consecutive work hours without a job related lost time work injury or illness. There was a slight increase in the number of slips and strains in CY 2017. There were no occurrences of a lost time injury due to the work performed during high risk radiological building deactivation or demolition. The site's focus on safety not only protects workers but also promotes protection of the environment by reducing the potential for releases of contaminants to the environment. Safe behaviors at the WVDP are continuously reinforced through safety exercises and frequent safety training initiatives.

Policy and Commitment

It is the environmental policy of the WVDP to integrate environmental requirements and pollution prevention into project planning and execution in order to ensure that sound stewardship practices are implemented. The environmental policy requires that site personnel:

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

The environmental policy is posted in many meeting areas across the site, and it is available on the CHBWV website:

www. chbwv.com/Safety_and_Environment.htm.

Managers are expected to take prompt action to address environmental concerns and to have zero tolerance for noncompliance with the policy.

Work 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.

Environmental Aspect Analysis. An "environmental aspect" is any element of an organization's activities, products, or services that can impact the environment. 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.

Potential significant environmental aspects of site activities planned for 2017 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 environmental aspects was to focus management attention on the most important environmental concerns associated with the 2017 scope of work. The most significant potential environmental aspects for 2017 are summarized in Table 1-1.

TABLE 1-1

WVDP Significant Environmental Aspects for 2017[a]

Environmental Aspect:
· Radiological and/or Asbestos Air Emissions
· Discharge of Metals, Organics, or Radiological Constituents to Surface Water
· Generation of Low-level Mixed and Transuranic Waste
· Savings in Energy Use
· Potential Accidental Radiological Release (i.e., High Efficiency Particulate Air [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."

Facility Demolition. Demolition of the VF began in September 2017 and is expected to be completed in 2018. The VF, a 13,000 square foot, steel-reinforced concrete, metal-sided building built in the 1980s, was constructed adjacent to the MPPB to vitrify HLW at the site. It housed the ceramic melter and associated components used to solidify the radioactive slurry remaining in the WTF underground storage tanks used during NFS operations.

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 demolition of the VF involved completion of "Demolition Readiness Checklists" that evaluated 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 the potential environmental emissions to air and water associated with the selected demolition method. Examples of demolition methods that were considered include removal using:

- diamond wire saw cutting,
- hydraulic hammering, and
- 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 regulatory notifications and approvals, as appropriate.

Activities which have the potential to cause accidental releases to air and water are closely monitored. 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.

A video that demonstrates progress on the VF demolition that involved EMS input to operational procedures and work instruction packages is available for viewing at:

https://youtu.be/QicIBs457fg
http://www.chbwv.com/video15.htm.

Demolition of the MPPB is planned to occur after VF demolition is successfully completed. The MPPB is a 40,000 square foot, five-story, steel-reinforced, concrete structure that housed the mechanical and chemical process equipment used to separate uranium and plutonium from spent nuclear fuel. It was used to reprocess nuclear fuel from 1966 to 1972 and portions of the facility were reused to support HLW vitrification. The MPPB is comprised of more than 55 rooms and is radiologically contaminated from these activities.

To prepare for demolition, thousands of feet of contaminated piping, radiologically contaminated tanks, building components with asbestos containing material, and a variety of specialized equipment that was used for chemical reprocessing of spent nuclear fuel are being removed from the facility. Deactivation of the MPPB is expected to continue throughout 2018.

VF demolition of the outer access aisles

Early stages of demolition of the VF process cell

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 2017 EMS objectives and targets included the following:

- reduction in energy use,
- reduction in the use of potable water,
- electronic stewardship, and
- reduction in the amount of waste generated during decommissioning activities.

Progress towards all of these targets was made in 2017. Reduction in energy use continues to be attained as buildings are demolished or prepared for demolition and no longer need energy for heat and ventilation. Scrap metal from nonradiological areas was recycled throughout 2017, and waste minimization objectives continue to be included in the work instructions for decommissioning projects. Achievements in 2017 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 work in radiological Contamination Areas (CAs) 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 Results and DOE Sustainability Goals

The WVDP EMS is 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. DOE sustainability goals are incorporated 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.

EMS Performance Metrics for 2017 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. All sites in the DOE complex and all other federal agencies are required to work towards the nationwide sustainability goals. Each year, the WVDP updates their site-specific sustainability goals to correlate with the planned work scope, and to contribute towards nationwide DOE sustainability goals outlined in the federal Strategic Sustainability Performance Plan (SSPP). The FY 2017 DOE SSPP and complex-wide scorecard can be seen at:

https://energy.gov/management/spo/sustainability-performance-office

The most significant contribution the WVDP is currently making towards sustainability is built into the current work scope of removing facilities. Demolition of the VF, MPPB, and 47 ancillary structures will reduce energy use and the site's impact on the environment. Based on the current status of the site's EMS, the WVDP scored "green" on the scorecard for FY 2017 indicating the site has a compliant and robust EMS. Site-specific information for the EMS is provided in the following sections.

Greenhouse Gas (GHG) Emission and Energy Use. Overall GHG emissions from the WVDP decreased approximately 12% from FY 2016 to FY 2017 and decreased by 58% compared to the FY 2008 baseline as shown by Figure 1-1.

Reduction of the environmental footprint of the project by demolition of site facilities results in decreasing energy use. Improvements to the site infrastructure that are in progress, such as replacing the electrical substation built in the 1950s, are anticipated to result in more efficient energy use. Use of electricity decreased from 2016 to 2017, and is below the 2008 baseline as shown by Figure 1-2. Use of natural gas remained approximately the same as FY 2016, but is also below the 2008 baseline. The combined energy resulted in decreased GHG emissions.

Water Use. The volume of potable water used at the site in 2017 has not changed significantly from previous years. In the final quarter of the calendar year supplemental industrial water was required for dust suppression during demolition of the VF. This increase in water usage during demolition is anticipated to be offset by a reduction in overall potable water usage as the site footprint continues to shrink.

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. During most of 2017, chlorination, iron filtration, and distribution of the water supply continued to take place in the MPPB utility room which is being prepared for demolition.

A new water treatment and distribution system was constructed in 2017 to facilitate deactivation of the MPPB utility room. The treatment system went online in early 2018. Repairs of several water leaks detected during the period of this construction reduced unnecessary water withdrawal.

Vehicle Fleet Fuel Use. Gasoline usage has been reduced by 51% from the FY 2005 baseline as shown by 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. Use of electric carts obtained from the government surplus list continues to limit the use of gasoline.

FIGURE 1-1
GHG Emissions

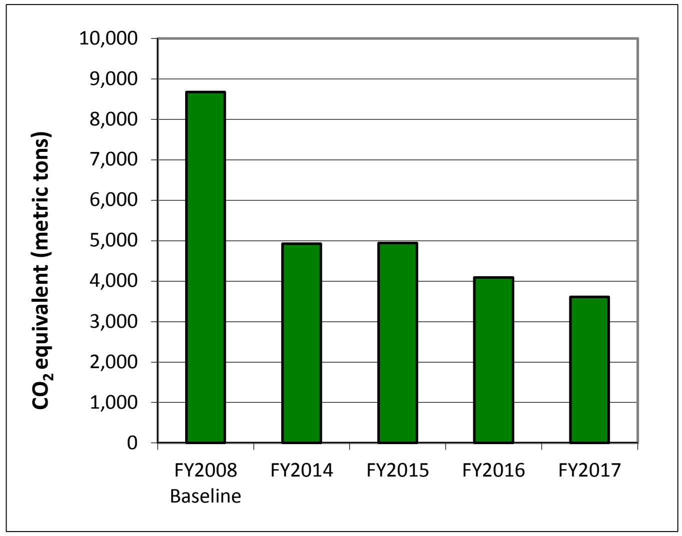


FIGURE 1-2
Energy Use

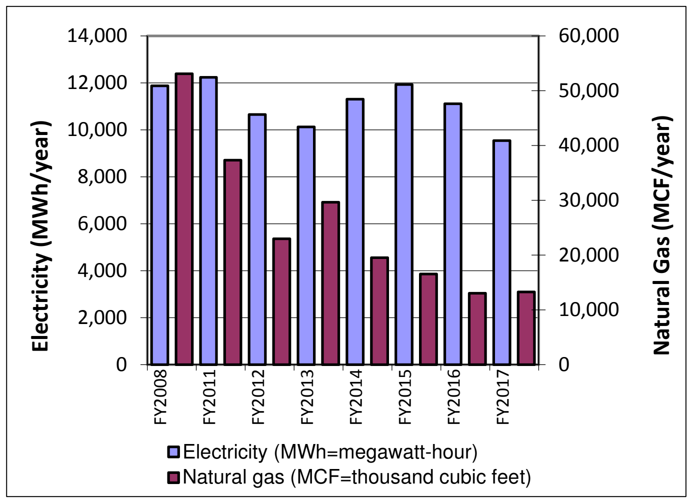
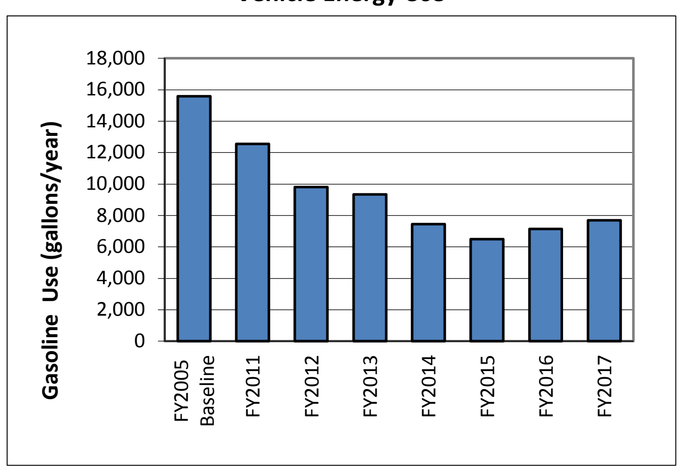


FIGURE 1-3
Vehicle Energy Use



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% post-consumer fiber. Reused material is also considered for major purchases.

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 2017 construction and custodial subcontracts incorporated sustainability requirements of DOE acquisition regulations.

Pollution Prevention and Waste Reduction. Waste minimization and recycling of nonhazardous, 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. During FY 2017, 39.4 tons of scrap metal was recycled. A total of approximately 67.4 tons of material was diverted from landfills in FY 2017. The quantity of each type of material recycled/reused or donated is summarized in Table 1-2.

TABLE 1-2
Recycled/Reused/Donated Material in FY 2017

Material	*FY 2017 Quantity (tons)*
Metals	39.4
Mixed paper and corrugated cardboard	21.8
Laboratory equipment donated	0.2
Electronics	1.6
Fluorescent bulbs	0.2
Batteries	1.2
Transfers to other DOE sites	1.5
Transfers to non-federal sites	0.4
Sales to other government agencies	0.1
Miscellaneous	1.0
Total	67.4

Electronic Stewardship. The site purchased 100% of eligible computer and electronic equipment certified through the Electronic Product Environmental Assessment Tool (EPEAT) program in FY 2017. 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 sent out for recycling through approved facilities.

Renewable Energy Credits (RECs). One of the DOE SSPP goals is for expanded on-site renewable energy generation across the complex. Because the WVDP is deactivating and demolishing facilities, renewable energy credits will be purchased to support other locations where renewable energy construction opportunities will result in long term gains. The WVDP is currently pursuing the purchase of RECs through the primary contracting agent used by the Department of Defense, Defense Logistics Agency (DLA).

Best Practices/Lessons Learned. During the May 2017 ISO 14001 routine maintenance audit conducted before conversion to the new standard, the existing EMS was assessed to be operating effectively to ensure good environmental practices were incorporated into all work performed at the site.

The following EMS program strengths were noted from this audit:

- Emergency preparedness drills continue to demonstrate excellent communications and meaningful critiques.
- Communication of environmental media policy to subcontractors was very effective.
- Lessons Learned process continues to be strong.
- Improvements were made in the process of tracking completion of required follow-up actions related to EMS concerns.
- The proposed new plastic recycling program will help to minimize waste.

Preliminary planning and results of the third party EMS gap analysis for conversion to the new standard suggests the anticipated changes to site operations required for recertification will be minor.

Management Review. The routine annual internal EMS senior management briefing was conducted at the Executive Safety Review Board (ESRB) meeting on September 13, 2017. The ESRB reviews the site's environmental performance annually to ensure the continuing suitability, adequacy, and effectiveness of the EMS. No findings were identified during this review.

Summary

The benefit of the WVDP's EMS to DOE's mission at the WVDP in 2017 includes an outstanding worker safety record, continued compliance with major environmental regulations, reduction of energy and supply water expenses, reduced waste inventory through reuse/recycling and shipping, and safe removal of asbestos.

CHAPTER 2

ENVIRONMENTAL MONITORING

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 of radiological and chemical contaminants from site activities in accordance with DOE Order 458.1, "Radiation Protection of the Public and the Environment," (Change 3). This chapter describes the Environmental Monitoring Program and discusses the 2017 results in comparison to background concentrations and permit limits.

The radiological environmental monitoring data is evaluated each year on the basis of the estimated potential dose to the public and the dose to local biota. The 2017 dose assessment is provided separately in Chapter 3.

2017 Highlights

There were no environmental permit exceedances in 2017. As in the past, although concentrations of certain radiological constituents from samples collected within the WVDP security fence exceeded comparison levels or background concentrations, results from off-site and downstream confirm that the public's health and safety, and the environment continue to be protected.

Air: The airborne emissions from on-site point sources during CY 2017 were below all applicable limits. Off site, none of the 2017 radioisotopic results at the ambient air sampling locations encircling the site were above the laboratory minimum detectable concentration (MDC) confirming that WVDP operations have had no discernible effect on off-site air quality.

Water: Discharge concentrations from the 001 outfall and natural drainage were similar to previous years. Gross beta, tritium, uranium isotopes, cesium-137 and strontium-90 continued to be detected above background but well below DCSs on the WVDP or immediately outside the WVDP property. Downstream of the WVDP, at the first point of public access, all radiological results were at background levels or non-detectable.

Drinking Water: Results from 2017 indicated that the Project's drinking water continued to remain below the local, state, and federal maximum contaminant levels (MCLs) and drinking water standards for chemical contaminants.

Sediment/Soil: Radioisotopic concentrations in on-site soils sampled in 2017 were below screening criteria. Off-site sediment and soils were similar to site background in 2017 with the exception of cesium-137, which continues to be detected above background in downstream sediments, as has been observed historically. The cesium-137 concentrations in 2017 in sediment downstream of the site have been decreasing overall since these locations were first monitored.

Food Sources: All radioisotopic concentrations in milk, deer, fish, and vegetable samples collected in 2017 were below any level of concern and continue to confirm the low dose estimates from the site based on air and water monitoring.

Direct Radiation Monitoring: Direct radiation measurements at the WNYNSC perimeter were statistically the same as measured in Great Valley, 18 miles south of the site, indicating no measurable direct radiation exposure from project activities.

Environmental Monitoring Program

The environmental monitoring program primarily focuses on surface water and air exposure pathways, as these are the principal means by which contaminants can be transported off site. As part of the program, on-site and off-site air, surface water, drinking water, sediment, soil, venison, fish, milk, and food crops are collected and measured for radiological and chemical constituents 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. Groundwater monitoring continues to receive emphasis at EPA and within DOE. Consequently, for all DOE site ASERs, the groundwater monitoring program and potential exposure pathways from the groundwater are discussed separately from the rest of the environmental monitoring program. WVDP groundwater is discussed in Chapter 4.

A description of the sampling schedule at each location in the WVDP environmental monitoring program, a discussion of the program drivers and rationale, as well as maps showing the 2017 sampling locations, are presented in Appendix A.

Airborne Emissions Monitoring Program

Radiological Air Emissions. The WVDP maintains required EPA approvals for radiological releases from four active air emission points from building ventilation systems (otherwise referred to as "stacks") and for up to 15 portable ventilation units (PVUs). These EPA approvals allow air containing small amounts of radioactivity to be released from plant ventilation stacks during normal operations. Details of these EPA approvals are listed in the Environmental Compliance Summary (ECS), Table ECS-8.

Radiological emissions also occur from non-point diffuse sources. The wastewater storage lagoons contribute a diffuse radiological release to air at the WVDP by surface water evaporation. Building demolition is also a diffuse source of radiological releases to air, even when best management practices are employed. Diffuse emissions are evaluated by measurement of radioactivity at the ambient air samplers.

Radiological air releases are evaluated and reported to the EPA in the annual NESHAP report. Sitewide releases must not exceed dose criteria specified in the NESHAP regulations to ensure that public health and safety and the environment are protected.

Nonradiological Air Emissions. The WVDP maintains an Air Facility Registration Certificate and routinely evaluates new potential sources of nonradiological emissions to determine if any new monitoring or permitting is required. All asbestos removal activities were routinely monitored for asbestos emissions. Particulate matter was monitored during demolition. No other nonradiological monitoring or permitting was required during CY 2017.

Active Ventilation and Emission Systems. Exhaust from each EPA-approved ventilation system on the WVDP is continuously filtered and the permanent systems are monitored as air is released to the atmosphere. 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 but remains well below regulatory limits for all radionuclides. For instance, releases of iodine-129 dropped sharply after vitrification was completed in 2002.

The sampling locations for point source air emissions are described below and are shown on Figure A-6 in Appendix A.

The Main Plant Process Building (MPPB) Ventilation Stack (ANSTACK). 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).

MPPB stack

The MPPB stack has historically ventilated exhaust from several systems, including the HEV system, the Ventilation Exhaust Cell (VEC), the WTF, process off-gas, and off-gas from the former vitrification system. Many of these historical contributors to the MPPB stack effluent have been isolated for a number of years and no longer contribute to the stack effluent. During 2017, ventilation through the MPPB stack was only from the VEC system. A trend graph of these emissions is included in Chapter 3, Figure 3-3.

Replacement Ventilation System (RVS) Stack (ANRVEU1). The RVS, which began operating in August 2015, ventilates the MPPB rooms that were most highly contaminated during Nuclear Fuel Services, Inc. (NFS) operations. The RVS was installed in order to allow dismantling of the HEV system which historically ventilated these rooms. Removal of the HEV system was required in preparation for demolition of the MPPB. The RVS is made up of two Replacement Ventilation Units (RVUs), as shown in the figure below, with a single emission point. The RVS exhausts through its own stack.

Replacement Ventilation System (RVS)

Supernatant Treatment System (STS) Stack (ANSTSTK). Airborne effluents are monitored from the system that ventilates the HLW tanks that contain STS components. Figure 3-3 in Chapter 3 provides a trend graph of these emissions. Historically, the second highest concentrations (after ANSTACK) were emitted from ANSTSTK. Dry conditions are being maintained in several of the HLW tanks through operation of the T&VDS. Emissions, shown on Table C-4, are well below DCSs. (See the ECS chapter for additional details about this system.)

Remote Handled Waste Facility (RHWF Stack) (ANRHWFK). The work areas where radioactive waste is remotely size-reduced are ventilated by a permanent stack. The RHWF stack has been in operation since 2004.

Container Sorting and Packaging Facility (CSPF) Stack (ANCSPFK). Intermittent ventilation of the CSPF in the LSA #4 storage building also occurs through a permanent stack that is monitored at sampling location ANCSPFK when there is repackaging activity. ANCSPFK discharge was restarted in April 2017, when the container sorting and packaging work was resumed, after being suspended since October 2014. The CSPF stack releases lesser amounts of radioactivity than the other active stacks and does not require EPA approval.

Recently Deactivated Air Emission Points. Demolition of two buildings with EPA approved stacks began in 2017, the VF and the Contact Size Reduction Facility (CSRF). Their emission sampling points (ANVITSK and ANCSRFK) were taken out of service prior to demolition.

Portable Ventilation Units (PVUs). PVUs are used to provide temporary 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. The site has been approved to use up to 15 PVUs at a time. Due to much lower air flow, the total emissions from all 15 PVUs combined are much lower than the emissions from the other stacks. Locations of PVUs may change throughout the year depending on operational needs and are therefore not shown on Figure A-6 in Appendix A.

Air Emissions Update for 2017

During 2017, WVDP radiological releases were measured and/or estimated from five emission points (the MPPB, RVS, STS, RHWF, and CSPF stacks), and from 15 PVUs. The MPPB stack continued to be the largest point source emitter of radioactivity to the air at the WVDP. Radiological emissions in 2017 were also estimated from two diffuse sources, from surface water evaporation from the wastewater treatment lagoons and from VF demolition activities. Emissions from diffuse sources in 2017 were estimated to be larger than point source emissions, but were still not detectable off site. These sources are discussed in the ambient air sampling results section and in Chapter 3, "Dose Assessment."

Total curies released from the MPPB stack (ANSTACK) in 2017 are listed in Table 2-1, together with annual averages, maxima, and a comparison of average isotopic concentrations with the applicable DCSs.

TABLE 2-1
Total Radioactivity Released at Main Plant Stack (ANSTACK) in 2017 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	6.72±0.15E-06	9.05±0.20E-15	1.53E-13	8.1E-14[d]	NA
Gross Beta	26	5.56±0.05E-05	7.49±0.06E-14	1.15E-12	1.0e-10[d]	NA
H-3	26	1.91±0.80E-04	2.57±1.08E-13	9.96E-13	2.1E-07	<0.0001
Co-60	2	2.71±3.62E-08	3.65±4.88E-17	6.18E-17	3.6E-10	<0.0001
Sr-90	2	1.60±0.05E-05	2.16±0.06E-14	4.09E-14	1.0E-10	0.0002
I-129	2	7.91±0.35E-06	1.07±0.05E-14	1.19E-14	1.0E-10	0.0001
Cs-137	2	1.82±0.03E-05	2.45±0.04E-14	4.59E-14	8.8E-10	<0.0001
Eu-154	2	1.06±1.00E-07	1.43±1.35E-16	1.88E-16	7.5E-11	<0.0001
U-232[e]	2	3.22±7.37E-09	4.34±9.93E-18	< 1.64E-17	4.7E-13	<0.0001
U-233/234[e]	2	3.51±1.10E-08	4.72±1.48E-17	5.75E-17	1.0E-12[f]	<0.0001
U-235/236[e]	2	7.05±5.88E-09	9.50±7.93E-18	1.54E-17	1.2E-12	<0.0001
U-238[e]	2	1.49±0.78E-08	2.01±1.06E-17	2.09E-17	1.3E-12	<0.0001
Pu-238	2	1.01±0.08E-06	1.37±0.11E-15	2.62E-15	8.8E-14	0.0155
Pu-239/240	2	1.69±0.10E-06	2.28±0.14E-15	4.37E-15	8.1E-14	0.0282
Am-241	2	3.12±0.13E-06	4.21±0.18E-15	8.00E-15	9.7E-14	0.0434
Sum of Ratios						**0.088**

N - Number of samples.
NA – Not applicable; ratio calculated from isotopic data.
[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] The representative DCS for gross alpha in air shown is for Pu-239 and for gross beta is Sr-90 (selected as the most restrictive) since DCSs do not exist for indicator parameters.
[e] Total Uranium = 6.33±0.24E-02 g; average = 8.53±0.32E-11 µg/mL, includes uranium contribution from glass fiber filter matrix.
[f] DCS for Uranium-233 used for this comparison.

Ventilation continues to be required in the MPPB while it is being prepared for demolition. Decontamination activities, which are ongoing, have been performed in the majority of the MPPB rooms, and debris and vessels have been removed, significantly reducing overall inventory of radioactivity.

To evaluate the ANSTACK emissions, the annual average radionuclide concentration measured for each nuclide was divided by its respective DCS and the ratios from all nuclides were summed. The sum of the ratios should not exceed 1.0. The sum of ratios for radiological concentrations from ANSTACK in 2017 was 0.088, well below the 1.0 DOE guideline. (For a discussion of the "sum of ratios" calculation, see the inset box for "Radiological Data Evaluation" on page 2-5.)

There was a slight increase in radioactivity from the MPPB stack in December 2017 that continued into early 2018. Work area monitors identified this increase, work was temporarily stopped, and the cause immediately evaluated. The increase was determined to be due to an inadequate seal on a closed damper. The problem was remedied before work continued. As shown by the Chapter 3 trend graphs in Figure 3-3, this increase in 2017 was within recent historical ranges.

The total curies released from the other air emission points in 2017 were a small fraction of the total curies released from ANSTACK in 2017. Appendix C presents total radioactivity released for specific radionuclides at each of the other on-site air sampling locations including the RVS, STS, RHWF, CSPF stacks and the PVUs.

Radiological Data Evaluation

Derived Concentration Standards (DCSs). Environmental sampling results are assessed to determine whether the constituents of interest are present and, if so, their concentrations 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.

DCSs are defined 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.

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. For water effluents, when only gross alpha and beta measurements are available, activity is assumed to come from uranium-232 for gross alpha, and strontium-90 for gross beta, also because their DCSs are the most limiting for major WVDP waterborne exposures.

Sum of Ratios. To evaluate the radioactivity released from each location with respect to the DCSs, the annual average radionuclide concentration measured for each nuclide was divided by its respective DCS and the ratios from all nuclides were summed. When, the sum of the ratios (also called the "sum of fractions") exceeds 1.0, or if expressed as the sum of percentages, exceeds 100%, then the total radioactivity released from that location during the current year exceeds DCSs and further evaluation is required.

Off-site ambient air network results are evaluated against NESHAP Concentration Levels for Environmental Compliance provided in U.S. EPA 40 CFR Part 61.

Statistical Comparison to Background. 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.

No DCSs were exceeded by airborne emissions on an annualized basis during CY 2017. DCSs are applied to annual totals since they are a criteria associated with exposure for an entire year. Biweekly sample results from the stacks occasionally exceed background concentrations for some isotopes. On-site air sampling locations with radiological results statistically greater than background values are summarized in Table 2-4. Airborne concentrations on site are naturally reduced by dispersion such that low, but detectable concentrations at the on-site stacks have not been detectable off site to date. (See "Ambient Air Monitoring" discussion below.)

Ambient Air Monitoring

Seventeen ambient air samplers surround the WNYNSC within approximately one mile of the WVDP property boundary as shown in Figure A-7. One of these is a high-volume sampler located downwind in the prevailing wind direction, which is the direction of the hypothetical maximum potential exposure.

The ambient air samplers are sampled throughout the year during all site activities for environmental surveillance (to watch for potential environmental concerns) and for regulatory compliance. Samples are collected biweekly for gross alpha and gross beta screening and monthly for iodine-129 screening analysis. The biweekly and monthly samples are 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.

Ambient Air Sampler

The background ambient air sampler (AFGRVAL) is located 18 miles (29 km) south of the site. This location in Great Valley, New York has been monitored for many years. (See Figure A-14.) This distant background location samples regional air with very low potential to be affected by radiological releases from the WVDP.

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 by radiological protection personnel and are used to direct work activities.

Ambient Air Sampling Update for 2017

Results from the ambient air samplers within a mile of the site boundary have confirmed that WVDP operations in CY 2017 have had no discernible effect on off-site air quality.

Gross alpha, gross beta, and composited isotopic results collected in all sixteen ambient air sectors have very similar concentrations as those observed at AFGRVAL, the background ambient air sampler in Great Valley.

None of the 2017 annual average radioisotopic results at the ambient air sampling locations were above the laboratory minimum detectable concentration (MDC). Diffuse sources, including evaporation of radioactivity from the surface of the lagoons and potential airborne radioactivity from demolition, resulted in no detectable radioactivity off site at the ambient air monitors.

These data are used to demonstrate compliance with EPA air emissions standards for exposure to the public as discussed in Chapter 3. Data collected from the ambient air monitors from January to December 2017 are summarized in Tables C-9, C-10, and C-11 of Appendix C.

The Ambient Air Monitoring Network

The ambient air network that encircles the WVDP has been sampled since October 2012. The first quarter of sampling data was used for operational baselining and equipment testing. CY 2017 represents the fifth year of routine ambient air monitoring at these new samplers.

The high-volume sampler included in the ambient air network in the prevailing wind direction, 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.)

Filter samples are collected biweekly for gross alpha and gross beta screening and charcoal cartridges are collected monthly for iodine-129 screening analysis. These samples collected on a biweekly or monthly basis are composited quarterly and analyzed for stronitum-90, iodine-129, cesium-137, uranium-232, plutonium-238, plutonium-239/240 and americium-241.

Meteorological Monitoring

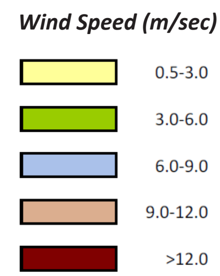
Meteorological monitoring at the WVDP provides representative and verifiable data that characterize the local climatology. These data are used to assess potential effects of routine and non-routine releases of airborne radioactivity and to provide input to dispersion models which can be used to calculate dose to off-site residents. These data would also be used by the Emergency Response Organization (ERO) at the WVDP to predict the direction of plume migration if an air release occurred. 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 pressure is also measured on the meteorological tower at ground level. Precipitation is measured on site east of the main parking lot.

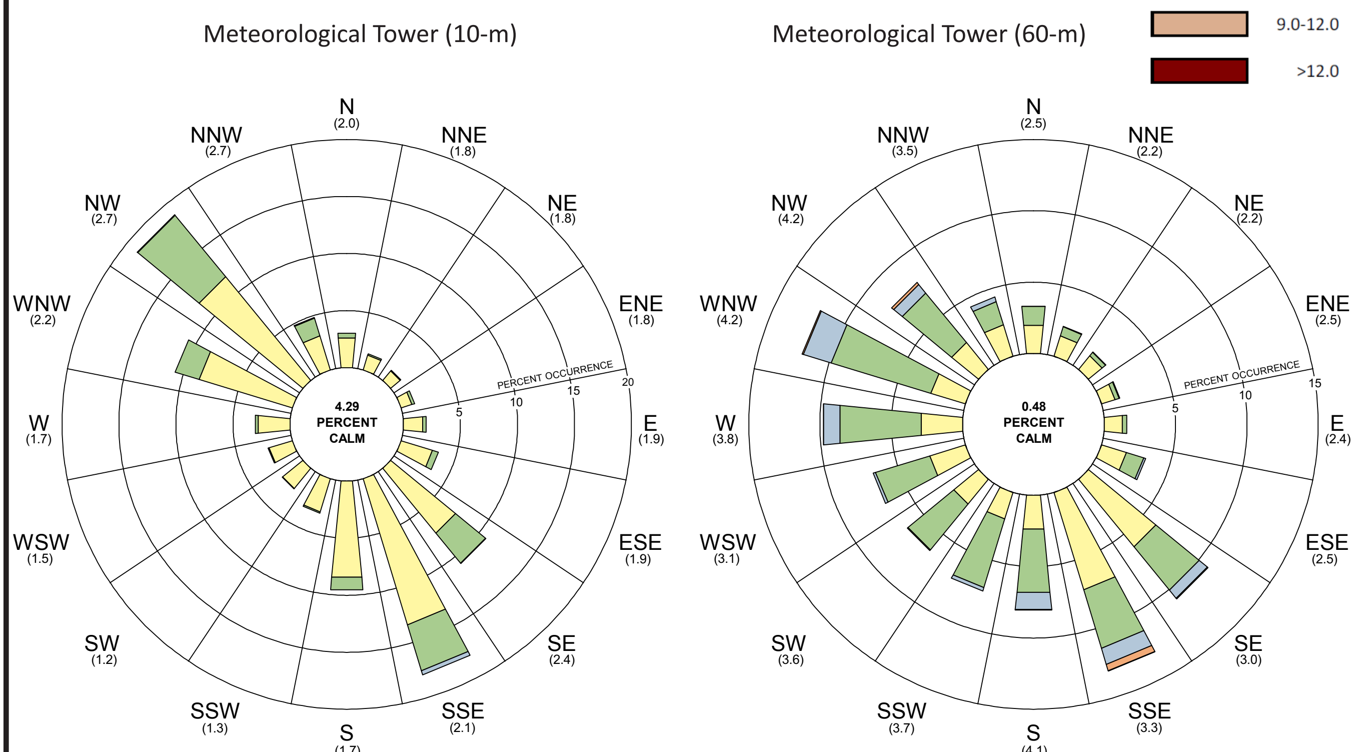
The meteorological tower sends data to digital and analog data acquisition systems on site. The systems are provided with backup power in the event of site power failures. Documentation, such as meteorological system calibration records, site log books, and analog strip charts, are stored in protected archives. In 2017, the data recovery rate (the time valid data were logged versus the total elapsed time) was 96.3%.

Total precipitation in 2017 was 44.5 inches, 9.6% greater than the 10-year annual average. (See Table UI-8.) The predominant wind direction measured in 2017 at the meteorological tower (at a height of 10-m and at 60-m) is shown on the "wind roses" below. The prevailing wind direction continues to be towards the north-northwest (NNW) at the 10-m elevation due to the influence of the orientation of the topography around the site and does not typically change year to year. As expected, wind speeds measured at the 10-m elevation were lower than those from the 60-m elevation.

FIGURE 2-1

Wind Frequency and Speed From the Meteorological Tower (10-m and 60-m Elevations)
January 1-December 31, 2017





Key: Numbers indicate sector mean wind speed. Sectors show the direction from which the wind is blowing.

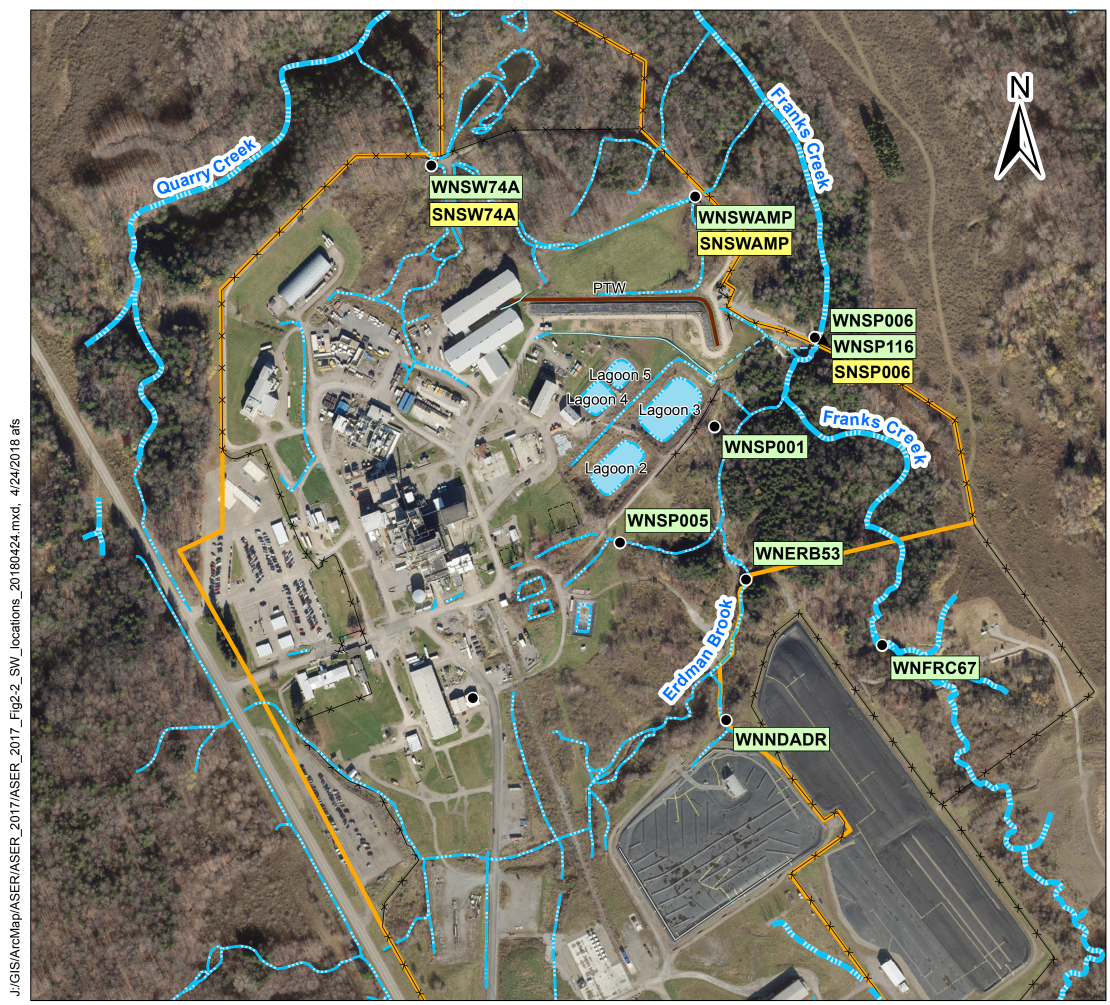
Water Monitoring Program

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 low-level waste treatment system (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. (See Figure 2-2.) 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-5 and A-14.)

Waterborne Radiological Releases. The primary sources of radionuclide releases from the site to surface waters occur at three locations, the lagoon 3 weir which discharges at outfall 001 (WNSP001), at the northeast swamp drainage ditch (WNSWAMP) by natural drainage, and from the north swamp drainage ditch (WNSW74A), also by natural drainage. (See Figure 2-2.)

Process plant discharges are maintained below DOE DCSs, in accordance with the WVDP SPDES permit. Pre-discharge concentrations are compared with DCSs and submitted to NYSDEC for approval before process waters may be discharged. The DOE regulatory limit for all waterborne releases is based on the contribution of each release to the dose limit of 100 mrem/year (1 millisievert [mSv]/year) to an off-site individual from all pathways.

FIGURE 2-2
Surface Water and On-Site Soil Sampling Locations



Members of the public do not have access to the WVDP and therefore do not have any potential of direct exposure at WNSP001, WNSWAMP, and WNSW74A. 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 Felton Bridge (WFFELBR), the first point of public access.

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.

Discharge from WNSW74A, which drains the western edge of the WVDP, also contributes a minor amount to the radiological releases from the site and is included in the estimated dose from waterborne releases from the site.

Waterborne Nonradiological Releases. Plant process water discharges through the lagoon 3 weir at SPDES outfall 001 into Erdman Brook. Storm water (surface water run-off from heavy rainfall over impervious surfaces) is also regulated for nonradiological constituents under the SPDES permit.

State Pollutant Discharge Elimination System (SPDES) Permit Required Monitoring. Liquid discharges from the WVDP are regulated for chemical constituents under a SPDES permit. The permit lists compliance points from which liquid effluents are released to Erdman Brook, and specifies the sampling and analytical requirements for each. 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. SPDES discharges must also be below DCSs and must be preapproved for release by NYSDEC. Predischarge radiological data are provided to the state together with DOE DCSs to facilitate this approval, as required by the SPDES permit.

The conditions and requirements of the current SPDES permit include monitoring of four wastewater discharge outfalls (only one of which, outfall 001, is an active discharge point) and 19 storm water discharge outfalls.

Storm water runoff is generated from rain and snow-melt events that flow over land or impervious surfaces, such as paved streets, parking lots, and building rooftops, that does not soak into the ground. The runoff can pick up pollutants like trash, chemicals, oils, and dirt or sediment that can cause changes in hydrology and water quality, resulting in habitat modification and loss, increased flooding, decreased aquatic biological diversity, and increased sedimentation and erosion. (Definition from https://www.epa.gov/npdes/npdes-stormwater-program.)

Requirements of the SPDES permit for monitoring storm water runoff include measurements of the water quality for specific chemical parameters in storm water discharges from specified WVDP locations, the amount of rainfall, the storm event duration, and the resulting volume of flow at the outfalls.

The WVDP storm water outfalls are grouped into eight representative drainage basins that could potentially be influenced by industrial or construction activity runoff. Storm water samples are not analyzed for radiological parameters. One representative outfall from each group must be sampled on a semiannual basis.

The SPDES permit also includes periodic special studies such as Whole Effluent Toxicity (WET) testing every five years. This test involves sending samples of discharge and receiving waters from the site to a bioassay laboratory where vertebrate fathead minnow and invertebrate water flea freshwater species are tested and evaluated for survival rate, growth rates, and rates of reproduction.

Other On-Site Surface Water Sampling. To ensure that the public's health and safety and the environment are protected, the near-site surface water drainage is routinely sampled at several other points on the north and south plateaus, where no known releases to surface water are occurring. These locations are shown on Figure 2-2 and in Appendix A, on Figure A-2. These monitoring points are sited at locations where releases from other potential source areas on the north and south plateaus could be detected. This vigilance allows site operations to be modified as needed if anomalous or unexpected concentrations are detected in the near-site surface water.

Potential Surface Water Contamination Sources on the North Plateau. On the north plateau, in addition to the planned discharges at the 001 outfall and natural discharges from the strontium-90 plume to surface water, other possible contaminant sources that could affect surface water include the WTF, the MPPB, the lagoon system associated with the LLW2, and waste handling and storage facilities. North plateau sampling locations that monitor these potential sources include locations WNSP005 and WNSP006.

Potential Surface Water Contamination Sources on the South Plateau. On the south plateau, the two inactive underground radioactive waste disposal areas (the NDA and SDA), the 56 VSCs (stored on the interim HLW Cask Storage Pad), and the drum cell (a building formerly used to store drums of processed LLW), are all potential, although not anticipated sources of contamination.

Surface water drainage across the south plateau is monitored downstream of the NDA, SDA, HLW Cask Storage Pad, and drum cell at locations WNNDADR, WNERB53, and WNFRC67. Drainage is directed around the NDA and SDA by storm water drainage pipes, culverts, and drop inlets.

2017 Update for On-Site Water

SPDES Outfall Results. There were no SPDES effluent limit exceedances and no SPDES noncompliance events during 2017. Appendix B-2 presents 2017 process effluent data with SPDES permit limits provided for comparison.

During CY 2017, two sets of storm water samples were collected from all eight outfall groups, with no exceedances of the oil and grease compliance limit. Appendix B-3 presents 2017 storm water runoff monitoring data for outfalls designated in the WVDP SPDES permit.

All WET testing results for WNSP001 performed in 2017 were below acute action levels. However, action levels were exceeded for two of the chronic tests (one for the vertebrate fathead minnow and the other for the invertebrate water flea) as shown in Table B-2K. In consultation with NYSDEC, it was agreed acute and chronic WET testing will continue through 2018 in order to determine the reason for the test failures and whether any additional actions need to be taken. See the footnotes at the bottom of Table B-2K in Appendix B for further explanation of the 2017 WET testing results.

Radiological Results. Gross beta, tritium, uranium isotopes, cesium-137 and strontium-90 continued to be detected above background but well below DCSs on the WVDP or immediately outside the WVDP property. WNSP001 and WNSWAMP are the two largest contributors of radioactivity to off-site waters. Curies released from these locations are summarized using flow-weighted mean concentrations in Tables 2-2 and 2-3. An explanation of the flow-weighted mean calculation is provided below.

Calculating Flow-Weighted Mean Concentrations

Flow-weighted mean concentrations (FWMC) are concentrations that are adjusted for the variability in stream flow over a given period of time (e.g., monthly or annually). FWMC is useful for estimating the typical concentration of a contaminant adjusting for stream flow. This allows for comparisons between streams with different flows or between years when a stream has different flow volumes.

$$\text{Flow-weighted mean concentration is defined as} = \frac{\text{Total Load (kg or Ci)}}{\text{Total Stream Flow Volume (m}^3\text{)}}$$

where the total load (kg or Ci) is divided by the total stream volume (m^3) for a given time period (e.g., year or month). By calculating FWMC on a monthly or annual basis, variability due to seasonal and historical sampling frequency fluctuations and missing data can be reduced.

(http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/wat2417)

WNSP001. Four batch releases totaling about 7.4 million gallons (27.8 million L) were discharged from WNSP001 in 2017. The sum of ratios for the release from WNSP001 in 2017 was approximately 0.26, or only approximately 26% of the 1.0 criterion. (See Table 2-2.)

The annual average flow-weighted mean concentration for each radioisotope is compared to the DCS for WNSP001 and WNSWAMP in Tables 2-2 and 2-3 to determine a ratio, and all the ratios are summed. The sum of ratios should not exceed 1.0. (See "Sum of Ratios" in the "Radiological Data Evaluation" inset box on page 2-5.) The comparison to DCS values in these tables is not a comparison to regulatory criteria, but is included to provide a perspective on the measured on-site concentrations.

Lagoon 3

TABLE 2-2
Total Radioactivity Discharged at Lagoon 3 (WNSP001) in 2017 and Comparison of Discharge Concentrations with DOE DCSs

Isotope [a]	*Discharge Activity* [b]		*Flow-Weighted Mean Concentration*	*DCS* [d]	*Ratio of Mean Concentration to DCS*
	(Ci)	*(Becquerels)* [c]	*(µCi/mL)*	*(µCi/mL)*	
Gross Alpha	6.61±0.54E-04	2.45±0.20E+07	2.38±0.19E-08	9.8E-08[e]	NA
Gross Beta	1.15±0.01E-02	4.26±0.03E+08	4.13±0.03E-07	1.1E-06[e]	NA
H-3	1.72±0.18E-02	6.37±0.66E+08	6.19±0.64E-07	1.9E-03	0.0003
C-14	3.69±4.82E-04	1.37±1.78E+07	1.33±1.73E-08	6.2E-05	<0.0003
K-40	3.67±5.18E-04	1.36±1.92E+07	1.32±1.86E-08	NA[f]	NA
Co-60	-0.04±4.03E-05	-0.01±1.49E+06	-0.01±1.45E-09	7.2E-06	<0.0002
Sr-90	5.34±0.10E-03	1.98±0.04E+08	1.92±0.03E-07	1.1E-06	0.1745
Tc-99	2.28±0.36E-04	8.42±1.33E+06	8.17±1.29E-09	4.4E-05	0.0002
I-129	5.55±2.11E-05	2.05±0.78E+06	1.99±0.76E-09	3.3E-07	0.0060
Cs-137	8.65±1.04E-04	3.20±0.38E+07	3.11±0.37E-08	3.0E-06	0.0104
U-232[g]	1.46±0.08E-04	5.41±0.29E+06	5.25±0.29E-09	9.8E-08	0.0536
U-233/234[g]	1.25±0.07E-04	4.61±0.25E+06	4.48±0.25E-09	6.6E-07[h]	0.0068
U-235/236[g]	6.88±1.57E-06	2.55±0.58E+05	2.47±0.57E-10	7.2E-07	0.0003
U-238[g]	9.91±0.61E-05	3.67±0.23E+06	3.56±0.22E-09	7.5E-07	0.0047
Pu-238	1.65±0.87E-06	6.11±3.20E+04	5.93±3.11E-11	1.5E-07	0.0004
Pu-239/240	1.49±0.76E-06	5.52±2.82E+04	5.36±2.73E-11	1.4E-07	0.0004
Am-241	1.79±0.72E-06	6.63±2.65E+04	6.44±2.57E-11	1.7E-07	0.0004
Sum of Ratios					**0.26**

NA – Not applicable; ratio calculated from isotopic data.
[a] Half-lives are listed in Table UI-4.
[b] Total volume released: 2.78E+10 milliliters (mL) (7.35E+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] The representative DCS for gross alpha in water shown is for U-232 and for gross beta is for Sr-90 (selected as the most restrictive) since DCSs do not exist for indicator parameters.
[f] The DCS is not applied to potassium-40 (K-40) activity because of its natural origin.
[g] Total uranium (g) = 3.34±0.10E+02; Average uranium (µg/mL) = 1.20±0.03E-02.
[h] The DCS for U-233 is used for this comparison.

The sum of ratios at WNSP001 in 2017 was primarily attributable to strontium-90 with significant contributions from uranium-232, and cesium-137. The total annual release and isotopic distribution are very similar to 2016.

WNSWAMP. Natural drainage from the WNSWAMP location in CY 2017 was estimated to be approximately 25.9 million gal (98.2 million L). The sum of ratios from WNSWAMP was 0.61, also below the 1.0 criterion. (See Table 2-3.) The maximum sum of ratios calculated at WNSWAMP to date was 2.67 in 2009, prior to installation of the PTW.

As in past years, the sum of ratios at WNSWAMP was almost entirely attributable to strontium-90. The 2017 flow weighted annual average strontium-90 concentration at WNSWAMP (6.70±0.08E-07 µCi/mL) was below the DCS (1.1E-06 µCi/mL]). The strontium-90 concentration at WNSWAMP first exceeded the DCS in 1995. The 2017 annual average strontium-90 concentrations at WNSWAMP are lower than both the 2016 and 10-year annual average concentrations. (See Figure 2-3.)

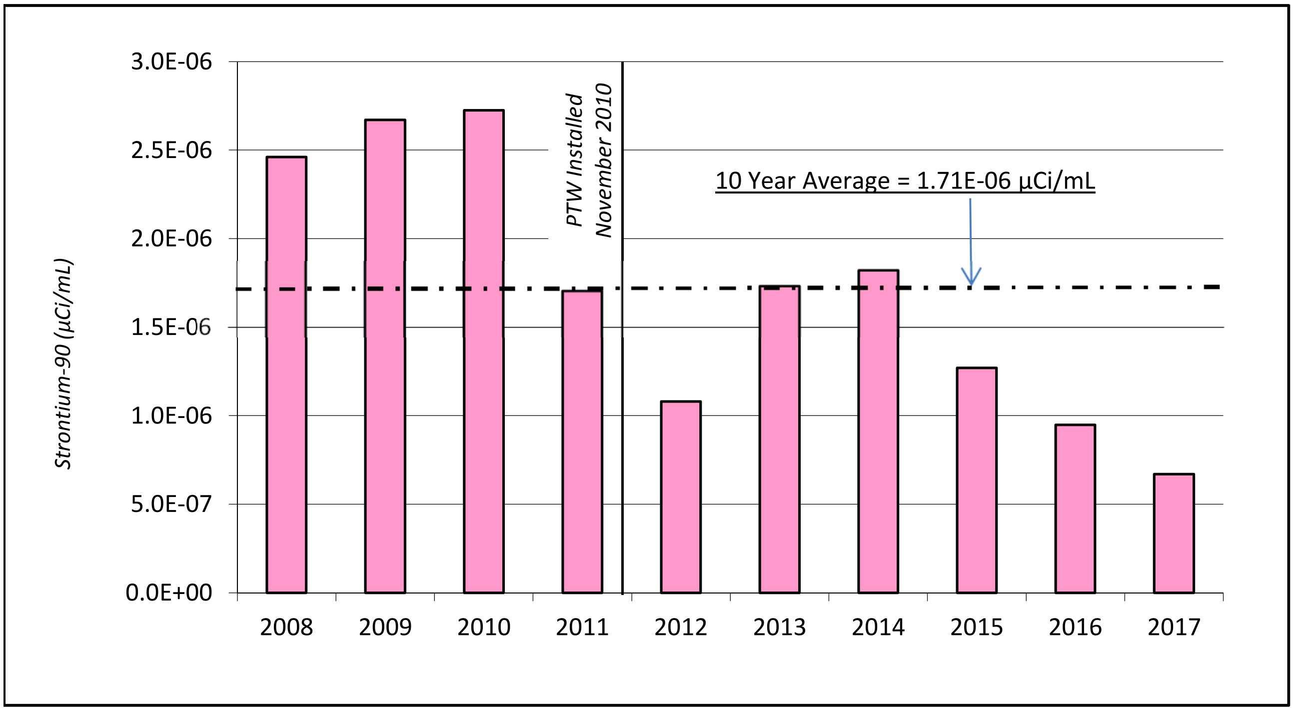
Dilution of this contamination occurs as it flows downstream in Buttermilk Creek to Felton Bridge on Cattaraugus Creek (sampling point WFFELBR), the first point of public access to surface water. The strontium-90 concentrations at Felton Bridge were statistically equivalent to background in 2017, and three orders of magnitude below the strontium-90 DCS.

TABLE 2-3
Total Radioactivity Released at Northeast Swamp (WNSWAMP) in 2017 and Comparison of Discharge Concentrations with DOE DCSs

Isotope [a]	*N*	*Discharge Activity* [b]		*Flow-Weighted Mean Concentration*	*DCS* [d]	*Ratio of Mean Concentration to DCS*
		(Ci)	*(Becquerels)* [c]	*(µCi/mL)*	*(µCi/mL)*	
Gross Alpha	26	2.68±7.11E-05	0.99±2.63E+06	2.73±7.24E-10	9.8E-08[e]	NA
Gross Beta	26	1.30±0.01E-01	4.79±0.01E+09	1.32±0.01E-06	1.1E-06[e]	NA
Tritium	26	5.12±2.74E-03	1.89±1.01E+08	5.21±2.79E-08	1.9E-03	< 0.0001
C-14	2	0.04±2.11E-03	0.15±7.80E+07	0.04±2.15E-08	6.2E-05	< 0.0003
Sr-90	12	6.58±0.08E-02	2.43±0.03E+09	6.70±0.08E-07	1.1E-06	0.61
I-129	2	3.45±4.50E-05	1.28±1.67E+06	3.52±4.59E-10	3.3E-07	< 0.0014
Cs-137	12	-0.98±7.74E-05	-0.36±2.87E+06	-1.00±7.89E-10	3.0E-06	< 0.0003
U-232[f]	2	-2.03±3.91E-06	-0.75±1.45E+05	-2.06±3.99E-11	9.8E-08	< 0.0004
U-233/234[f]	2	1.47±0.67E-05	5.42±2.47E+05	1.49±0.68E-10	6.6E-07[g]	0.0002
U-235/236[f]	2	2.38±3.42E-06	0.88±1.26E+05	2.43±3.48E-11	7.2E-07	< 0.0001
U-238[f]	2	9.27±5.55E-06	3.43±2.05E+05	9.44±5.65E-11	7.5E-07	0.0001
Pu-238	2	1.66±2.46E-06	6.14±9.09E+04	1.69±2.50E-11	1.5E-07	< 0.0002
Pu-239/240	2	3.25±4.09E-06	1.20±1.51E+05	3.31±4.17E-11	1.4E-07	< 0.0003
Am-241	2	0.98±2.30E-06	3.63±8.51E+04	1.00±2.34E-11	1.7E-07	< 0.0001
Sum of Ratios						**0.61**

Notes: Average concentrations represent sample composite concentrations weighted to monthly stream flow.
The average pH at this location was 7.3 Standard Units (SU).
N - Number of samples.
NA – Not applicable; ratio calculated from isotopic data.
[a] Half-lives are listed in Table UI-4.
[b] Total estimated volume released: 9.82E+10 mL (2.59+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] The representative DCS for gross alpha in water shown is for U-232 and for gross beta is for Sr-90 (selected as the most restrictive) since DCSs do not exist for indicator parameters.
[f] Total Uranium (g) = 4.71±0.30E+01 ; Average Total Uranium (µg/mL) = 4.80±0.30E-04.
[g] The DCS for Uranium-233 is used for this comparison.

FIGURE 2-3
Flow-Weighted Annual Average Strontium-90 Concentrations at WNSWAMP



North Plateau (WNSP005 and WNSP006). On-site, at sampling location WNSP005, located east of the MPPB, the CY 2017 annual average gross beta and strontium-90 concentrations statistically exceeded background concentrations, but were below DCSs. (See Table B-4C.)

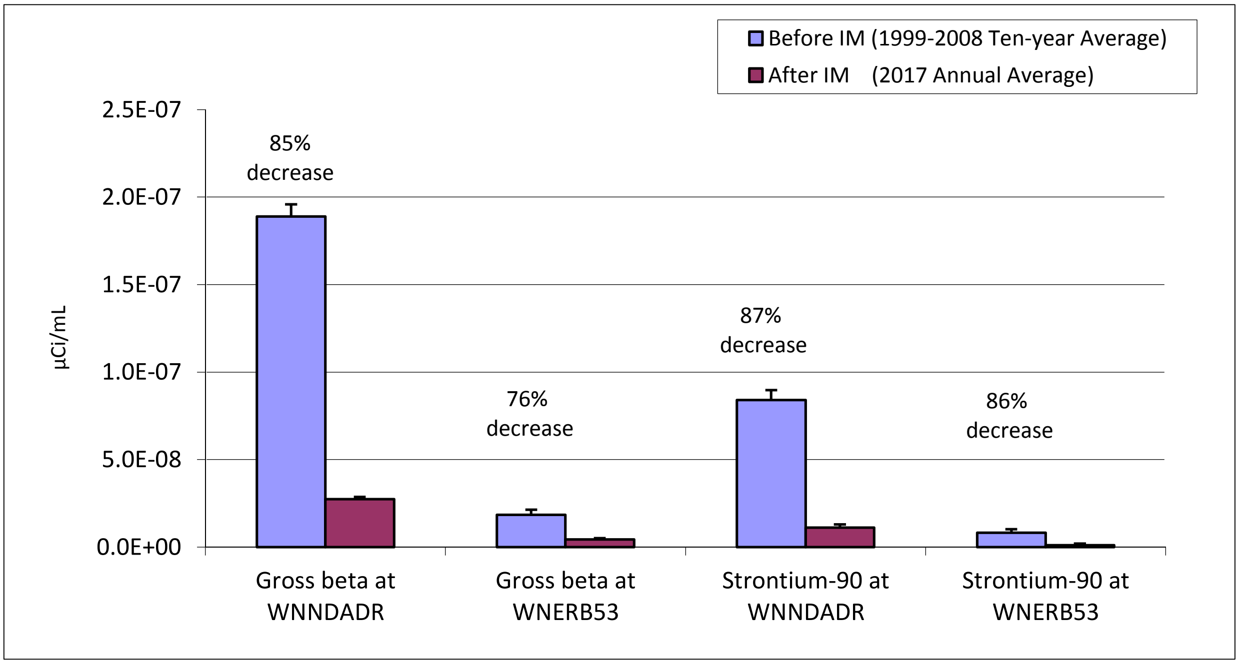
As in previous years, concentrations at WNSP006, sampled at Franks Creek downgradient of the lagoon 3 outfall, statistically exceeded background for gross beta and several radioisotopes. However, all of the radioisotopic concentrations measured at WNSP006 in 2017 were also well below DCSs. (See Table B-4D.)

South Plateau (WNNDADR, WNERB53, and WNFRC67). Downgradient of the NDA, gross beta and strontium-90 concentrations continued to exceed background concentrations in 2017 at both WNNDADR and WNERB53, and tritium continued to exceed background at WNNDADR, but all remain well below their respective DCS. Residual soil contamination from past waste burial activities is thought to be the source of this radioactivity.

Figure 2-4 compares the gross beta and strontium concentrations at the two surface water locations downstream of the NDA before and after 2008, when a geomembrane cap and slurry wall were constructed at the NDA to limit groundwater, surface water, and precipitation flowing into the NDA. Average gross beta concentrations at WNNDADR and WNERB53 downstream of the NDA have decreased by 85% and 76% respectively, and the strontium-90 concentrations have decreased by 87% and 86% respectively. By reducing surface water infiltration and groundwater migration through the NDA, the cap and slurry wall have effectively reduced the discharge of gross beta and stronium-90 contaminated groundwater into the surface water drainage downstream of the NDA.

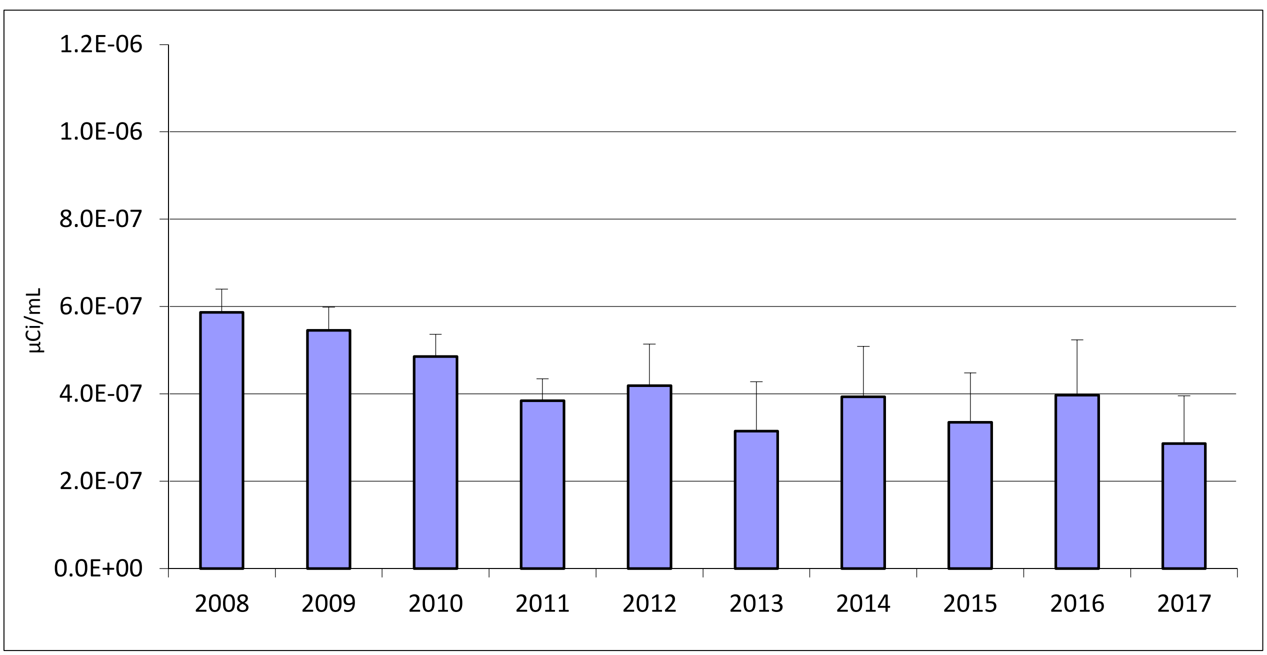
Tritium concentrations at WNNDADR have been decreasing overall since routine monitoring began at this location. (See Figure 2-5.) Tritium concentrations at WNNDADR have decreased from a high of 1.79E-05 µCi/mL in 1992 to an annual average concentration of 2.86E-07 µCi/mL in 2017. Since tritium's half-life is only slightly more than 12 years, these observed decreasing tritium concentrations are partly attributable to radioactive decay. Tritium concentrations at WNNDADR remained above the background concentration at Buttermilk Creek of <8.98E-08 µCi/mL but well below the tritium DCS of 1.9E-03 µCi/mL.

FIGURE 2-4
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 2017 were 2.20±0.67E-09 and -0.64±7.67E-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 2-5
Average Concentration of Tritium in Surface Water at WNNDADR: 2008-2017



Note: The upper limit of the uncertainty term is indicated with each point. Average background tritium concentration in Buttermilk Creek (WFBCBKG) in CY 2017 was <8.98E-08 µCi/mL.

The tritium concentration at WNFRC67 during the fourth quarter was slightly elevated above recent levels but the results were determined to be statistically indistinguishable from background and well below the DOE DCS for tritium of 1.9E-03 µCi/mL. The annual average for the four quarters was a non-detect result.

Appendix B-4 presents the data for the site surface water drainage monitoring locations discussed above. 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. Locations with results exceeding applicable limits and those with results statistically greater than background values are summarized in Table 2-4.

Off-Site Stream Monitoring

Buttermilk Creek receives surface water drainage from the WNYNSC. Buttermilk Creek drains into Cattaraugus Creek which eventually drains into Lake Erie. (See Figure INT-1 in the introduction.)

Surface water samples were collected at three off-site locations in 2017:

- one background location on Buttermilk Creek upstream of the WVDP at Fox Valley Road (WFBCBKG) shown on Figure A-5,
- one downstream location on Buttermilk Creek at Thomas Corners Bridge (WFBCTCB), just before Buttermilk Creek flows into Cattaraugus Creek, shown on the aerial photo below, and
- one further downstream location on Cattaraugus Creek at Felton Bridge (WFFELBR), the first point of public access to surface water downstream of both the WNYNSC and the WVDP, also shown on the aerial photo below.

Background samples were also historically collected on Cattaraugus Creek at Bigelow Bridge on Route 240 (WFBIGBR), upstream of the confluence of Buttermilk Creek and Cattaraugus Creek. This location is also annotated on Figure A-5.

FIGURE 2-6
Surface Water Sampling Locations Downstream of the WVDP on Cattaraugus Creek and Buttermilk Creek

TABLE 2-4
2017 Environmental Monitoring Locations
with Results Greater than Applicable Limits or Background

Sample Type	*Total Number of Sampling Locations and Description* [b]	*Locations with Results Greater than Applicable Limits or Screening Levels* [a] *(Constituent)*	*Number of Locations with Results Greater Than Background*	*Locations with Radiological Results Statistically Greater than Background (Constituent)*
Air				***background location=AFGRVAL***
On-site air emission points	5 MPPB Stack MPPB RVU HLW Tanks LSA Storage RHWF	**None**	5	**ANSTACK** (gross alpha, gross beta, H-3, Sr-90, I-129, Cs-137, Pu-238, Pu-239/240, Am-241); **ANRVEU1** (I-129); **ANSTSTK** (H-3, I-129); **ANCSPFK** (I-129) **ANRHWFK** (I-129)
On-site portable ventilation units (PVUs)	15 In work areas inside or outside of the MPPB, VF, CSRF, and LSA 4	**None**	0	**None**
Off-site ambient air network	16 In each direction on NYSERDA site permeter and in Great Valley	**None**	0	**None**
Surface water				***background locations = WFBCKBG on Buttermilk Creek and WFBIGBR on Cattaraugus Creek***
On-site surface water effluent and natural drainage	8 001 Outfall Franks Creek downstream of 001 MPPB Ditch Northeast SWAMP drainage North SWAMP drainage North of the NDA Erdman Brook Franks Creek upstream of 001	**WNSWAMP** (Gross beta)	7	**WNSP001** (Gross alpha, Gross beta, H-3, Sr-90, Tc-99, Cs-137, U-232, U-233/234, U-235/236, U-238, Pu-238, Pu-239/240, Am-241) **WNSP006** (Gross beta, Sr-90, U-232, U-233/234, U-235/236, U-238); **WNSP005** (Gross alpha, Gross beta, Sr-90); **WNSWAMP** (Gross beta, Sr-90); **WNSW74A** (Gross beta, Sr-90, U-238); **WNNDADR** (Gross beta, H-3, Sr-90); **WNERB53** (Gross beta, Sr-90)
Off-site downstream surface water	2 Thomas Corners Bridge Felton Bridge	**None**	1	**WFBCTCB** (Gross alpha, Gross beta, Sr-90);

[a] Applicable regulatory, guidance, or screening limits are listed in Table UI-4 (radionuclides in air and water), and Appendix B-1 (water).
[b] Sampling locations shown on Figures A-2 (on-site water), A-5 (off-site water, soil, sediment), A-6 (on-site air), A-7 (off-site air), A-11 (near-site deer, fish, milk, crops), A-12 (on-site Thermoluminescent Dosimeters [TLDs]), A-13 (off-site TLDs), A-14 (samples > 5 km from site).

TABLE 2-4 *(concluded)*
2017 Environmental Monitoring Locations
with Results Greater than Applicable Limits or Background

Sample Type	***Total Number of Sampling Locations and Description*** [b]	***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)*
Soil (1 background location=SFGRVAL)				
Off-site soil	3 Fox Valley Road Route 240 Rock Springs Road	**None**	0	**None**
Sediment (2 background locations, one on Buttermilk Creek=SFBCSED and one [historical] on Cattaraugus Creek=SFBIGSED)				
<u>On-site</u> sediment/soil	3 Northeast SWAMP drainage North SWAMP drainage Franks Creek	**SNSWAMP** (Sr-90)	3	**SNSWAMP** (Gross alpha, Gross beta, Sr-90, Cs-137, U-233/234); **SNSW74A** (Cs-137); **SNSP006** (Gross beta, Sr-90, Cs-137)
<u>Off-site</u> sediment	3 Thomas Corners Bridge Springville Dam Felton Bridge	**None**	1	**SFTCSED** (Cs-137)
Food				***background locations = BFMCTLS milk and BFDCTRL venison***
<u>Off-site</u> milk samples	4 From local producers as shown on Figure A-11	**None**	0	**None**
<u>Off-site</u> venison samples	3 Rock Springs Road	**None**	0	**None**
<u>Off-site</u> fish	2 Above and below Springville Dam	**None**	0	**None**
<u>Off-site</u> vegetables	3 Apples Beans Corn	**None**	0	**None**
Environmental radiation				***background location=DNTLD23***
<u>On-site</u> dosimeters near WVDP facilities	11 Near CPCWSA, HLW Tanks, MPPB, NDA, SDA, HLW Cask Storage, and Drum Cell	**None**	3	**DNTLDs #24, 38, 40**
<u>Off-site</u> perimeter dosimeters	17 In each direction on NYSERDA site permeter and in Great Valley	**None**	0	**None**

[a] Applicable regulatory, guidance, or screening limits are listed in Table UI-4 (radionuclides in air and water), and Appendix B-1 (water).
[b] Sampling locations shown on Figures A-2 (on-site water), A-5 (off-site water, soil, sediment), A-6 (on-site air), A-7 (off-site air), A-11 (near-site deer, fish, milk, crops), A-12 on-site TLDs), A-13 (off-site TLDs), A-14 (samples > 5 km from site).

Historical data from WFBIGBR from 1991 through 2007 have been used to establish upstream background concentrations for Cattaraugus Creek for comparison to samples collected at WFFELBR.

Timed, continuous composite samples from these locations are analyzed for gross alpha, gross beta, tritium, strontium-90, and cesium-137 radioactivity. These data are tabulated in Appendix B-4.

2017 Update for Off-Site Stream Monitoring

Felton Bridge (WFFELBR). All of the CY 2017 monthly gross alpha, gross beta, tritium, strontium-90, and cesium-137 concentrations at Felton Bridge, the first point of public access downstream of the site, were below the Cattaraugus Creek background (WFBIGBR). (This data is summarized in Table B-4I.)

Thomas Corners Bridge (WFBCTCB). As in previous years, gross beta and strontium-90 were detected above background in the samples collected downstream of the WVDP on Buttermilk Creek at Thomas Corners Bridge. Gross beta, which is naturally occurring in the environment, is frequently detected in surface water due to minor amounts of sediment in the samples. The maximum gross beta concentration at WFBCTCB was 1.1% of the strontium-90 DCS. The annual average strontium-90 concentration was a slightly positive value in 2017 (1.92E-09 µCi/mL). (See Table B4-H.) However, the maximum strontium-90 concentration at this location was less than 0.2% of the strontium-90 DCS.

The gross alpha concentration at Thomas Corners Bridge was also above background in 2017. The samples from this location were observed to contain fine sediment, which are believed to be contributing to the slightly elevated alpha. A special analysis was done on these samples for alpha isotopes. Very low levels of natural uranium were detected but all site alpha isotopes were non-detects.

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, 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. Construction of the new drinking water treatment and distribution system, designed to replace the drinking water components that are currently housed in the utility room was completed in 2017 and went on-line in early 2018.

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 CCHD 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.

Drinking Water Update for 2017

Results from 2017 indicated that the Project's drinking water continued to remain below the local, state, and federal MCLs and drinking water standards for chemical contaminants.

Radiological measurements for the supply wells and the nearby bedrock wells were similar to background levels. The 2017 results for the potable water supply system are presented in Appendix B-5.

Sediment and Soil Monitoring Program

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 WVDP 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. In 2017, on-site soils were 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.)

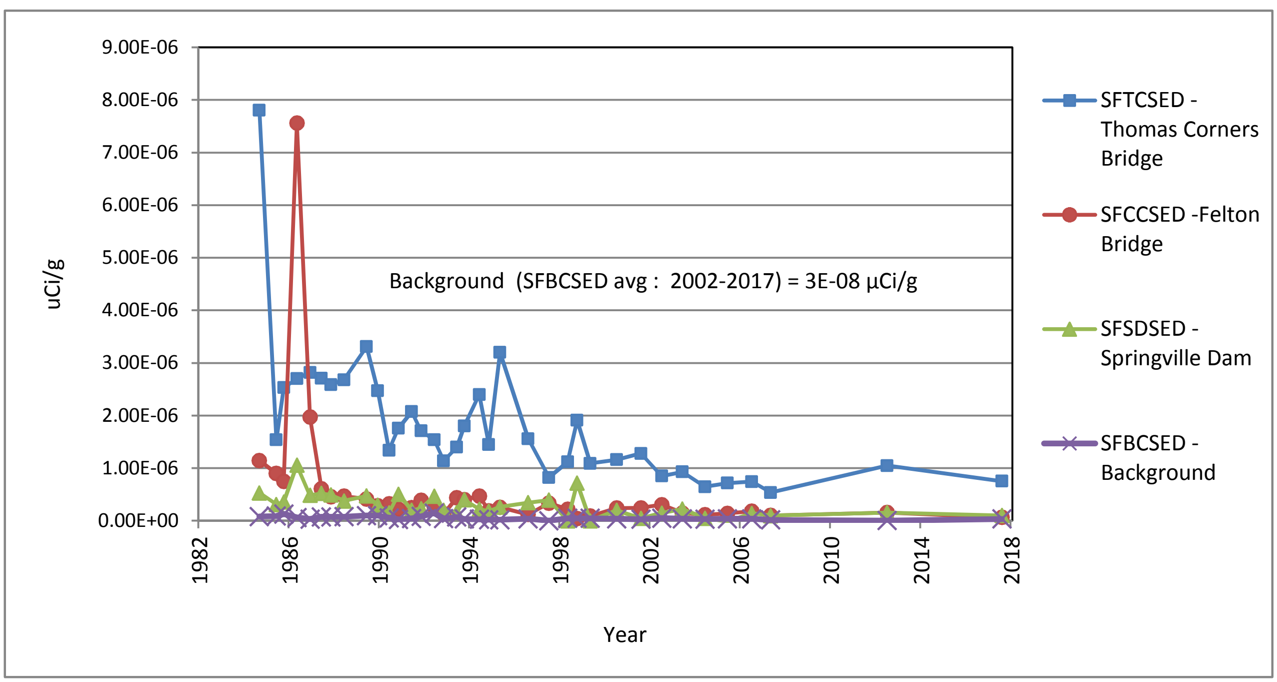
Sediment and Soil Update for 2017

The five year routine soil/sediment sampling under the environmental monitoring program was conducted in 2017. These data are presented in Appendix F. On-site soils are compared to several different clean-up criteria since on-site soil could potentially require remediation. Only strontium-90 at on-site location SNSWAMP exceeds the NRC soil screening level and WVDP site-specific goal presented with the data in the Appendix F tables. None of the other measured on-site soil concentrations exceed these reference values. This is consistent with past on-site soil data.

On-site soil samples collected in 2017 were also compared to background. Radioisotopes that statistically exceeded background are listed in Table 2-4. Cesium-137 was found at all three on-site soil sampling locations statistically above background, and strontium-90 was found at two of the three on-site soil locations statistically above background. The cesium-137 and strontium-90 in on-site soils are a result of historical site activities. The strontium-90 detected at SNSWAMP is due to the strontium-90 groundwater plume discharging to the WNSWAMP drainage swale.

Off-site soils and sediments are compared to the appropriate background in Appendix F. None of the measured concentrations of soil or sediment collected off-site in 2017 statistically exceeded background with the exception of cesium-137 which was detected at the Thomas Corners Bridge sampling location on Buttermilk Creek, downstream of the site. Cesium-137 has exceeded background at this location since sediment sampling for the WVDP at these locations first began in the early 1980s. Cesium concentrations in the downstream sediment appear to be decreasing overall. (See Figure 2-7.) It is interesting to note that cesium-137 is also frequently detected in soils and sediment across the globe from nuclear weapons testing that occurred from 1945 to 1980.

FIGURE 2-7
Historical Cesium-137 Concentrations in Sediment



Monitoring of Food Sources

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 2017 being the most recent sampling year in this cycle. Corn, apples, and beans are collected at harvest time. Venison samples are typically collected during the fall when deer are most active and fish may be collected at any time of the year, but are not usually collected during the winter. The edible portions of the deer and fish are sampled and analyzed for radionuclides.

Food Update for 2017

In 2017, milk and venison data continue to demonstrate that the Project has a minimal effect on local food sources. No radionuclides were detected in milk, venison, fish or vegetables samples statistically above background in 2017.

Steelhead trout
collected from Cattaraugus Creek in 2017

In the 2017 venison samples, none of the cesium-137 concentrations in the three near-site deer exceeded the cesium concentrations detected in the background deer collected more than 10 miles (16 km) from the site.

Near-site whitetail deer

Data from 2017 for milk, venison, fish and vegetable samples are presented in Appendix E.

As discussed under "Calculated Dose from Food Samples" in Chapter 3, the 2017 conservative dose estimates from consuming maximum quantities of near-site deer, fish, milk, beans, corn, and apples are well below any level of concern and have consistently helped confirm the low dose estimates from the site based on results from air and water monitoring.

Direct Radiation Monitoring

Thermoluminescent Dosimeters (TLDs) directly measure radiation in the environment. 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. On-site/near-site TLD locations are shown on Figure A-12 and perimeter TLD locations (off-site) are shown on Figure A-13 in Appendix A. No changes were made to the location of TLDs in 2017.

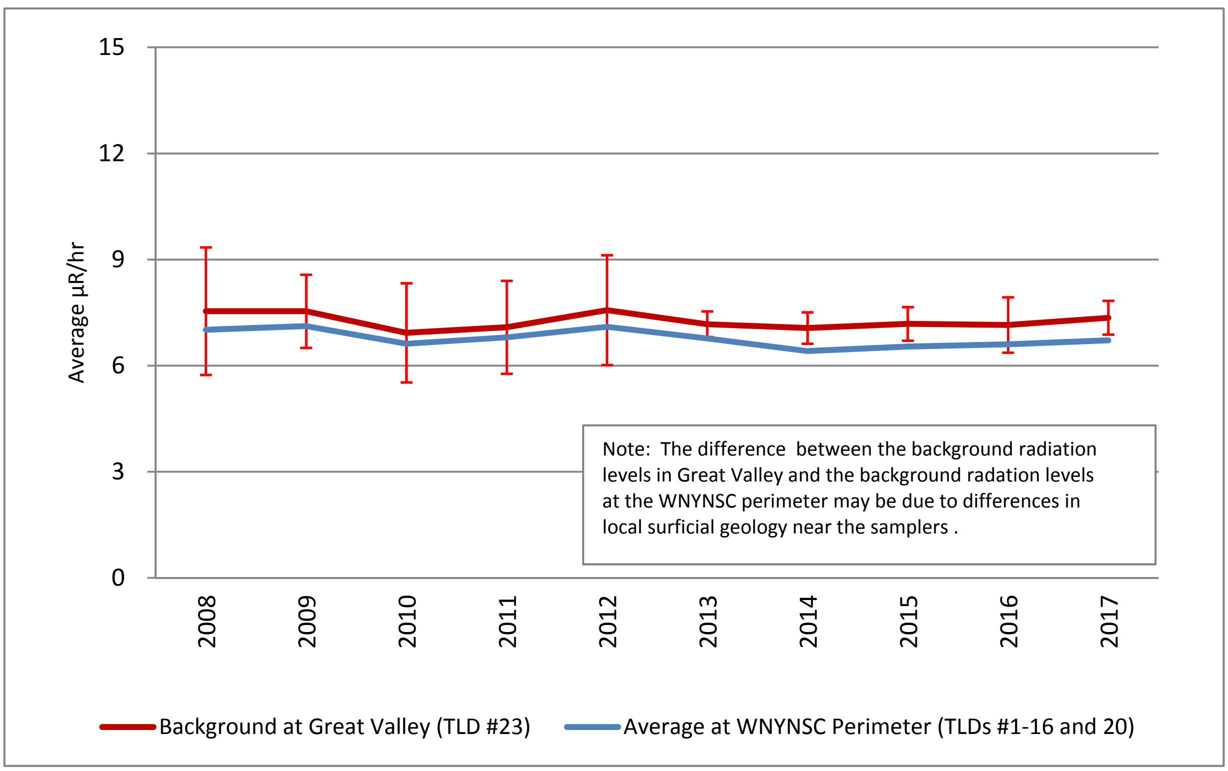
Direct Radiation Update for 2017

Figure 2-8 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. No discernible trends over time are evident. TLD data is presented in Appendix G.

Consistent with historical data, the 2017 results from three of the on-site/near-site TLDs (DNTLD24, DNTLD38, and DNTLD40) located on site near north plateau waste storage facilities, were higher than background. These locations are not accessible by the public. On the south plateau, all of the on-site/near-site TLD results remained at background levels.

The average 2017 results at the off-site WNYNSC perimeter TLDs (TLDs #1-16 and 20) are equivalent to the background TLD (TLD #23) in Great Valley. As shown in Figure 2-8, the average for the perimeter TLDs has consistently been very close to, but below the value measured at the background TLD in Great Valley. This dissimilarity may be due to geological characteristics that differ between the perimeter and background locations.

FIGURE 2-8
10-Year Trends of Environmental Radiation Levels at Perimeter and Background Thermoluminescent Dosimeters (TLDs)



NOTE: The upper and lower limits of the 95% confidence limit of the mean are plotted with each result.

Special Projects - VF Demolition Study

Sampling of two on-site ambient air monitors located downwind of the VF began in 2016, as required by EPA, and will continue during VF demolition. The VF demolition results from the samplers will be used to validate that the modeled demolition emissions of less than 0.1 mrem are not underestimated so that the same predictive methodology can be used for planning demolition of the MPPB.

This monitoring program is part of the "Test Plan for Study of Air Emissions from the Demolition of the Vitrification Facility at West Valley Demonstration Project Compared to Emissions Estimates using Methodology for Radionuclide Source Term Calculations for Air Emissions from Demolition Activities," (Blunt Consulting, LLC, December 2016).

The demolition study samplers collected data from September to December 2017 during the beginning months of VF demolition. Additional monitoring and sampling of the work area is performed for worker protection and safety by Radiological Controls personnel. The demolition study samples are collected on a weekly basis. Low levels of cesium-137 were observed in December 2017 on the study samplers located just outside the contamination area as demolition into the VF progressed into the VIT cell, the most highly contaminated area of the building. However, cesium-137 was not detected at the off-site samplers.

In addition to the application of fixatives, a continuous spray of misting water, typically water mixed with dust control products, is used for dust suppression during demolition to limit airborne releases. The maximum cesium-137 concentration detected in CY 2017 at the demolition study samplers was 2.89E-15 µCi/mL, well below the cesium-137 DCS of 8.8E-10 µCi/mL.

Environmental Monitoring Summary

As in the past, although concentrations of certain radiological constituents from samples collected within the security fence exceeded comparison levels or background concentrations (as shown in summary Table 2-4), results from off-site and downstream confirm that the public's health and safety, and the environment continue to be protected. Off-site releases are well below the DOE public dose limit of 100 mrem/yr as demonstrated by the discussion in Chapter 3, "Dose Assessment."

Monitoring results from CY 2017 confirm the effectiveness of radiological and nonradiological contaminant control measures practiced at the WVDP. A video describing the WVDP environmental monitoring program is available for viewing at:

https://youtu.be/rTXr-COlmEs or
http://www.chbwv.com/video9.htm

CHAPTER 3

DOSE ASSESSMENT

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. This chapter provides estimates of the maximum potential dose to the public and to plants and animals (biota) from 2017 WVDP activities. A discussion is also included of cancer risk that puts the predicted maximum potential dose estimates into perspective with other lifetime cancer risks.

2017 Highlights

As in previous years, estimated potential dose from the WVDP to the maximally exposed individual were orders of magnitude below applicable EPA standards and DOE public dose limits and constitute a very small fraction of 620 mrem that the average member of the public receives annually from natural background sources, such as radon, and man-made sources such as medical procedures. There has been negligible change in the estimated annual dose from the WVDP in recent years.

Total Dose from All Pathways. The 2017 total estimated dose from the Project to an off-site resident was <0.47 mrem, far below the DOE public dose limit of 100 mrem for dose from all pathways established 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 from the Air Pathway. The estimated dose from airborne emissions from the WVDP in 2017 was below detection limits (<0.46 mrem) using the data collected at the ambient air samplers. Annual air emissions of radioactivity are regulated by EPA and limited to 10 mrem per year. Demolition of the VF began in September 2017. Radioisotope concentrations at the 16 ambient air samplers were below minimum detectable concentrations (MDCs) throughout 2017.

Dose from the Water Pathway. The total estimated dose from waterborne releases from the site was modeled as 0.016 mrem. Dose from surface water exposure pathways is evaluated by their contribution to the DOE total all pathway dose limit of 100 mrem per year.

Dose to Biota. Biota dose modeling indicates the plants and animals living on or near the WVDP are not being exposed to doses in excess of the DOE biota dose standard.

Dose to the Public

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 EPA- and DOE-approved methods and models.

Radiation Sources at the WVDP

Members of the public are routinely exposed to natural and man-made sources of ionizing radiation that can be absorbed by living tissue. (See the inset on page 3-4 for discussions of "Radiation Dose" and "Units of Dose Measurement.") 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.

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. (See the "Useful Information" section of this report for discussions of ionizing radiation.) Figure 3-1 shows the estimated (all pathway) maximum potential individual dose from the WVDP in CY 2017 compared with the average annual dose a U.S. resident receives from man-made and natural background sources. The estimated (all pathway) maximum individual dose from the WVDP in CY 2017 was <0.47 mrem. This is a very small fraction of the average annual dose a U.S. resident receives from man-made and natural background sources (620 mrem).

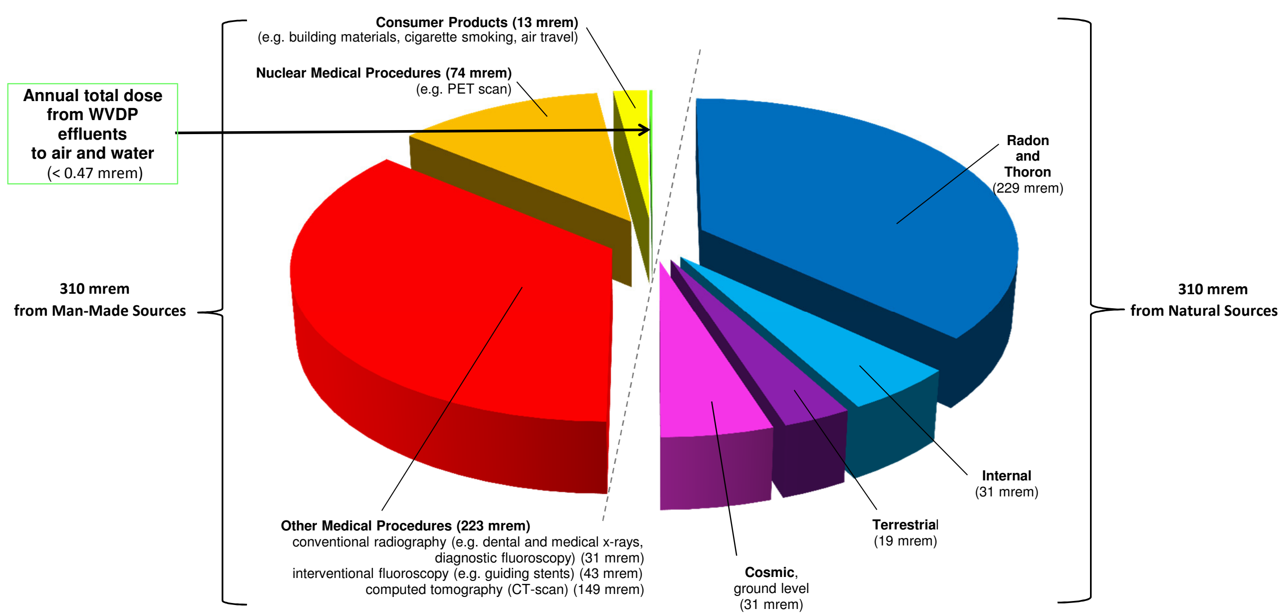
Each year, very small quantities of the radioactive materials remaining at the WVDP are released to the environment. Radioactive materials at the WVDP are residues from the commercial reprocessing of nuclear fuel by NFS in the 1960s and early 1970s. Emissions and effluents are strictly controlled so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

Exposure Pathways

Human beings are exposed to natural radiation and to man-made radiation sources through a variety of exposure pathways. An exposure pathway consists of a route for contamination to be transported by an environmental medium from a source to a receptor. 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.

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. As noted in this table, the WVDP model for the waterborne pathway includes ingestion of milk, crops, meat and fish, and external exposure from waterborne activities like swimming and boating.

FIGURE 3-1
Comparison of Doses from Natural and Man-Made Sources to the Dose From 2017 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.

Note that drinking water is not considered a pathway from the WVDP to the public because surveys have determined that no off-site public water supplies are drawn from downstream Cattaraugus Creek before Lake Erie or from groundwater in aquifers potentially affected by the WVDP.

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 Air 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.

Airborne Dose Assessment Methodology

Dose via the air pathway historically was estimated using an air dose model with input from measured or estimated emissions from on-site sources. After a period of comparison with modeled results, EPA gave final approval for the WVDP to use measured ambient air monitoring data to demonstrate compliance with the CAA regulations. Since 2014, dose via the air pathway has been estimated by comparing measured ambient air radioactivity with EPA standards using a sum of the ratios analysis. Figure A-7 shows the location of these samplers.

There are sixteen low-volume ambient air samplers encircling the WVDP and one high-volume sampler co-located with a low volume sampler in the north-northwest (NNW) sector, the predominant downwind direction and approximate location of the historically modeled maximally exposed individual. These 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. Ambient air is also monitored at the background low-volume air sampler located in Great Valley, New York (AFGRVAL, shown on Figure A-14), 18 miles (29 km) south of the site. Ambient air conditions have been monitored at this background location since 1984. The network of samplers remained more than 97.4% operational in 2017, the fifth complete year the ambient network was in service.

Since the WVDP was established in 1980, point source emissions from the Project stacks have been very low. Slight increases in point source emissions were observed for iodine-129 from 1996 to 2002 when the HLW in the tanks was being vitrified. The dose from this increase was well below compliance limits. Since vitrification was completed in 2002, the primary work performed on site has included decontamination of the rooms and cells in the MPPB and VF and removal of facilities. In recent years, diffuse sources, such as releases from demolition combined with low levels of radioactivity released to the air from natural evaporation from the lagoons, have become the larger potential contributors to airborne dose. Consequently, compliance based on ambient air monitoring is now a more appropriate method at the WVDP as point source discharges have been curtailed and work activities at the WVDP have progressed toward decommissioning and facility demolition.

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, with the dose from internally deposited radionuclides, to obtain the total EDE.

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 80 km collective dose is the sum of all doses to all individual members of the public within 80 km of the WVDP.

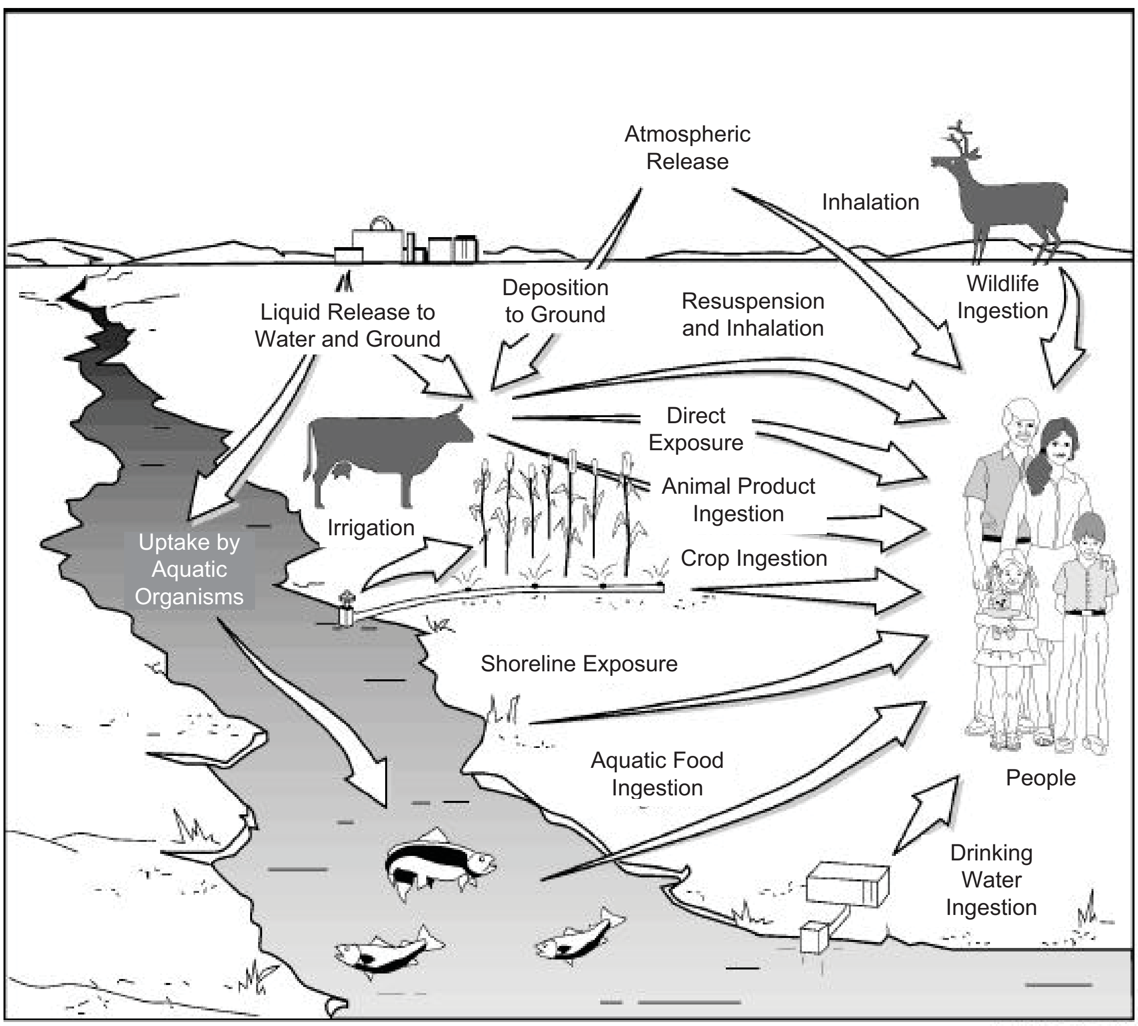
2017 Maximum Airborne Dose to an Off-Site Individual

The site work performed in 2017 was focused on VF demolition, continued preparation of the MPPB and ancillary facilities for demolition, and off-site waste shipments. No measured radioactivity increases were observed at the off-site ambient air monitoring network encircling the site in 2017, including in the fall and winter quarter during VF demolition. Radioactivity measurements at the ambient air samplers in 2017 were similar to the measurements at the background sampler in Great Valley.

The estimated annual dose from airborne emissions from the WVDP is calculated using the data collected at the ambient air samplers with a "compliance ratio." This method of estimating dose is explained in the inset box "Using Ambient Air Concentrations and the Compliance Ratio to Estimate Airborne Dose" on the following page. Because the measured radioactivity at the samplers is below detection limits, the estimated dose based on these data is also below detection. This has been the case since the ambient air samplers were first installed.

The dose from WVDP air emissions in 2017 was <0.46 mrem (<0.0046 mSv), which is well below the 10 mrem/year (0.1 mSv/year) permissible NESHAP emission limit established by EPA. The estimated dose, using the measurements from the ambient air monitors (which were all non-detect), is an upper bound of the potential dose that is based on the detection limits of the samplers.

FIGURE 3-2 Potential Radiation Exposure Pathways to Man



Reference: DOE-HDBK-1216-2015

Using Ambient Air Concentrations and the "Compliance Ratio" to Estimate Dose

Filter media and charcoal canisters from each ambient air sampler around the WVDP were analyzed throughout the calendar year and are used to calculate the average airborne radioactivity measurements for each radionuclide at each sampler location. The 2017 ambient air data are summarized in Table C-10.

The NESHAP regulations include a tabulation of hypothetical radionuclide concentrations that would result in a 10 mrem/yr dose if a person were exposed to that concentration for a full year. The dose estimate methodology involves comparing actual measured concentrations to the hypothetical concentrations associated with a 10-mrem dose. A measured concentration that is a fraction of the concentration from the EPA standard corresponds to an equivalent fraction of the 10 mrem dose.

Low-volume (left) and high-volume (right) samplers located in the historical predominant downwind direction from the site

To determine dose, the measured annual average radioactivity at the ambient air samples is compared to the concentration levels for NESHAP compliance to determine a radionuclide specific ratio. The ratios for each isotope are summed to generate a "compliance ratio" for each sampling location. This ratio is a value showing what fraction of the limit was measured in the ambient air for each radionuclide of interest. Since the concentrations for NESHAP compliance are the annual average radionuclide concentrations that would result in a 10 mrem/year dose if a person were exposed to that concentration for a full year, a measured concentration that is a fraction of the standard corresponds to an equivalent fraction of the 10 mrem dose. Therefore, the compliance ratio (the sum of the ratios for each isotope 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. The table below demonstrates how this compliance ratio is calculated.

Example Compliance Ratio Calculation using 2017 AF10_SSW Data

Isotope	*Annual Average Concentration*	*NESHAP Compliance Level (Appendix E)*	*Ratio of Average Concentration to Compliance Level*	*Dose (Compliance Ratio x 10 mrem)*
	(µCi/mL)	*(µCi/mL)*		*(mrem)*
Sr-90	< 1.08E-16	1.90E-14	<0.0057	< 0.057
I-129	< 6.79E-17	9.10E-15	<0.0075	< 0.075
Cs-137	< 9.94E-17	1.90E-14	<0.0052	< 0.052
U-232	< 1.58E-17	1.30E-15	<0.0122	< 0.122
Pu-238	< 1.11E-17	2.10E-15	<0.0053	< 0.053
Pu-239/240	< 9.92E-18	2.00E-15	<0.0050	< 0.050
Am-241	< 9.38E-18	1.90E-15	<0.0049	< 0.049
			Compliance Ratio <0.046	**Dose (Sum of Ratios) <0.46 mrem**

*NOTE: The isotopes analyzed for were selected based on historical site significance with respect to dose to the public.

Continuous Air Effluent Monitoring. The emissions from the on-site ventilation stacks are monitored continuously while in operation, and will continue to be monitored until ventilation is no longer needed. There have been no major changes in air emissions from the ventilation stacks since vitrification was completed in 2002, as shown by the Figure 3-3 trend graphs of annual average gross alpha, gross beta and iodine-129 concentrations over the past 16 years.

The MPPB stack sampler (ANSTACK) and the STS stack sampler (ANSTSTK) data are shown on these graphs because they have historically been the largest contributors to the total estimated dose from airborne emissions. Iodine-129 is included in these graphs because the majority of the historical airborne dose came from this radioisotope during vitrification. As shown, iodine-129 is no longer being released at these higher concentrations.

The trend graphs show a slight increase in the annual average gross alpha and gross beta activity for ANSTACK in 2017 that continued into early 2018. This short term increase was the result of a poor seal on a closed damper that was identified and remedied. This small increase in on-site emissions did not result in a detectable increase in off-site radioactivity in air.

Radon

NESHAP regulations specifically exclude radon from being included in annual total air emission dose calculations. However, a discussion of radon dose in the ASER is required by DOE guidance. Both naturally occurring and man-made radon may be a significant contributor to dose.

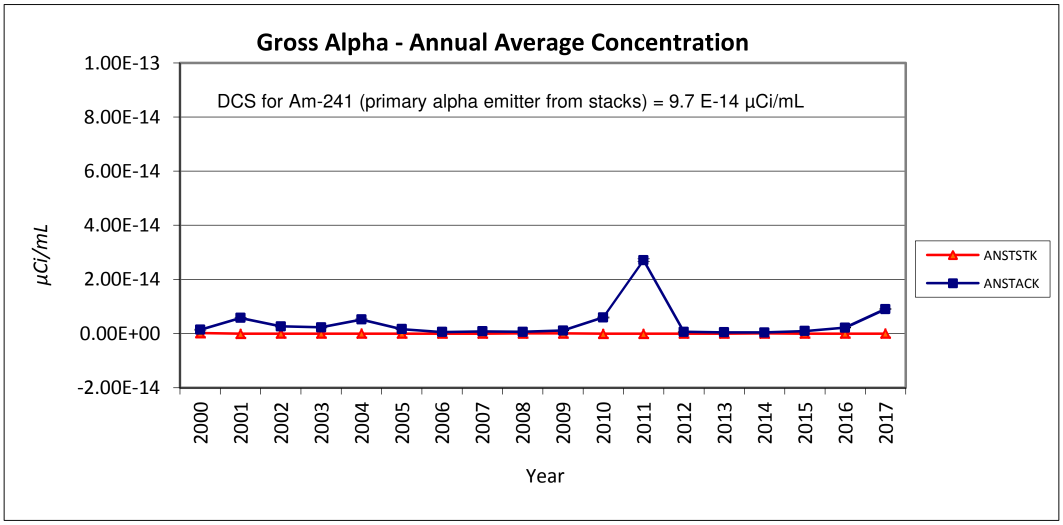
According to the federal report on typical population exposures published by the National Council on Radiation Protection and Measurements (NCRP-160), naturally occurring radon (radon-222) and thoron (radon-220) contribute, on average, an estimated dose of 229 mrem. (See Figure 3-1.)

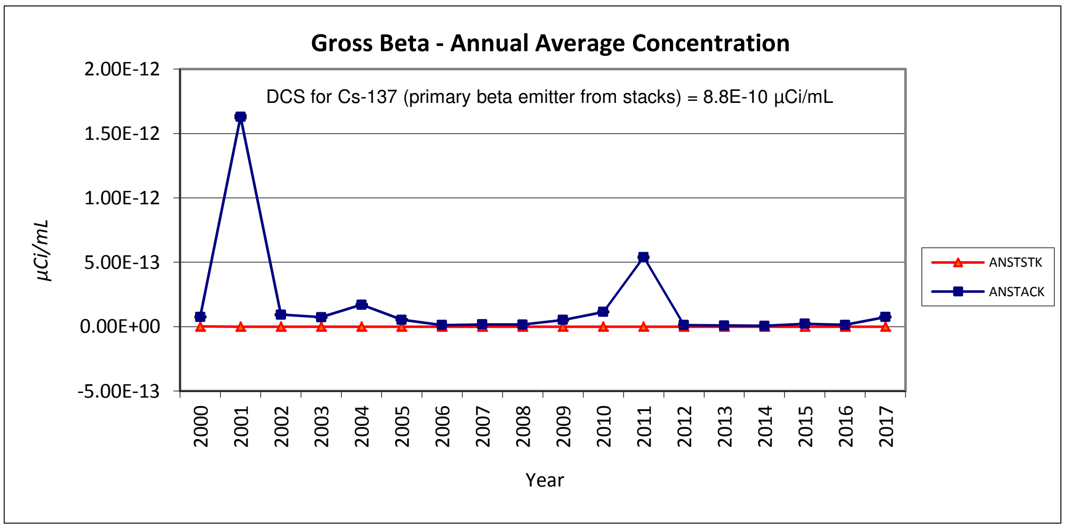
Radon-220, also known as thoron, is a naturally occurring gaseous decay product of thorium-232. However, radon-220 has also historically been measured in the airborne emissions from the WVDP due to the thorium reduction extraction (THOREX) process that was performed in the MPPB during NFS operations.

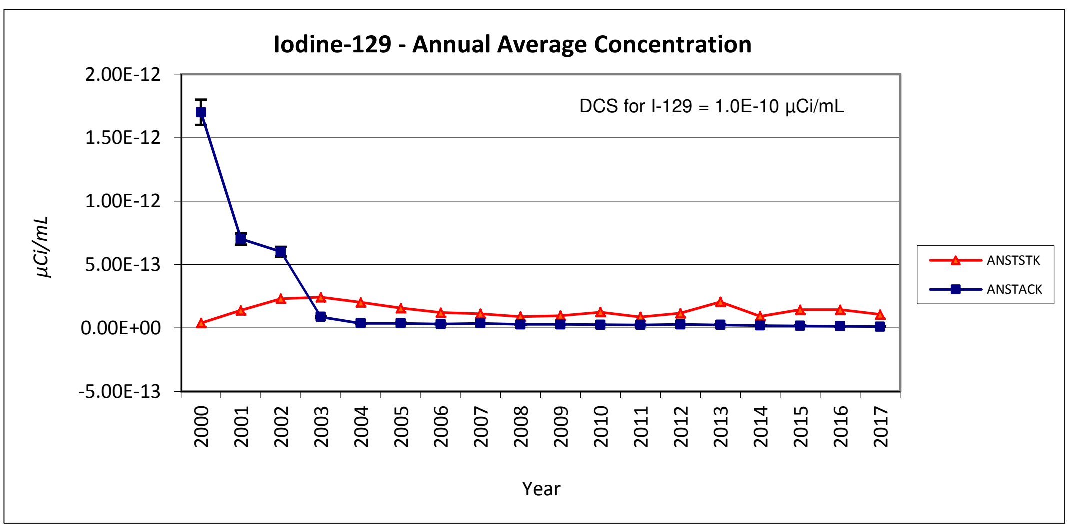
Thoron levels were observed to increase during startup of HLW vitrification in 1996. An average of about 12 curies per day (Ci/day) were assumed to have been released based on an estimate of thoron released during each waste concentration cycle of the VIT process. (Chapter 2 of the 1996 WVDP ASER, West Valley Nuclear Services Company [WVNSCO] and Dames & Moore, June 1997). With vitrification completed, thoron releases were estimated to return to pre-VIT levels of about 3 Ci/day (conservatively based on thoron radioactivity measured from ANSTACK in the 1990s). Historical CAP88 modeling results indicate the dose from a 3 Ci/day thoron release to a MEOSI located 1.2 miles from the site would have been only 0.094 mrem (0.00094 mSv), significantly below the 10-mrem NESHAP standard. The collective dose to the population within a 50-mi (80-km) radius would have been 4.5 person-rem (0.045 person-Sv).

Monitoring for radon-220 is no longer performed. However, it is likely that the thoron emissions from the MPPB have decreased substantially in recent years due to removal of significant source material during decontamination activities, including removal of some of the MPPB HEPA filters. Thus, the current dose from thoron is likely even less than 0.094 mrem/year.

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







Population Data

Population information is required when using computer models for annual dose assessments for a community. 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 U.S. census and the 2011 Canadian 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. The spatial distribution of population within the 50-mile (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. No local population changes occurred in 2017.

Collective Population Dose

The annual collective population dose is the sum of the dose to each individual living within 50 miles (80 km) of the site. This population receives 502,836 person-rem/yr from natural sources. This is computed by multiplying 310 mrem/yr (the individual annual dose from natural sources as shown on Figure 3-1) by 1.62 million people living within 50 miles of the WVDP. The collective population dose from WVDP activities (to the same 1.62 million people) is estimated using dose assessment models for air and water exposure. The WVDP collective population dose is a very small fraction of that received from natural sources as described in the following sections of this chapter.

The WVDP is located in a sparsely populated rural area (view of the site from Dutch Hill)

2017 Collective Population Dose (Airborne)

Historically, CAP88 was used to determine the collective airborne dose to the population within a 50 mile radius of the site. The model took into account meteorological data and the spatial distribution of the public surrounding the site to determine the total collective population dose. Population unit dose conversion factors developed with the CAP88 model, were used together with the ambient air monitoring data in 2017 to make a conservative estimate of the 2017 collective population dose. The computed collective airborne dose using this method was <0.46 person-rem (<0.0046 person-Sv) from radioactive nonradon airborne emissions released from the WVDP in 2017, <0.000091% of the annual collective background population dose of 502,836 person-rem from natural sources. (See inset explanation above and Table 3-2.)

Dose From Waterborne Releases

DOE Order 458.1 requires DOE facilities to limit annual radiological exposure to less than 100 mrem from all pathways. There are no DOE dose limits for the water only pathway.

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). Exposure from drinking water is not included in the site-specific dose model for the WVDP since Cattaraugus Creek is not used as a drinking water supply. The nearest municipal water supplies downstream of the site are located on Lake Erie. Significant surface water dilution occurs between the site and Lake Erie. Therefore, a comparison of estimated doses from this source with the 4-mrem/year (0.04-mSv/year) EPA and NYSDOH drinking water limits is not appropriate (although values are well below the drinking water limits).

Special requirements in the SPDES permit specify that radionuclide concentrations in the discharge are subject to requirements of DOE Order 458.1, "Radiation Protection of the Public and the Environment." This is implemented by comparing pre-discharge concentrations with the DCS and obtaining NYSDEC approval prior to discharge.

Waterborne Dose Assessment Methodology

Potential dose to near-site residents and the local population from the waterborne pathway are estimated using site-specific surface water exposure models, GEN II and LADTAP, to simulate the pathways of radiation exposure

TABLE 3-2
Summary of Annual Total Effective Dose Equivalents (EDEs) to an Individual and From WVDP Releases in 2017

Exposure Pathways	***Annual Individual Dose***			***Estimated Collective Population Dose*** [b] *(1,622,050 people live within 80 km)*
	Critical Receptor/MEOSI [a]	***Comparison to EPA and DOE Standards***	***Comparison to Natural Background Radiation***	
Airborne Releases[c]				
Total Airborne Dose (measured at the ambient air ring)	**<0.46 mrem** (<0.0046 mSv)	<4.6% of 10 mrem EPA standard for air (0.1 mSv)	<0.15% of 310 mrem (3.1 mSv) Natural Background Radiation	**<0.46 person-rem** (<0.0046 person-Sv)
Waterborne Releases[d]				
Total Waterborne Dose (effluents and natural drainage)	**0.016 mrem** (0.00016 mSv)	*There are no EPA or DOE dose standards for the water only pathway.*	0.0051% of 310 mrem (3.1 mSv) Natural Background Radiation	**<0.068 person-rem** (<0.0068 Person-Sv)
Total From All Pathways	**<0.47 mrem** (<0.0047 mSv)	<0.47% of 100 mrem DOE standard for air and water combined (1 mSv)	<0.15% of 310 mrem (3.1 mSv) Natural Background Radiation	**<0.53 person-rem** (<0.0053 person-Sv) vs. the Background Population Dose of 502,836 person-rem[e]

[a] The critical receptor applies to the airborne dose. The MEOSI applies to the waterborne dose.
[b] The 80-km collective dose is the sum of all doses to all indvidual members of the public within 80 km of the WVDP. A population of 1.62 million is etimated 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, 2018).
[e] The background population dose = 1.62 million x 0.310 rem (from natural sources) = 502,836 person-rem.

from source to receptor. These models predict the dose based on site-specific sources, pathways, and exposure scenarios described below. Additional details about the model are included in the inset box "Using Dose Conversion Factors to Estimate Waterborne Dose" on page 3-12.

The primary waterborne sources of potential radioactivity from the WVDP are the 001 SPDES outfall (sampling location WNSP001 on lagoon 3), and at the two natural drainage channels on the north plateau, 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. Waterborne radioactivity released through these monitoring points is included in the dose calculations for the MEOSI and the collective population.

Felton Bridge on Cattaraugus Creek is the first point of public access to surface water downstream of the WNYNSC property and of the WVDP. Because the Project's liquid effluents eventually reach Cattaraugus Creek, the most important waterborne exposure pathway considered in the dose model 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.

2017 Maximum Waterborne Dose to an Off-Site Individual

Controlled discharges with low levels of radioactivity from SPDES outfall 001 and surface water discharges of strontium-90 by natural drainage continued in 2017. (Concentrations and flow volumes from these discharges are reported in Chapter 2.) Measurements of the radioactivity discharged in these effluents were combined with the Unit Dose Conversions Factors (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.

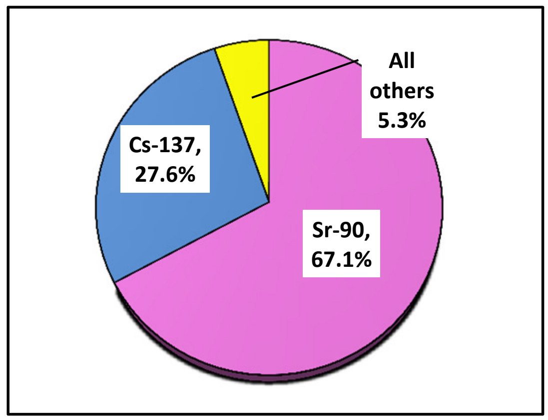
Contributions to the waterborne dose from controlled releases and from natural drainage are estimated separately.

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 2017. Most of the dose from the lagoon 3 discharge was from cesium-137.

An off-site individual could have received a maximum EDE of 0.011 mrem (0.00011 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 2017.

FIGURE 3-4
Dose Percent by Radionuclide
from Waterborne Releases in 2017



The combined EDE to the MEOSI from liquid effluents (0.005 mrem) and natural drainage (0.011 mrem) was 0.016 mrem (0.00016 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. (See Table 3-2.)

2017 Collective Population Dose (Waterborne)

The collective dose to the population living within 50 miles (80 km) of the WVDP from the site effluents plus the north plateau drainage was 0.068 person-rem (0.00068 person-Sv), 0.000014% of the annual collective background population dose from natural sources.

Dose From Air and Water Pathways

The total estimated dose for the WVDP in 2017 is a combination of a measured dose from air exposure and a modeled dose from water exposure.

Using Dose Conversion Factors To Estimate Waterborne Dose

The computer models GENII version 1.485 and LADTAP II were used to calculate site-specific unit dose factors (UDFs) for routine waterborne releases and dispersion of these effluents from the WVDP. These UDFs for water were used to estimate the annual waterborne dose from measured radioactivity in the 2017 water samples by multiplying the measured annual average radioactivity by the UDFs.

Radiological impacts were calculated by the models in terms of doses to the Maximally Exposed Off-Site Individual (MEOSI) and to the general population living within an 80-kilometer radius of the WVDP (collective population dose).

Site-specific average surface water flow rates for the potentially impacted streams are included in the input parameters to the model. Liquid effluents are assumed to reach surface waters via travel to Erdman Brook, Franks Creek, Buttermilk Creek, Cattaraugus Creek (the first potential source of off-site dose), and finally Lake Erie, approximately 40 kilometers (25 miles) west of the WVDP. Cattaraugus Creek flows into Lake Erie near its eastern end about 45 kilometers (28 miles) southwest of Buffalo.

Cattaraugus Creek serves as a water recreation area for swimming, canoeing, and fishing. Exposure pathways include consumption of game fish from Cattaraugus Creek, ingestion of meat and plant food products, as well as external exposure to sediment and water from swimming and boating. No potable water is drawn from Cattaraugus Creek downstream of the WVDP and no exposure to drinking water is included in the dose to the MEOSI.

The collective dose to the population within 80 kilometers of the site is analyzed for the population consuming water and fish from Lake Erie and includes exposure from other radiological pathways from the use of Lake Erie water (e.g. from irrigation). Consumption of potable water from Lake Erie is included in the population dose estimate since there is a drinking water exposure pathway from the lake. (Additional details are provided in the "Manual for Radiological Assessment of Environmental Releases at the WVDP," WVDP-065, revision 6, 2012.)

Cattaraugus Creek downstream of the site

2017 Total Dose (Air and Water)

Table 3-2 summarizes the dose from both the air and water exposure pathways. The potential dose to the public from both airborne and liquid effluents released from the Project in 2017 was <0.47 mrem (<0.0047 mSv), <0.46 mrem from the air pathway, plus 0.016 mrem from the water pathway. This dose is <0.47% of the 100-mrem (1-mSv) annual limit in DOE Order 458.1.

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 2017 the total curies released to surface water was greater than the total curies released to the air.

In CY 2017, the total collective dose to the population within 50 miles (80 km) of the site was <0.53 person-rem (<0.0053 person-Sv), <0.46 person-rem from air exposure plus 0.068 person-rem from water exposure, <0.00011% of the annual collective population dose from natural sources.

Radioactivity in the human pathway represented by these data illustrate that the WVDP contributes only a very minor dose to the natural background radiation dose that individuals and the nearby WVDP population receive.

Calculated Dose from Food Samples

As an independent check of the total dose estimates presented earlier in this chapter, the dose from local food consumption is estimated based on actual food samples collected near the WVDP. The air and water dose models include the dose from food using the measured radioactivity in air, soil, sediment and water to predict levels of contamination in food products as one of several exposure pathways. The potential dose to the public from actual radioactivity measurements in food from locations near the WVDP boundaries corroborates results from the air and water pathways dose calculations. Both dose estimates are well below the public dose limit.

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.) Ingestion Dose Conversion Factors (DCFs) for radionuclides measured in food have been developed by DOE (DOE/EH-0071) for use at DOE sites to convert measured radioactivity concentrations into dose. The measured radioactivity in food multiplied by these DCFs provides the estimated maximum potential dose from the food only pathway.

Radioactivity measurements in food from locations near the site are also compared with similar measurements from food samples collected at background locations to the WVDP. Near-site results are statistically compared with background results. These results are used as a conservative, independent confirmation of the dose estimates from all environmental pathways.

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. Although the DOE is currently re-evaluating these policies, no decision has been made based on this re-evaluation to date. Consequently, the moratorium and suspension currently remain in effect and compliance with the Secretary of Energy’s suspension of unrestricted release of scrap metal from radiological areas of DOE facilities for recycle continues at the WVDP.

Presently there are no approved criteria for transferring 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. At the WVDP, only scrap metal that has never been stored in a radiologically contaminated area can be recycled. All scrap metal determined recyclable must be accompanied by a “No Radioactivity Added Certification“ form that includes the history of the waste storage.

TABLE 3-3
WVDP Radiological Dose and Release Summary

Total Annual Dose for Calendar Year CY 2017									
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
<0.47 (<0.0047)	mrem (mSv)	<0.47%	1,622,050	<0.53 (<0.0053)	person-rem (person-Sv)	502,836 (5,028.36)	person-rem (person-Sv)	<0.00011%

WVDP Radiological Atmospheric Emissions[b] CY 2017 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)
2.85E-03 (1.05E+08)	NA	NA	NA	8.14E-04 (3.01E+07)	2.49E-05 (9.22E+05)	6.09E-05 (2.25E+06)	2.23E-07 (8.24E+03)	5.08E-06 (1.88E+05)	7.18E-06 (2.66E+05)	1.10E+03 (4.05E+13)

WVDP Liquid Effluent Releases[d] of Radionuclide Material - CY 2017 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
2.40E-02 (8.88E+08)	3.50E-03 (1.29E+08)	9.45E-05 (3.50E+06)	7.13E-02 (2.64E+09)	4.17E-04 (1.54+07)	8.89E-06 (3.29E+05)	3.06E-06 (1.13E+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 U.S. census) plus the Canadian population (from the 2011 Canadian census) residing within a 50-mi (80-km) radius.
[b] Air releases are from point and diffuse sources.
[c] Total uranium (airborne) (g) = 1.14E-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) = 3.91E+02.

2017 Estimated Dose from Food

Radionuclide concentrations in near-site milk, venison, fish and vegetable samples collected in 2017 were statistically indistinguishable from concentrations in background samples collected in the Western New York area (sampling locations shown on Figure A-14).

Conservative dose estimates for 2017 due to consuming near-site deer, fish, milk, beans, corn, and apples were estimated using concentrations measured in samples collected in 2017 to be about 0.091 mrem/year (0.00091 mSv/year), which is about 0.015% 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 2017 WVDP Effluents.") This estimate assumes the individual consumes the maximum quantities of each food item. This independent estimate of dose from the food only pathway helps confirm the low calculated doses based on air and water effluents, as summarized in Table 3-2.

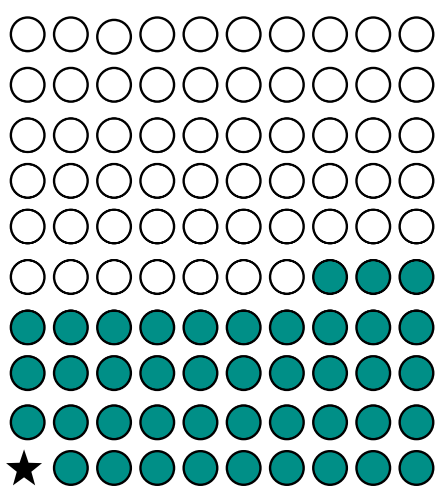
Risk Assessment

High doses of radiation are known to cause cancer in humans. There has been considerable research in recent years to evaluate cancer risk due to low doses of radiation. (See inset box for the "BEIR VII Cancer Risk Study.")

BEIR VII Cancer Risk Study

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. This 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 and continues to be debated.

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 2017 was <0.47 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 in the figure at left. 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 <0.47 mrem from WVDP operations in 2017 is almost five orders of magnitude lower than 10,000 mrem.

The potential risk from <0.47 mrem represents a fraction so small that it could not be seen if plotted as a fraction of the star on the BEIR VII Cancer Study graphic at left.

A risk assessment is performed each year in order to put the estimated maximum potential dose from WVDP activities for the current year into perspective with cancer risk.

Estimates of cancer risk from ionizing radiation have been presented by the National Council on Radiation Protection and Measurements (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 (ISCORS, 2002) suggests the probability might be slightly higher, or six per 10,000 people (0.0006) and DOE guidance also recommends using a risk factor of 0.0006.

2017 Estimated Cancer Risk

The estimated cancer risk to an individual residing near the WVDP from airborne and waterborne releases can be calculated by multiplying the predicted dose from all pathways (<0.47 mrem or <0.00047 rem in 2017) with the probability of cancer risk (0.0006). In 2017, this risk computes to approximately 28 per 100 million (a risk of 0.00000028).

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.

DOE Order 458.1 requires protection of the local biota from potential adverse effects due to WVDP releases of radioactivity to the environment and has established a methodology and dose rate limits to assist in this evaluation. A description of this technical standard (DOE-STD-1153-2002, "A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota) is provided in the inset box titled "Biota Dose Modeling Methodology using RESRAD."

The RESRAD-BIOTA model was run using WVDP site-specific input concentrations of surface water, soil and sediment to output the annual dose to various categories of aquatic and terrestrial animals and plants. The current year's surface water data and multiple years' soil and sediment data are used in the model. The exposure pathways for terrestrial plants and for aquatic, riparian, and terrestrial animals are built into the model.

The model uses Biota Concentration Guides (BCGs) to convert measured concentrations in environmental media to dose to the biota. BCGs are defined as the limiting concentration of a radionuclide in soil, sediments, or water that would not cause dose limits for protection of populations of aquatic and terrestrial biota to be exceeded. The methodology involves using ratios of measured radioactivity in the soil, sediment, and water that the biota are exposed to versus the BCG associated with a predicted dose to a specific plant/animal.

2017 Biota Dose Modeling Results

A maximum potential biota dose was first modeled using the maximum current year measured radionuclide concentrations from surface waters, sediments, and soils. The resulting dose exceeded applicable BCGs for both aquatic and terrestrial evaluations in 2017.

As recommended in DOE-STD-1153-2002, a more typical dose model was then run using estimates of average measured radionuclide concentrations derived from measurements in site-wide surface waters, sediments, and soils. These results are summarized in Table 3-4.

Doses were assessed for compliance with the DOE standard presented in DOE-STD-1153-2002, Table 2.2:

1.0 rad/d for aquatic animals
0.1 rad/d for riparian animal
1.0 rad/d for terrestrial plants and
0.1 rad/d for terrestrial animals.

(Note that the absorbed dose unit (rad) is used for biota instead of the units used for indicating human risk (rem)).

It was found that the isotopes that contributed the largest component of both aquatic and terrestrial dose to biota were strontium-90 and cesium-137. The populations of organisms most sensitive (most likely adversely affected) to strontium-90 and cesium-137 via the aquatic and terrestrial pathways were riparian animals (such as the raccoon [aquatic dose]) and terrestrial animals (such as the

Biota Dose Modeling Methodology using RESRAD

DOE has 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), are used to evaluate radiation doses to aquatic and terrestrial biota within the confines of the WNYNSC, which includes the WVDP.

RESRAD-BIOTA® (version 1.8, April 2016), a calculation tool provided by DOE for implementing the technical standard, is 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.

Soil, sediment and surface water concentrations are input to the model. Average and maximum concentrations are needed. Data were taken from surface water samples obtained from the current sampling year. Data for multiple years are used for the soil and sediment. In 2007, the soil and sediment sampling frequency was changed from annually to every five years. Therefore, for 2017, the most recent sediment samples included samples collected from 2005–2007, 2012 and 2017 and the most recent routine on-site surface soil sampling includes samples collected from 1995–2007, 2012 and 2017. Historical on-site surface soil sampling data from several special projects was 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).

The concentration for each radionuclide in each medium is 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-STD-1153-2002 if the sum of fractions for the water medium plus that for the sediment medium is less than 1.0. (Note, this sum of fractions methodology converts a concentration to dose in the same manner as the NESHAP sum of fractions methodology explained earlier in this chapter). 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.

deer mouse [terrestrial dose]). Populations of both animals are found on the WNYNSC.

Table 3-4 shows that at the site-specific screening level, the sums of fractions for the aquatic and terrestrial evaluations were 0.17 and 0.56, respectively. The results are very similar to 2016. The sum of fractions for both the aquatic and terrestrial evaluations was less than 1.0, indicating that applicable BCGs were not exceeded, and therefore populations of aquatic and terrestrial biota (both plants and animals) on the WNYNSC are not being exposed to doses in excess of DOE standards.

The biota dose model predicts terrestrial animals at the WVDP are the most sensitive organism.

TABLE 3-4
2017 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	2.57	6.03E-02	3,130	4.98	1.59E-03	0.062
Strontium-90	279	19.5	7.01E-02	583	19.6	3.37E-02	0.10
All Others	NA	NA	6.88E-04	NA	NA	5.45E-04	0.0012
Sum of Fractions			1.31E-01			3.58E-02	**0.17**
Estimated upper bounding dose to an aquatic animal = **0.0057 rad/day**; to a riparian animal = **0.017 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	2.57	4.30E-06	20.8	4.46	2.14E-01	0.21
Strontium-90	54,500	19.5	3.59E-04	22.5	7.69	3.42E-01	0.342
All Others	NA	NA	1.91E-06	NA	NA	7.78E-04	0.00015
Sum of Fractions			3.65E-04			5.57E-01	**0.56**
Estimated upper bounding dose to a terrestrial plant = **0.0042 rad/day**; to a terrestrial animal = **0.056 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.

Dose Assessment Summary

Tables 3-2, 3-3, and 3-4 summarize radiological dose and release information for CY 2017.

Predictive computer modeling of waterborne releases and measurements of radioactivity at near-site ambient air samplers resulted in estimated 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.

The 2017 estimated dose (<0.47 mrem [<0.0047 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.

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 only exposed to a fraction of DOE standards for dose to biota.

The estimated risk to an individual residing near the WVDP from airborne and waterborne releases is well below the range considered by the ICRP to be a reasonable risk for any member of the public.

Based on the overall dose assessment, the WVDP was found to be in compliance with applicable effluent radiological guidelines and standards during CY 2017.

CHAPTER 4

GROUNDWATER PROTECTION PROGRAM

The primary objectives of the groundwater monitoring program are to identify, delineate, and monitor groundwater migration pathways that could transport contaminants off site and to support mitigative actions. The Groundwater Monitoring Program (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," (Change 3) and the RCRA §3008(h) Administrative Order on Consent.

2017 Highlights

Groundwater sampling data from 2017 continues to show that the most widespread area of groundwater contamination at the WVDP is the well-defined strontium-90 plume on the north plateau. The Permeable Treatment Wall (PTW) installed in 2010 continues to remove Sr-90 from this groundwater plume as it passes through the wall.

The 2017 monitoring results also show that: 1) measures implemented to reduce water levels and collect groundwater moving through the NDA on the south plateau have proven to be effective, thus reducing the potential for groundwater contamination to move beyond the NDA; and 2) previously identified areas of localized groundwater radiological and chemical contamination continue to be present with concentrations generally stable or decreasing as shown by the contaminant concentration trend graphs presented in this chapter.

The WVDP monitoring program currently includes sampling and analysis for some emerging contaminants of concern (e.g., 1,2,3-trichloropropane [TCP] and 1,4-dioxane) with no indication of their persistence at the site, and no historical records that indicate these compounds were used or produced at the WVDP.

No new areas of groundwater contamination were observed in 2017 and no changes to the GMP were deemed necessary.

Groundwater Monitoring Program (GMP) Introduction and Background

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 sites 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 GMP is also designed to support the requirements of the RCRA §3008(h) Administrative Order on Consent. The "WVDP Groundwater Protection Management Program Plan" documents the Project's approach for groundwater protection from site activities. 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" on the following page. Compliance with the Consent Order and the conclusions in the RFI reports require routine monitoring of certain analytes at specified groundwater monitoring locations.

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.

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 4-1 for the geographic distribution and additional description of these units.

Groundwater Use. 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.

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 4-1. In CY 2017, 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 are located to monitor releases from one or more of the SWMUs or SSWMUs on site per the Consent Order. Table 4-2 lists the monitoring locations in the routine groundwater monitoring network, the geologic units monitored, and the analytes measured in CY 2017. Table 4-3 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 4-4 and 4-5 provide an overview of groundwater monitoring performed during CY 2017, organized by geographic area and monitoring purpose.

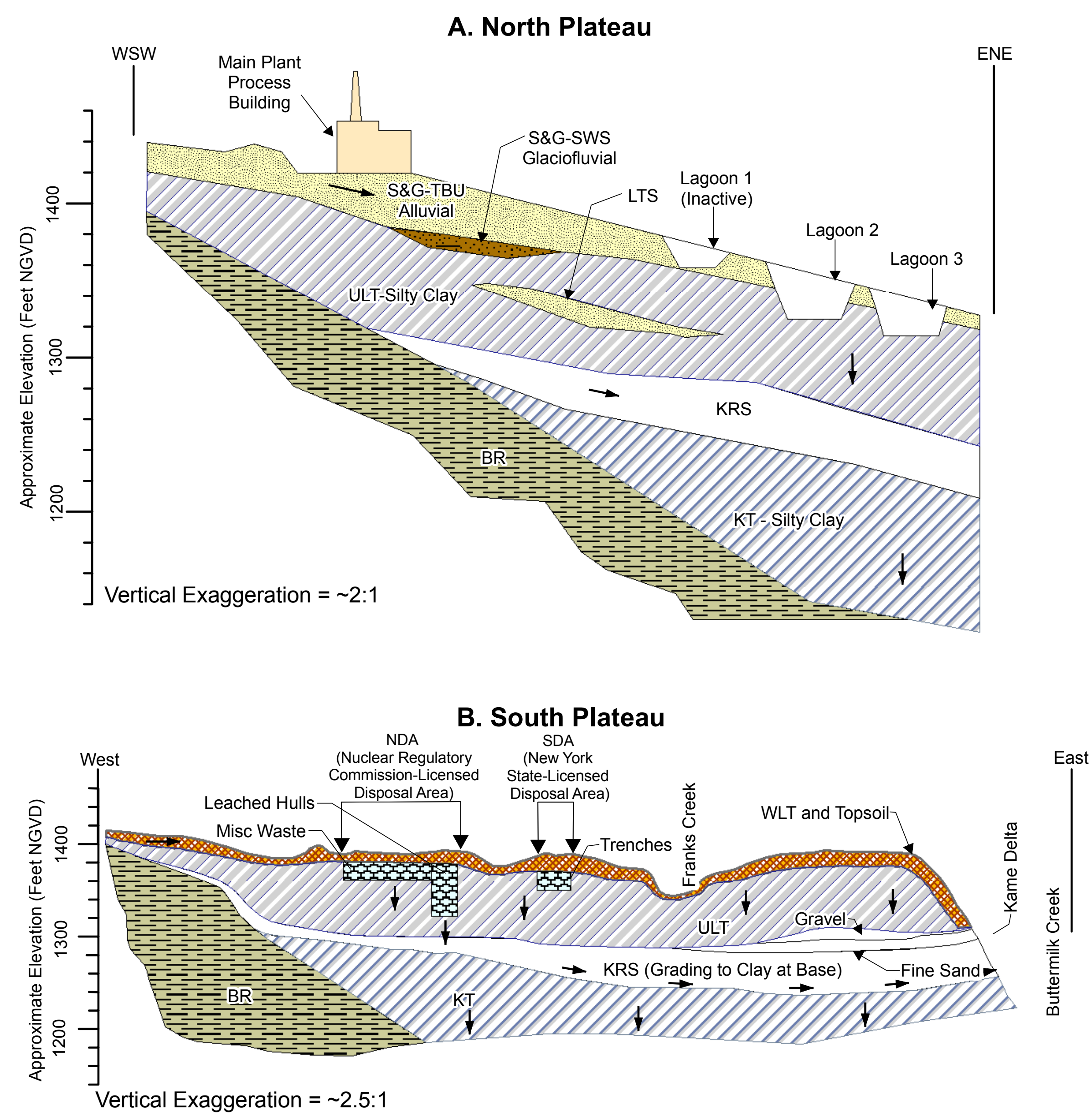
Supplemental groundwater monitoring programs are also implemented for evaluation of the effectiveness of the PTW in treating the north plateau strontium-90 groundwater plume and general plume surveillance discussed later in this chapter. (See inset "Permeable Treatment Wall [PTW] for Strontium-90 Remediation" on page 4-12.)

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 map groundwater flow directions and gradients. Long-term trend graphs are used to evaluate 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 NDA.")

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)*	

TABLE 4-1
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 1987 to 2012 conductivity testing results.

TABLE 4-2
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 4-3)*
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, 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 4-3
WVDP Groundwater Sampling and Analysis Program

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)
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

TABLE 4-4
2017 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	7,139	5,972	1,167
Percent of results below detection limits	84%	84%	87%

[a] Does not include PTW performance monitoring.

TABLE 4-5
2017 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	7,139	6,172	967
Percent of results below detection limits	84%	89%	54%

[a] Does not include PTW performance monitoring.

Emerging Contaminants of Concern

In recent years, there has been increasing regulatory interest in emerging contaminants of concern which may be present at federal facilities. WVDP groundwater and surface water monitoring has included several of these (e.g., 1,2,3-trichloropropane [TCP] and 1,4-dioxane) with no indication of their persistence at the site. A category of manmade chemicals known as Per- and Polyfluoroalkyl Substances (PFAS) have been detected in surface waters and groundwater at other facilities. However, historical information does not suggest that these compounds were used or produced at the WVDP. Additional information on this topic can be found at:

https://www.epa.gov/fedfac/emerging-contaminants-and-federal-facility-contaminants-concern

Routine Groundwater Data Evaluation Methodology

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.

Trigger levels are periodically updated as more data is collected over time or after a period of time following physical changes (e.g., caps or slurry walls), that can influence the monitoring data. Groundwater trigger levels for selected chemical and radiological constituents were last recalculated in September 2015, incorporating data collected through June 2015.

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 (e.g., regulatory limits, guidance limits, or background). Methods used to develop the GSLs are discussed in detail in Appendix D.

Routine North Plateau Groundwater Sampling

The monitoring well network on the north plateau provides detection monitoring capabilities for potential and existing chemical and radiological sources, including those identified in the RFI reports. This includes areas of previously detected contamination such as the CDDL and lagoon 1. The focus of radiological groundwater monitoring is the 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. 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 2017. 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 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.)

2017 Routine Groundwater Monitoring Update for the North Plateau

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 23 years (1994, 2005, and 2017). The GMP wells that monitor the plume and the measured gross beta concentrations are shown on the figure.

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.

Measuring groundwater elevations

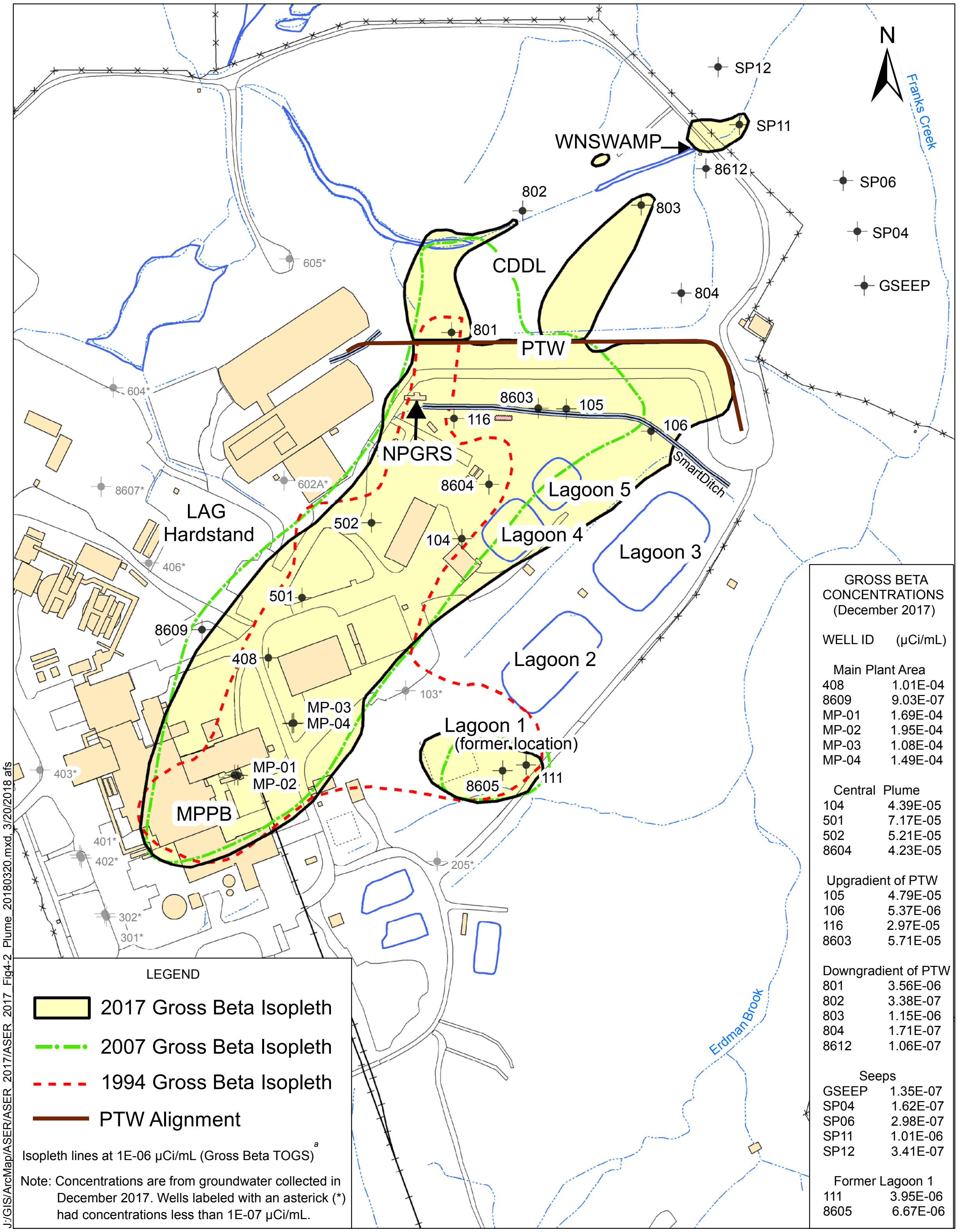
Routine groundwater sampling

Figure 4-2 shows that for 2017 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 are shown on Figures 4-3 through 4-6. 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.

Special focused monitoring is performed for the downgradient portion of the plume and for the PTW. A description of the PTW installation and the prior pump and treat system (NPGRS) is provided in the insert box titled “Permeable Treatment Wall (PTW) for Strontium-90 Remediation.”

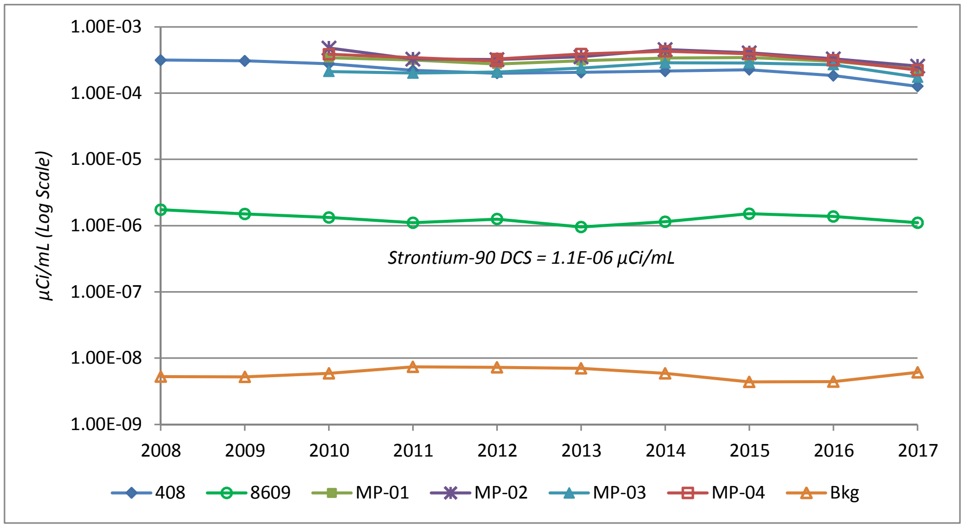
FIGURE 4-2
North Plateau Plume in the S&G Unit



J:/GIS/ArcMap/ASER/ASER_2017/ASER_2017_Fig4-2_Plume_20180320.mxd 3/20/2018 afs

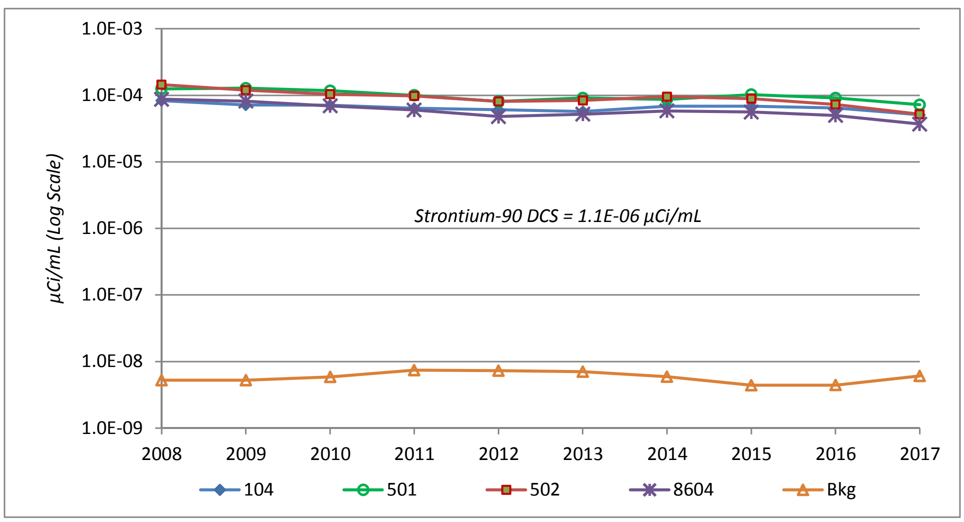
[a] Gross beta isopleths primarily reflect GMP sampling results supplemented with NPGMP and PTWPMP sampling results.

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

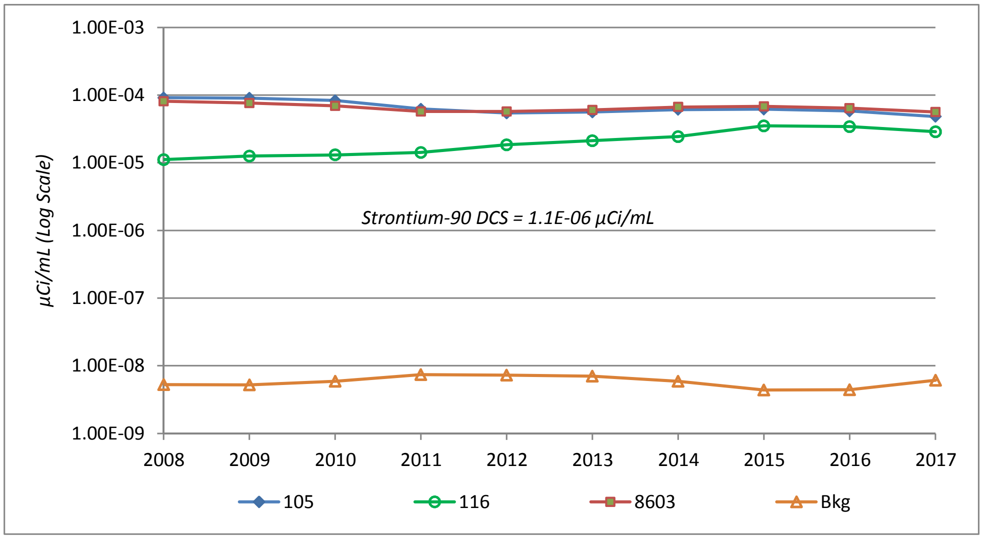


Note: S&G background (Bkg) wells 301, 401, 706, and 1302 are averaged for this comparison.

Monitoring the Central Area of the Plume. 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 3.44E-04 µCi/mL in March 2017, shown in Appendix D-2) of any routinely monitored wells in the GMP. The 2017 gross beta concentrations at these wells remained relatively stable throughout the year and were lower, on average, compared with 2016.

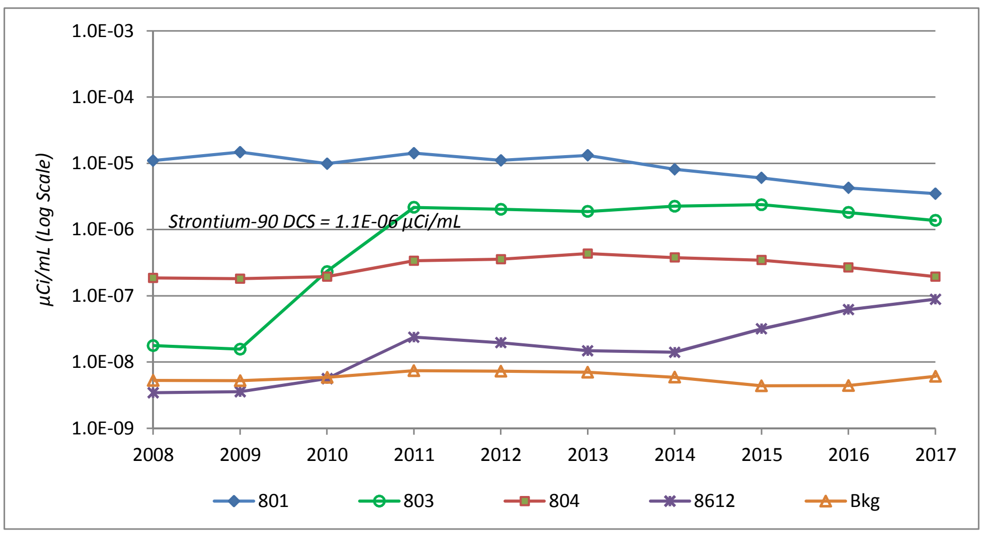
Figure 4-4 illustrates gross beta concentrations in wells 104, 501, 502, and 8604 centrally located within the plume area. Concentration ranges in these wells were slightly lower on average in 2017 as compared with 2016.

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.

Monitoring Upgradient and Downgradient of the PTW. Figure 4-5 illustrates gross beta concentrations at monitoring wells 105, 116, and 8603, upgradient of the PTW. The annual average gross beta concentration at these wells decreased slightly in 2017.

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. The gross beta concentration increased in well 8612, the furthest downgradient of the PTW, and decreased in the other three wells in 2017. Continued monitoring will determine whether gross beta concentrations decrease over time as more treated groundwater migrates out of the PTW.

Permeable Treatment Wall (PTW) for Strontium-90 Plume Remediation

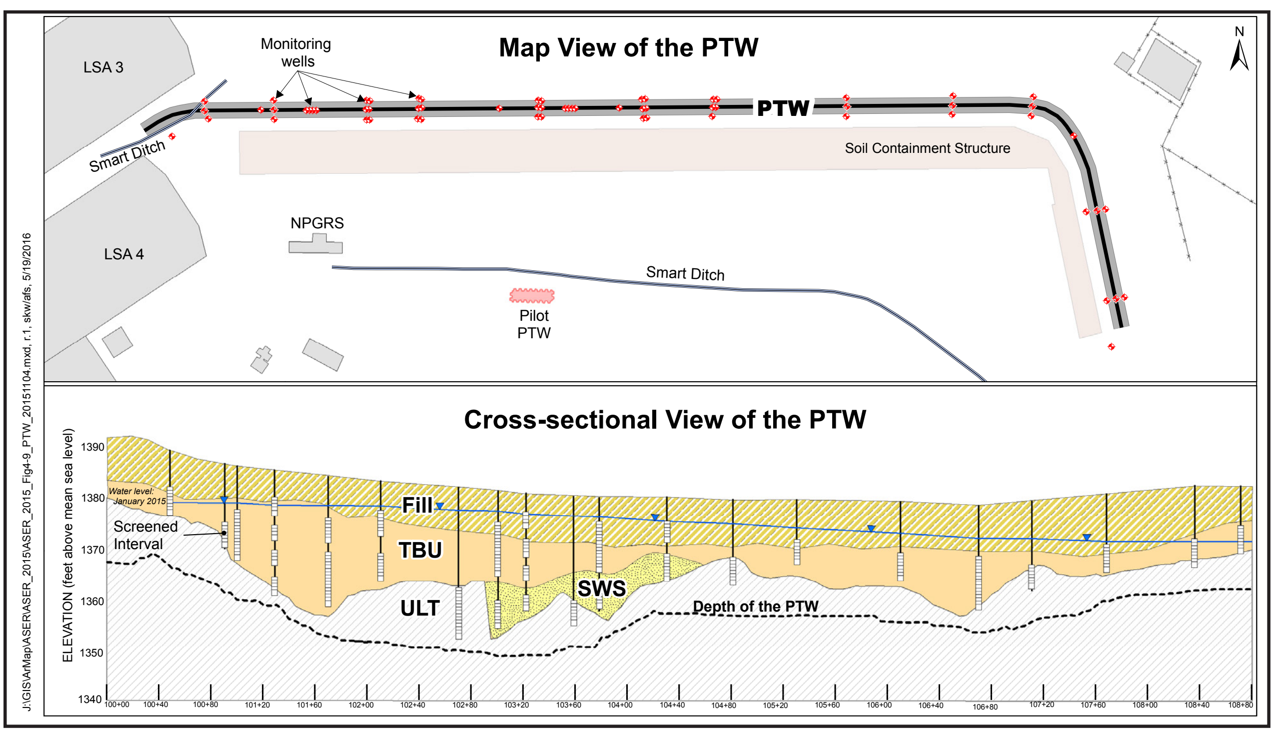
In November 2010, an 860-ft-long full-scale PTW was installed to treat the north plateau strontium-90 plume. The PTW has operated now for over seven full years. The overall average concentrations of strontium-90 immediately downgradient of the PTW were lower during 2016 and 2017 than they were when the 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 4-7.

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 DCG of 1.0E-06 µCi/mL (the RAOs for the PTW were determined before the Derived Concentration Guides (DCGs) found in superceded DOE Order 5400.1, were replaced by the Derived Concentration Standards (DCSs) found in DOE-STD-1196-2011;
- 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.

FIGURE 4-7



Permeable Treatment Wall (PTW) for Strontium-90 Plume Remediation *(continued)*

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. North plateau monitoring shows evidence of treated groundwater exiting the PTW downgradient of the wall with significantly lower strontium-90 concentrations than were observed at the time of PTW installation.

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 decisionmaking process for the WVDP and the WNYNSC.

In 1995, the NPGRS was installed to slow the advance of the strontium-90 plume. (See Figure 4-2.) 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. A pilot-scale PTW was constructed in 1999 which helped determine that the PTW technology was an effective remediation method for strontium-90-contaminated groundwater.

PTW Performance Monitoring Plan (PTWPMP). Following PTW construction, 66 monitoring wells were installed along the PTW (immediately upgradient, immediately downgradient, and within the PTW itself) in December 2010 to monitor treatment wall performance. The PTWPMP was developed and implemented immediately following the PTW installation. This plan describes the performance monitoring requirements for the PTW. The annual monitoring event, performed in April, includes sampling of additional wells and parameters not sampled quarterly.

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 includes quarterly gross beta sampling at 26 well locations and water level measurements at 40 well locations performed concurrent with the PTWPMP. Data from these wells supports the development of groundwater elevation contour maps and gross beta isopleth maps such as Figure 4-2.

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 road-salt ions will compete with the strontium-90 for removal in the PTW), storm water management via the upgradient Smart-Ditch™, and monthly inspections.

2017 PTW Performance. Performance monitoring data collected to date, including data collected for the 2017 annual monitoring event, 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 the last 2017 quarterly monitoring conducted in October, 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.

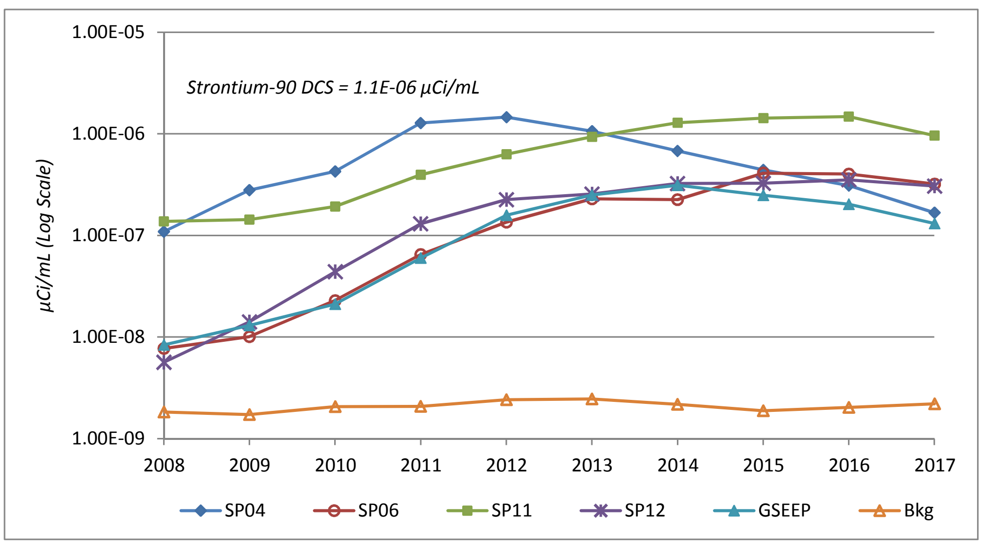
These observations indicate the ongoing processes within the PTW continue to achieve the RAOs defined in the PTWPMP and shown in the previous section. Monitoring continues to be conducted in accordance with the PTWPMP.

Monitoring at the North Plateau Seeps. Groundwater is also monitored along the northeast edge of the north plateau, 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 4-8).

As noted on the bottom of page 4-7, the gross beta concentrations in the north plateau plume have been demonstrated to be approximately half strontium-90 and half its daughter product yttrium-90. Therefore, to compare the gross beta results shown in Figure 4-8 to the strontium-90 DCS, the gross beta values should first be divided by two. The data show that the strontium-90 DCSs were not exceeded at any of the seep locations in 2017.

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 these seep locations decreased during 2017 compared with 2016.

FIGURE 4-8
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.

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. These waters ultimately flow into Franks Creek. (See Figure 4-2.)

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 considered to be the source of the strontium-90 activity at WNSWAMP. Approximately 25.9 million gal (98.2 million L) of water flowed through this monitoring point in 2017. (See "Water Monitoring Program" in Chapter 2.)

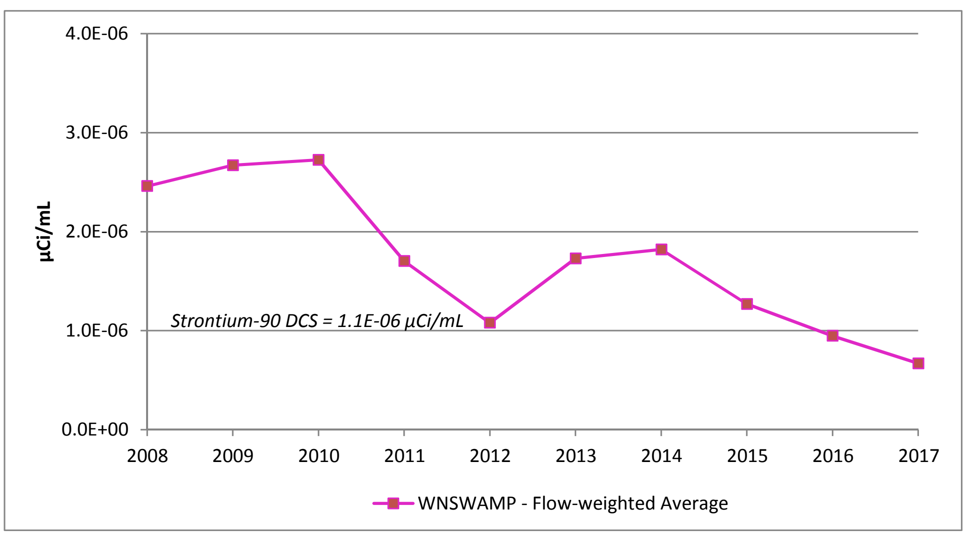
Strontium-90 concentrations at WNSWAMP have been generally decreasing since 2010 when the PTW was installed, with some annual variability, as shown on Figure 4-9. The flow-weighted average plotted on this graph uses the volume of water flowing down the ditch at the time of sampling to proportionally weight the measured monthly concentrations. The method for computing a flow-weighted average is provided in Chapter 2, page 2-11.

Strontium-90 concentrations at WNSWAMP had been above the strontium-90 DCS for several years but were below the DCS in 2016 and 2017.

The strontium-90 released through WNSWAMP and WNSW74A accounted for an annual estimated dose of 1.1E-02 mrem in 2017. (See "2017 Maximum Waterborne Dose to an Off-Site Individual" in Chapter 3.)

Monitoring of surface water on Cattaraugus Creek downstream of the seeps and WNSWAMP drainage ditch at the first point of public access (location WFFELBR) continued to show that strontium-90 concentrations in 2017 were similar to historical concentrations from the Cattaraugus Creek background surface water location at Bigelow Bridge (WFBIGBR). (See Table B-4I.) The annual average strontium-90 concentration at WFFELBR in 2017 was a non-detect.

FIGURE 4-9
Annual Average Strontium-90 Concentrations at WNSWAMP



Note: DCSs are used for evaluation only. 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.

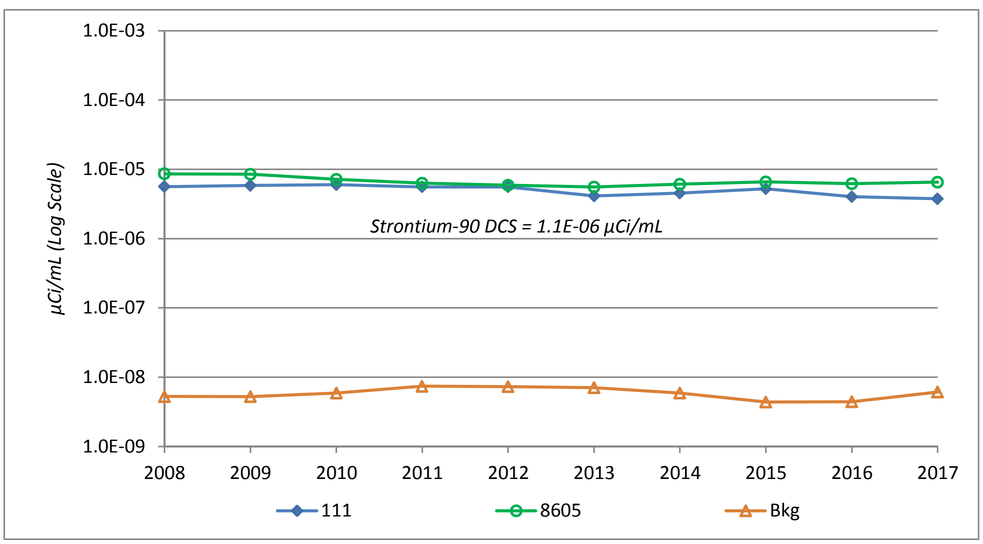
Monitoring Radiological Indicators Near Former Lagoon 1. Southeast of the strontium-90 plume, elevated gross beta concentrations are documented in groundwater downgradient of former lagoon 1, which was backfilled in 1984. (See Figure 4-2 and the photo below.)

Gross beta concentrations in wells 8605 and 111 have been consistently above the strontium-90 DCS and are remaining relatively stable from year to year. (See Figure 4-10.)

As shown in the 10-year trend graph, the annual average gross beta concentrations at well 111 decreased slightly in 2017 compared with 2016 and increased slightly at well 8605. The source of the gross beta activity is assumed to be the radiologically contaminated material used as backfill and the residual sediment within former lagoon 1.

WVDP Treatment Lagoons

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.

TABLE 4-6
2017 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		**6.83E-07**	WP-C		**1.68E-05**	1.78E-07
Strontium-90	MP-02		**9.91E-05**	–			5.90E-09
Technetium-99	MP-02		**4.25E-08**	–			5.02E-09
Iodine-129	NDATR		**2.52E-08**	–			9.61E-10
Radium-226[d]	401		**1.53E-09**	1304	J	3.92E-10	1.33E-09
Radium-228[d]	909		**4.73E-09**	–			2.16E-09
Uranium-233/234[d]	NDATR		**1.68E-09**	1304	J	1.65E-10	6.24E-10
Uranium-235/236	MP-03	J	**1.59E-10**	–			8.07E-11
Uranium-238[d]	NDATR		**9.02E-10**	1304	J	1.34E-10	4.97E-10
Total Uranium[d] (µg/mL)	NDATR		**2.81E-03**	1304		4.09E-04	1.34E-03

Note: Bolding indicates that the radionuclide exceeds the GSL.
- 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.

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 on the north plateau and across the site as a whole 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. Tritium is a fission product of the nuclear fuel cycle that generates nuclear power. The observed tritium in site groundwater is due to residual tritium in the nuclear fuel that was reprocessed by NFS.

As shown in Table 4-6, the maximum tritium concentration measured in groundwater from the north plateau in 2017, 1.68E-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 a slight increase from the 2016 result but was approximately two orders of magnitude below the DCS for tritium of 1.9E-03 µCi/mL. Overall, the WP-C tritium concentrations have been decreasing for more than ten years.

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 4-2 and 4-3.) The maximum radionuclide concentrations measured at either the north or south plateau during 2017 are presented in Table 4-6.

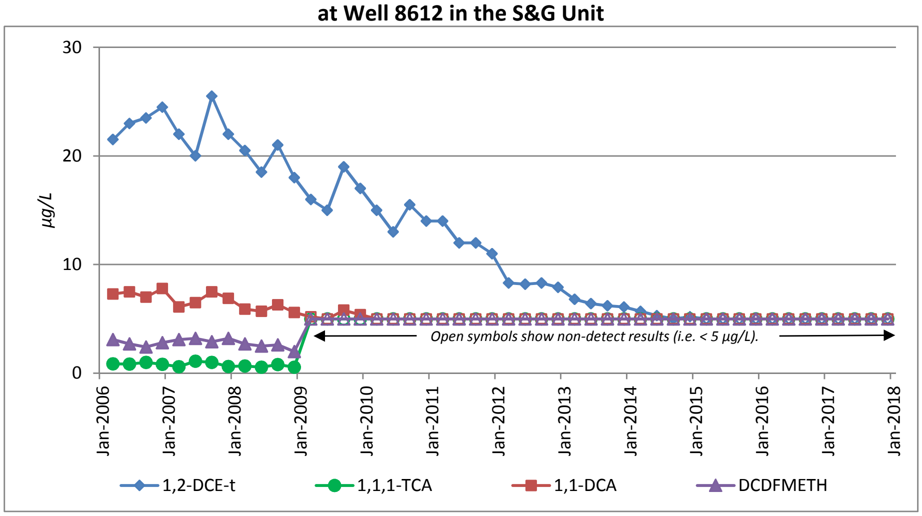
The MPPB wells (MP-01, -02, -03, and -04) are analyzed for the following additional radioisotopes to evaluate their presence in groundwater as a result of former MPPB operations: neptunium-237, plutonium-238, plutonium-239/240, plutonium-241, americium-241, and curium-243/244. None of these radioisotopes were detected above their detection limits in the MPPB wells during 2017 or 2016. (See Appendix D-2, Table D-2G.)

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 north-east edge of the north plateau. Figure 4-11 illustrates the concentration ranges of four VOCs historically detected at well 8612. None of these VOCs were detected during 2017 and have not been detected for three or more years. The VOCs previously detected in well 8612 are presumed to be from wastes buried in the CDDL.

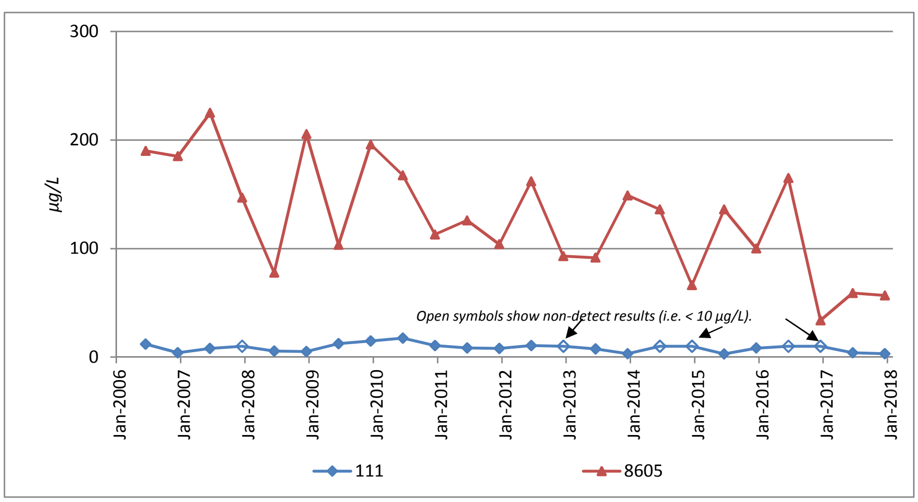
Tributyl phosphate (TBP), an SVOC, has been continually detected in groundwater from well 8605, downgradient of former lagoon 1 since monitoring at this location began. (See Figure 4-12.) TBP is thought to be residual contamination from liquid waste management activities in the former lagoon 1 area during nuclear fuel reprocessing. There were no other organics above detection limits in 2017.

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 TBP at Monitoring Wells Near Former Lagoon 1 in the S&G Unit



The maximum TBP concentration measured in 2017 (59.1 micrograms per liter [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. A TOGS 1.1.1 water quality standard has not been established for TBP. Historically, TBP has also been detected in well 111, located near well 8605. During 2017, TBP was detected at low levels (<5.0 µg/L) at well 111.

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 2017, routine metals sampling continued to be performed, as outlined in the GMP. The sampling results were compared with the established GSLs and background levels. The only metals detected above background in groundwater in 2017 were barium, chromium, and nickel. (See Table 4-7.)

The background concentration of barium was exceeded for one quarter during 2017 at well MP-01. Naturally occurring levels of barium and other metals have been observed in WVDP background monitoring wells. (See Table D-1B in Appendix D-1.) Chromium and nickel were detected at concentrations above background and the GSL in wells 111 and 405. Nickel was also detected above background and the GSL in well 706. Wells 111, 405 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. The elevated chromium and nickel in these wells in 2017 is believed to be due to corrosion of the stainless steel well screens.

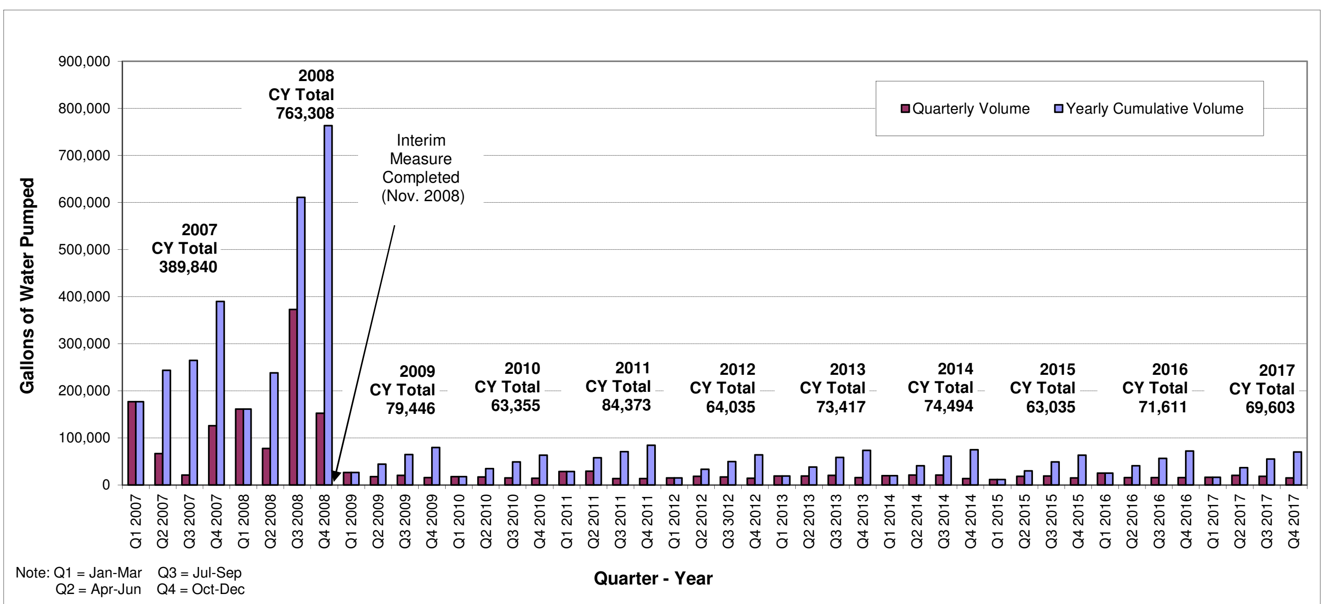
Groundwater Sampling on the South Plateau Including the NDA

Interim Measures (IMs)

In accordance with the RCRA §3008(h) Administrative Order on Consent, an IM including a trench system was constructed in 1990 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.

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.

FIGURE 4-13
Volume of Water Pumped from the NDA Interceptor Trench



2017 Update of NDA Interim Measure (IM) Monitoring and Effectiveness

In 2017, 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.

Figure 4-13 shows the reduced water volume extracted from the interceptor trench since the cap and barrier wall were installed, indicating that the IM is effectively reducing flow through the NDA. The total volume pumped from the NDA trench in 2017 (69,603 gal [263,476 L]) was approximately one-sixth of the volume pumped in CY 2007, before the IM.

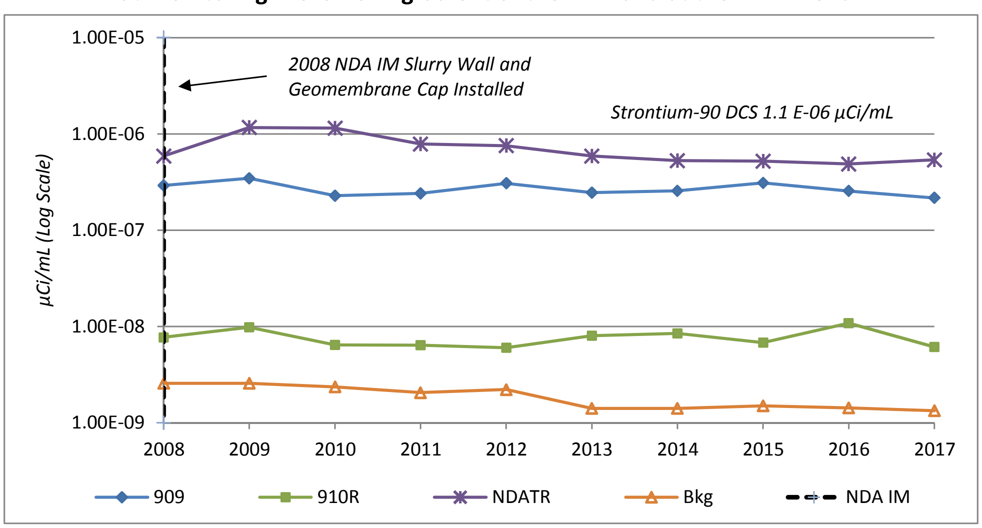
Water level data from piezometers installed to monitor the effects of the NDA IM indicate that the slurry wall and geomembrane cover are causing the WLT to become dry in some areas. Refer to the "Environmental Compliance Summary" in this report for further discussion of the NDA IMs.

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 4-7 and Figure 4-14.) 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 from 2013 through 2017. 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 2017 exhibited concentrations for iodine-129 that were 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 and Figure 4-13.)

FIGURE 4-14
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.

WLT well 909 exhibited elevated tritium, iodine-129, strontium-90, and uranium-233/234 concentrations above their respective GSLs during 2017, consistent with historical values, as shown in Table 4-7 and Appendix D-2.

The radionuclide concentrations in groundwater described above for the NDA sump (NDATR) and from well 909 downgradient of the NDA are presumed to be associated with former waste burial operations.

Groundwater Monitoring of Other WVDP Facilities and Processes

Groundwater Monitoring Downgradient of the Waste Tank Farm (WTF). Waste in the underground tanks was removed and solidified through the vitrification 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 the "Environmental Compliance Summary" in this report for additional information.) Throughout and subsequent to 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 a relatively low maximum concentration of 7.63E-08 µCi/mL measured in 2005. Low levels of gross beta activity have also been observed in the dewatering well and the tank 8D-2 pan. During 2017, gross beta concentrations measured at well 8607 were less than 52% of the 2005 maximum.

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. Sample results following installation of these wells in 2014 and subsequent years indicate that the Project's drinking water continues to remain below the local, state, and federal maximum contaminant levels (MCLs) and drinking water standards. 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 2017 from these three wells, presented on Table B-5H, show that radiological indicator results (gross alpha and gross beta) are within site background concentrations.

Groundwater Monitoring History

Highlights of the site groundwater monitoring history and the evolution of the GMP are summarized in Table 4-8 at the end of this chapter.

Groundwater Protection Program Summary

Evaluation of groundwater sampling data from 2017 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. A full-scale PTW was installed in 2010 to reduce contaminant levels in the downgradient portions of the north plateau plume. Seven 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 implemented to reduce water levels and collect groundwater moving through the NDA have proven to be effective, thus reducing 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, future 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 beneath the MPPB.

TABLE 4-7
2017 Groundwater Monitoring Results Exceeding GSLs and Background Levels

Number of Locations exceeding GSLs[a] or Background[b]		***Geologic Unit (plateau)***	***Groundwater Sampling Location***					
RADIOLOGICAL PARAMETERS								
Gross Alpha								
1 > GSL	3 > BKG	S&G (NP)	111	**8605**	WP-H			
Gross Beta								
21 > GSL	36 > BKG	S&G (NP)	GSEEP	**104**	401	**801**	**8605**	**MP-03**
			SP04	**105**	403	**802**	8607	**MP-04**
			SP06	**106**	**408**	**803**	**8609**	**WP-H**
			SP11	**111**	**501**	804	8612	
			SP12	**116**	**502**	**8603**	**MP-01**	
			103	205	605	**8604**	**MP-02**	
		ULT (NP)	107					
		WLT (SP)	NDATR	909				
Tritium								
8 > GSL	8 > BKG	S&G (NP)	**106**	**WP-A**	**WP-H**			
			602A	**WP-C**				
		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**				
Radium-226								
1 > GSL	1 > BKG	S&G (NP)	**401**					
Radium-228								
1 > GSL	1 > BKG	WLT (SP)	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)	**408**	**MP-02**	**MP-03**	**MP-04**		
		WLT (SP)	**NDATR**					
Uranium-238[d]								
4 > GSL	4 > BKG	S&G	**MP-02**	**MP-03**	**MP-04**			
		WLT (SP)	**NDATR**					
Total Uranium[d]								
2 > GSL	2 > BKG	WLT (SP)	**NDATR**					

Note: Bolded wells indicate 2017 results that exceed GSLs. Unbolded wells indicate 2017 results that exceeded background.

TABLE 4-7 (*concluded*)
2017 Groundwater Monitoring Results Exceeding GSLs and Background Levels

Number of Locations exceeding GSLs [a] or Background [b]		*Geologic Unit (plateau)*	*Groundwater Sampling Location*	
METALS				
Barium				
0 > GSL	1 > BKG	S&G (NP)	MP-01	
Chromium				
1 > GSL	1 > BKG	S&G (NP)	**111**	
1 > GSL	1 > BKG	ULT (NP)	**405**	
Nickel				
1 > GSL	2 > BKG	S&G (NP)	111	**706**
1 > GSL	1 > BKG	ULT (NP)	**405**	
ORGANICS				
Benzene				
0 > GSL	1 > DL	S&G (NP)	803	
Tributyl phosphate				
No TOGS[c]	2 > DL	S&G (NP)	111	8605
Xylene				
0 > GSL	1 > DL	S&G (NP)	803	

Note: Bolded wells indicate 2017 results that exceed GSLs. Unbolded wells indicate 2017 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.

TABLE 4-8
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, West Valley Nuclear Services (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.
2011-2017	Groundwater monitoring continued from CY 2011 through 2017 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 2017.

CHAPTER 5
QUALITY ASSURANCE

The Quality Assurance (QA) program at the WVDP provides for and documents consistency, precision, and accuracy in collecting and analyzing environmental samples and in interpreting and reporting environmental monitoring data.

2017 Highlights

Environmental sampling and laboratory analysis were performed in accordance with all applicable regulatory and WVDP site-specific QA/Quality Control (QC) requirements in 2017.

There were no significant audit findings under the DOE Consolidated Audit Program (DOECAP) program for the laboratories and treatment, storage and disposal facilities (TSDFs) that the WVDP contracted with during 2017.

The WVDP participated in the Mixed Analyte Performance Evaluation Program (MAPEP) and Discharge Monitoring Report Quality Assurance Study (DMR-QA) cross-check programs in 2017, with satisfactory quality outcomes.

Environmental Data Quality Assurance (QA)/Quality Control (QC)

The WVDP QA program complies with the following regulations:

- 10 CFR Part 830, Subpart A, "Quality Assurance Requirements",
- DOE Order 414.1D, "Quality Assurance", and
- Nuclear Quality Assurance, Level 1 (NQA-1)-2008 with NQA-1a-2009 Addenda, "Quality Assurance Requirements for Nuclear Facility Applications".

Environmental Sampling QC

Field QC. Special field QC samples are collected and analyzed to assess the sampling process. Duplicate field samples are used to assess sample homogeneity and sampling precision. Field and trip blanks (laboratory deionized water in sample containers) are used to detect contamination potentially introduced during sampling or shipping. Environmental background samples (samples of air, water, vegetation, venison, and cow milk taken from locations remote from the WVDP) are collected and analyzed to provide baseline information for comparison with on-site or near-site samples so that site influences can be evaluated.

Calibration. Equipment or particular items affecting the quality of environmental data must be identified, inspected, calibrated, and tested before use. Calibration status must be clearly indicated and equipment must be re-calibrated on a routine schedule as appropriate.

Documentation. Records of all activities must be kept to document what was done and by whom. Records must be clearly traceable to an item or activity. Records such as field data sheets, chain-of-custody forms, requests for analysis, sample shipping documents, sample logs, data packages, training records, and weather measurements, in addition to other records in both paper and electronic form, are maintained as documentation for the environmental monitoring program.

DOE Consolidated Audit Program (DOECAP)

DOECAP conducts annual qualification audits of analytical environmental laboratories and commercial waste TSDFs in support of DOE facilities using these services. Personnel from the CHBWV QA department participate on these audit teams on a rotational basis as do representatives from other DOE facilities thereby providing cost efficiencies by eliminating auditing redundancies. CHBWV performed an audit of General Engineering Lab

(GEL) dosimetry in 2017 and conducts a vendor assessment every three years of all the laboratories the WVDP contracts with. Participation in the DOECAP involves regular communications of complex-wide audit findings.

During 2017, none of the environmental laboratories or TSDFs utilized by the site had any significant findings that would compromise the integrity of the environmental data presented in this report or in the disposal services provided. The WVDP maintained contracts in 2017 with the laboratories and TSDFs listed below. This list includes laboratories that analyze data for the waste management and safety departments as well as the laboratories used for environmental samples.

Laboratories:

- ALS Environmental
- Biotrax (subcontracted)*
- Cattaraugus County Laboratory Services
- EMSL Analytical, Inc.
- Environmental Dosimetry Co. (ED)*
- Galson Laboratories
- General Engineering Lab (GEL) *
- Landauer
- New England Bioassay (subcontracted)*
- Paradigm Environmental Services
- Southwest Research Institute
- Test America Laboratories (TA) *
- Tri-Air Testing

TSDFs:

- Advanced Disposal of Western PA
- Energy Solutions
- Perma Fix Inc.
- Perma Fix of Florida
- Waste Management Tracker Services
- Waste Control Specialists

Note: The laboratories listed with an * were used in 2017 to analyze the 2017 environmental data.

Environmental Laboratory Proficiency Testing

The majority of the environmental samples collected at the WVDP are analyzed at off-site laboratories. In 2017, analyses for data presented in this report were performed by GEL, in Charleston, South Carolina, TA, in Buffalo, New York, and ED, in Sterling, Massachusetts.

The WVDP maintains on-site capabilities to perform limited radiological analysis of air and water samples. This capability provides analytical results needed for shipping samples off-site and for evaluating anomalies, or investigating unique environmental circumstances. The analyses performed on-site include quick turn-around-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 2017, 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. As presented in Appendix G and in Table 5-1, 99.0% of the crosschecks performed in 2017 were acceptable.

TABLE 5-1
Summary of Crosschecks Completed in 2017

Type	Number Reported	Number Within Acceptance Limits	Percent Within Quality Control Limits
Radiological	80	80	100%
Nonradiological	115	113	98.3%
All types	195	193	99.0%

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 and the 2017 DOE EHSS "Dose Ranges" chart at the end of this section.)

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 making statistical evaluations difficult. Moreover, the body is able to repair damage caused by exposure to radiation. BEIR VII (2005) concludes that the smallest dose has the potential to cause a small increase in cancer risk to humans. The study determined that the cancer risk from exposure to radiation would continue in a linear fashion without a threshold, and is termed the "linear-no-threshold" model.

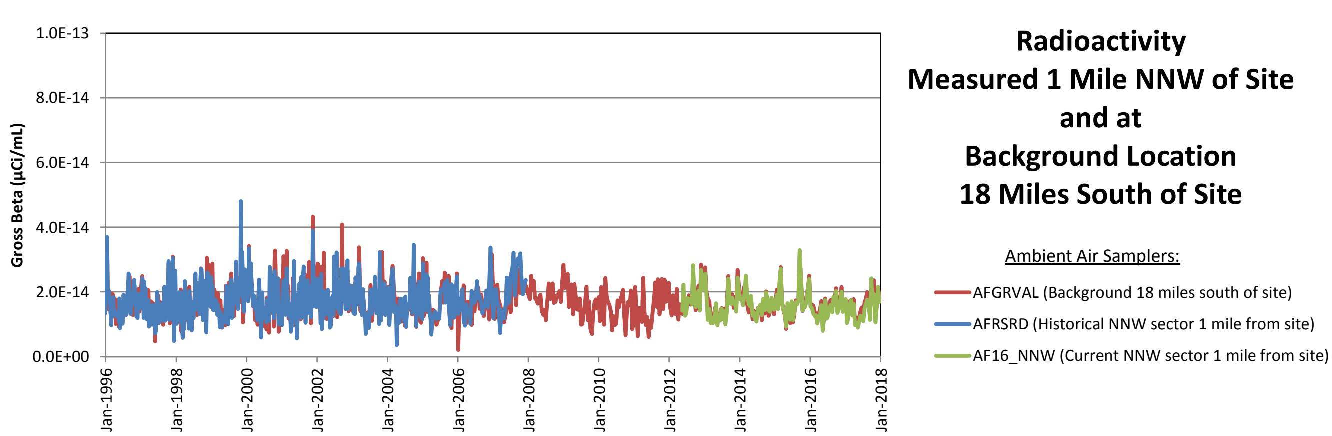
CAP88-PC Computer Modeled Air Dose Estimates Versus Measured Air Dose Estimates

The CAP88-PC model is used regularly for dose and risk evaluation when planning site work activities that have the potential to release airborne radioactivity. To achieve compliance with 40 CFR 61, subpart H, 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. 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 ambient air monitoring measurements 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. (For example, 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.

Historical ambient air concentrations at the samplers approximately one mile from the site have not changed and remain similar to concentrations at the background sampler 18 miles away as shown by the graph below.



The effect most often associated with exposure to relatively high levels of radiation appears to be increased risk of cancer. BEIR VII concludes that there will be some risk even at low doses, although the risk is small. (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.)

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.

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

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

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

Note: To convert from the units in column two to the units in column one, divide by the conversion factor.

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, the current SPDES permit for the WVDP became effective. Requirements of the CY 2011 SPDES permit are summarized in Appendix B-1. On July 28, 2015 a modification to the permit was issued to address 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 NYSDOH and EPA have 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 4-7.

Historic Timeline of the WNYNSC and the WVDP

Table UI-5, 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.

Historic Record of NEPA Activities

Table UI-6 provides a history of the significant NEPA activities and NEPA documents since the project began.

RCRA Units

Table UI-7 provides descriptions of the RCRA SSWMUs and the individual SWMUs identified in the RFI.

Precipitation

Table UI-8 provides the monthly precipitation data for the current calendar year.

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 (1 mSv).

[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.

TABLE UI-5
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 UI-5 *(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 Vitrification Facility (VF) was completed, fully tested, and "cold operations" began.

TABLE UI-5 *(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 VF. 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 UI-5 *(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	Work continued 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 VF, 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 UI-5 *(concluded)*
Historic Timeline of the WNYNSC and the WVDP

Year	*Activity*
2013	Demolition of seven buildings was completed 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 VF. 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. Preparation for HLW canister relocation continued in 2014, 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 VF 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	The first 20 canisters of HLW were safely removed from the MPPB and placed in VSCs. The first four VSCs were relocated to the HLW Cask Storage Pad on the south plateau. 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 VF. 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.
2016	Removal and relocation of the remaining canisters of HLW from the MPPB was safely completed. The canisters were loaded into a total of 56 VSCs, relocated on site, and safely stored on the WVDP interim HLW Cask Storage Pad by the end of Novermber 2016, approximately one year ahead of schedule. The CFMT, MFHT, and VIT melter were safely shipped to Waste Controls Specialists LLC (WCS), a long-term disposal facility in Andrews, Texas. They were buried in an underground waste cell at WCS before the end of CY 2016. Deactivation and hazard reduction continued inside the MPPB. Deactivation of the VF was nearly complete by the end of the year with planning in progress to begin demolition of the VF in CY 2017. Progress was made in the initial development of a conceptual site model for the probabilistic performance assessment, and additional Phase 1 study work was performed in 2016 to support Phase 2 decisionmaking.
2017	CHBWV received the DOE VPP Legacy of Stars safety award for 4 consecutive years as a Star site. Deactivation of the VF was completed in 2017. Demolition of the VF began on September 11, 2017. Deactivation and hazard reduction in the MPPB continued in 2017. Shipment of legacy waste was 86% complete by the end of the year of 2017, with completion anticipated ahead of schedule. The remaining non-HLW drums were removed from the MPPB Chemical Process Cell (CPC) in preparation for MPPB demolition. Construction of the new potable water treatment system and communica-tions hub were completed in 2017, and progress was made towards upgrading the electrical supply infrastructure.

TABLE UI-6
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 temporary storage inside the VSCs on the south plateau interim 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 UI-6 *(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 ROD dictated that (1) the canisters of vitrified HLW will remain in storage on site until transfer to a geologic repository, (2) the decision on TRU waste will be deferred until certification is obtained from the Waste Isolation Pilot Plant in Carlsbad, New Mexico, and (3) LLW and mixed LLW will 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 UI-6 *(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 VF, 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 was designed to 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.
2016	In August 2016, DOE issued a final Request For Proposals (RFP) for the Supplemental EIS.	The Supplemental EIS contract was awarded to SC&A, Inc. in April 2017.
2017	At the November 2017 quarterly public meeting, the SEIS project team presented an overview of the process for developing the SEIS.	Work continued on the probablistic perfromance assessment to support the SEIS. Work began on development of SEIS alternatives and conceptual engineering designs for disposition of the disposal areas and underground storage tanks.

TABLE UI-7
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 VF
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 (CPC-WSA)	14	CPC-WSA
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 UI-7 *(concluded)*
WVDP RCRA SSWMUs and Constituent SWMUs
Identified in the RFI under the RCRA 3008(h) Order on Consent

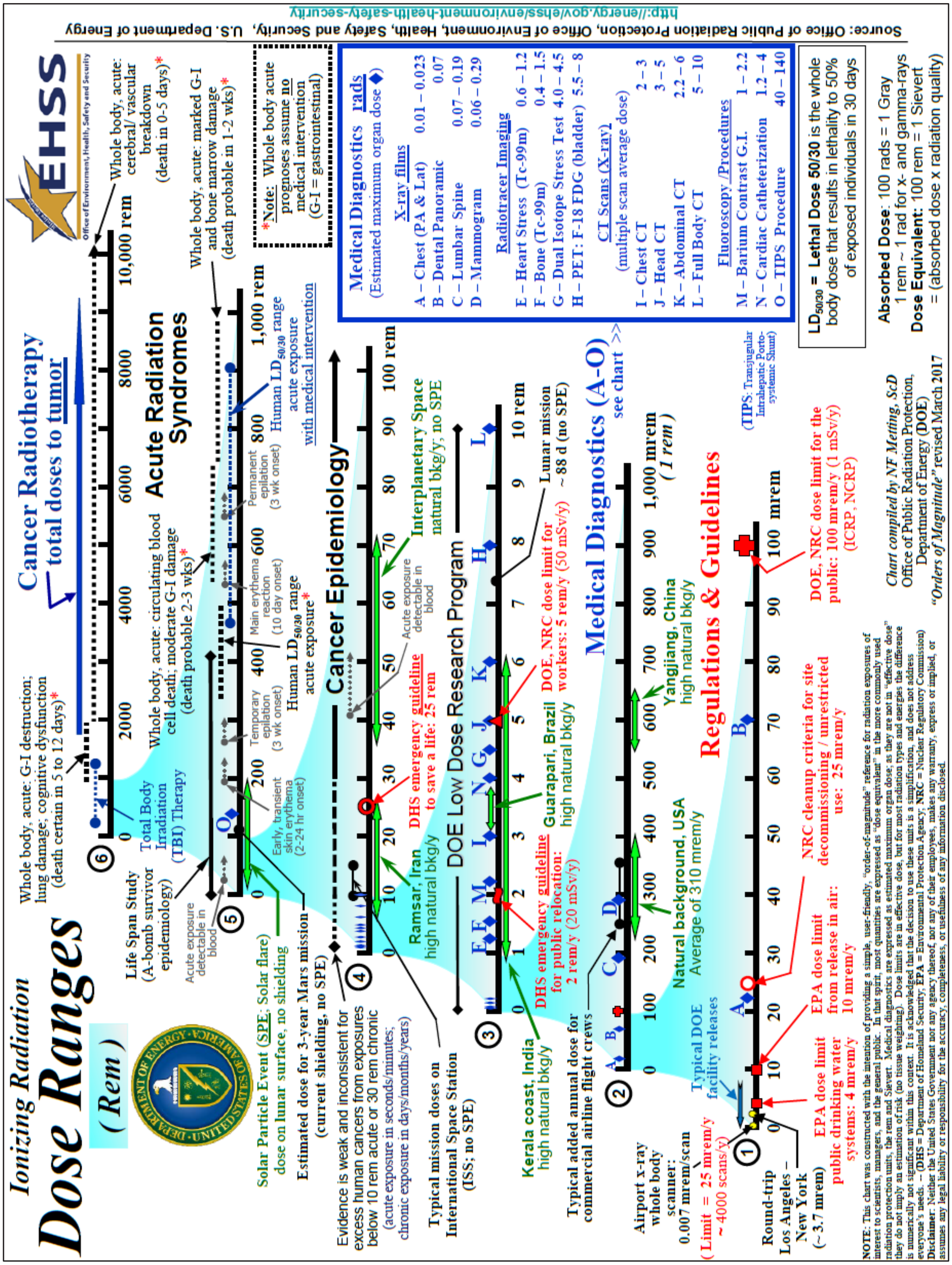
WVDP RCRA SWMUs Not Associated with a SSWMU		
Individual SWMUs	25	Inactive scrap metal landfill adjacent to bulk storage warehouse (NYSERDA SWMU)
	26	Subcontractor maintenance area
	27	Fire brigade training area
	28	VIT hardstand
	29	Industrial waste storage area
	30	Cold hardstand area near the CDDL
	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 UI-8
WVDP 2017 Monthly Precipitation Totals

Month	***2017 Monthly Total (inches)***	***10-Year Monthly Average (inches)*** *(2007 through 2016)*
January	3.87	2.91
February	2.67	2.36
March	3.28	2.53
April	3.90	3.55
May	3.95	2.26
June	4.92	3.57
July	3.44	4.55
August	3.64	4.45
September	2.64	3.84
October	3.82	3.68
November	4.98	2.75
December	3.38	4.15
Total (inches)	**44.5**	**40.6**
Total (centimeters)	113.0	103.1

FIGURE UI-1
The DOE Ionizing Dose Ranges Chart (December 2017)



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, C, and Greater-than-Class-C (GTCC) 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," 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 - An 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 and 2015 - Standards for an EMS, which require 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) - An 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 sievert.

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
BEIR - Biological Effects of Ionizing Radiation
BOD_5 - Biological Oxygen Demand (5-day)
BOSF - Balance of Site Facilities
Bq - Becquerels
BKG - Background
BR - Bedrock

C

CAA - Clean Air Act
CBS - Chemical Bulk Storage
CCHD - Cattaraugus County Health Department
CD - Compact Disk
CDDL - Construction and Demolition Debris Landfill
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
CPC - Chemical Process Cell
CPC-WSA - Chemical Process Cell-Waste Storage Area
CSAP - Characterization Sampling and Analysis Plan
CSPF - Container Sorting and Packaging Facility
CSRF - Contact Size-Reduction Facility
CWA - Clean Water Act
CX - Categorical Exclusion
CY - Calendar Year

D

D&D - Decontamination and Decommissioning
DCF - Dose Conversion Factor
DCG - Derived Concentration Guide
DCS - Derived Concentration Standard
DEIS - Draft Environmental Impact Statement
DL - Detection Limit
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)
DOECAP - DOE Consolidated Audit Program
DP - Decommissioning Plan

E

EA - Environmental Assessment
ECL - (New York State) Environmental Conservation Law
ECS - Environmental Compliance Summary
ED - Environmental Dosimetry Co.
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
EWG - Erosion Working Group
EXWG - Exhumation Working Group

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

GEL - General Engineering Lab
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

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)
LPS - Liquid Pretreatment System
LSA - Lag Storage Addition
LTS - Lavery Till Sand
LWC - Liquid Waste Cell
LWTS - Liquid Waste Treatment System

M

MAPEP - Mixed Analyte Performance Evaluation Program
MCF - One thousand cubic feet
MCL - Maximum Contaminant Level
MCLG - Maximum Contaminant Level Goal
MDC - Minimum Detectable Concentration
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
MSDS - Material Safety Data Sheet
MWh - Megawatt-hour

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.
NGVD - National Geodetic Vertical Datum
NH_3 - Ammonia
NOI - Notice of Intent
NO_2-N - Nitrite (as N)
NO_3-N - Nitrate (as N)
NO_x - Nitrogen Oxides
NOV - Notice of Violation
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
NTU - Nephelometric Turbidity Units
NUREG - (U.S.) NRC Regulation
NYCRR - New York State Official Compilation of Codes, Rules, and Regulations
NYGATS - New York Generation Attribute Tracking System
NYS - New York State
NYS ECL - New York State Environmental Conservation Law
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
PFAS - Per- and Polyfluoroalklyl Substances
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
PVC - Polyvinyl chloride
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
REC - Renewable Energy Credits
REM - Roentgen Equivalent Man
RFP - Request for Proposal
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
SDS - Safety Data Sheet
SEIS - Supplemental Environmental Impact Statement
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
SPA - Special Package Authorization
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
SWS - Slackwater Sequence

__T__________________________________

T&VDS - Tank and Vault Drying System
TA - Test America Laboratories
TBP - Tributyl Phosphate
TBU - Thick-Bedded Unit
TCP - Trichloropropane
TDS - Total Dissolved Solids
TER - Technical Evaluation Report
TKN - Total Kjeldahl Nitrogen
TLD - Thermoluminescent Dosimeter
TOGS - Technical and Operational Guidance Series
TRU - Transuranic
TSDF - Treatment Storage and Disposal Facility
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

VEC - Ventilation Exhaust Cell
VF - Vitrification Facility
VIT - Vitrification
VOC - Volatile Organic Compound
VPP - Voluntary Protection Program
VSC - Vertical Storage Cask

W

WCS - Waste Control Specialists LLC
WET - Whole Effluent Toxicity
WIP - Work Instruction Package
WIR - Waste Incidental to Reprocessing
WLT - Weathered Lavery Till
WMA - Waste Management Area
WNYNSC - Western New York Nuclear Service Center
WPA - Waste Processing Area
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)

X

XC - Extraction Cell

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APPENDIX A

2017 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 2017. 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 2017. 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.

There were no changes to the overall environmental monitoring program in 2017, with the exception of discontinued monitoring at ANVITSK. The VF stack, which is sampled at ANVITSK, was shut down on July 28, 2017 in preparation for demolition.

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	Container Sorting and Packaging Facility	Figure A-6
ANVITSK (inactive)	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	not shown
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

Index of Environmental Monitoring Program Sample Points *(continued)*

Sample Location	Description of Monitoring Point	Location shown on Figure
Storm Water Outfalls *(continued)*		
GROUP 7		
S20 (WNSO20)	Disposal Area Drainage (WNNDADR)	Figure A-3
GROUP 8		
S27 (WNSO27)	Drum Cell Drainage West	Figure A-3
S35 (WNSO35)	Drum Cell Drainage East	Figure A-3
Storm Water Precipitation pH Measurement Location		
WNSWR01	Near the Site Rain Gauge	Figure A-3
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
On-Site Groundwater and Seeps		
SSWMU #1	LLW2 Wells	Figure A-9
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
RHWF	RHWF Wells	Figure A-9
MPPB Wells	MPPB Downgradient Wells	Figure A-9
North Plateau Seeps	Northeastern Edge of North Plateau	Figure A-9
Miscellaneous	Monitoring Locations WP-A, WP-C, WP-H (not associated with a SWMU)	Figure A-9
Surface Elevation	Surface Water Elevation Hubs (i.e., SE009)	Figure A-9
On-Site Potable (Drinking) Water (supplied by groundwater wells)		
WNDWELL1	Drinking Water Well #1	Figure A-8
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		
WNDNURSE	Nurse’s Office Sink	Figure A-8
WNDNKMP	Main Plant Shower	Figure A-8
WNDNKRH	RHWF Kitchenette Sink	Figure A-8
WNDNK06	Guardhouse Bathroom Sink	Figure A-8
WNDNK15	Parking Lot Men's Room Sink	Figure A-8
WNDNK23	10-Plex Men’s Room Sink	Figure A-8
WNDNK24	10-Plex Kitchenette Sink	Figure A-8
WNDNK25	RHWF Men’s Room Sink	Figure A-8
WNDNK26	New Women’s Locker Room Sink	Figure A-8
WNDNK27	New Men’s Locker Room Sink - South Extension	Figure A-8
WNDNK28	New Men’s Locker Room Sink - North Extension	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
Off-Site Biological		
BFMFLDMN	Southeast Milk, Near-Site	Figure A-11
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 = 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	
40 CFR 61, Subpart H (radiological air emissions); 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
2017 Environmental Monitoring Program

Sample Location Code	Sampling Type/ Medium	Collection Frequency/ Total Annual Samples	Measurements/Analyses
On-Site Air Emissions			
ANSTACK[a] MPPB ventilation exhaust stack **ANSTSTK**[a] STS ventilation exhaust **ANCSRFK**[a,c] (inactive) Contact size-reduction facility exhaust **ANCSPFK**[a] Container sorting and packaging facility exhaust **ANVITSK**[a,d] (inactive) VIT heating, ventilation, and air conditioning exhaust **ANRHWFK**[a] RHWF exhaust **ANRVEU1**[a,e] MPPB replacement ventilation emission unit exhaust	Continuous on-line air particulate monitors	Continuous measurement of fixed filter; replaced biweekly; held as backup	Real-time monitoring - CAM
	Continuous off-line air particulate filters	Biweekly; 26 each location	Gross alpha/beta, gamma isotopic[b] upon collection, flow
	Composite of biweekly particulate filters	Semiannually; 2 each location	Sr-90, U-232, U-233/234, U-235/236, U-238, total U, Pu-238, Pu-239/240, Am-241, gamma isotopic, flow
	Continuous off-line desiccant columns for collection of water vapor	Biweekly; 26 each at ANSTACK and ANSTSTK only	H-3, flow
	Continuous off-line charcoal cartridges	Cartridges collected biweekly and composited into 2 semiannual samples at each location	I-129
OVEs/PVUs[a] Outdoor ventilated enclosures/portable ventilation units	Continuous off-line air particulate filter	Collected as required by project	Gross alpha/beta, gamma isotopic[b] upon collection, flow
	Composite of filters	Semiannually	Sr-90, U-232, U-233/234, U-235/236, U-238, total U, Pu-238, Pu-239/240, Am-241, gamma isotopic, flow

[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. The building has been prepared for demolition.
[d] Operation of the VF stack was discontinued in July 2016. Preparations for VF demolition continued throughout CY 2016.
[e] The MPPB replacement ventilation emission unit, went online in August 2015.

TABLE A-2 (*continued*)
2017 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 2 to 8 times per year, averaging 6 to 7 days per discharge; 12–56 days per year	Daily flow, hold for flow-weighted composite
	Grab	Twice during discharge; 4–16 per year	Gross alpha/beta, H-3, Sr-90, gamma isotopic
	Flow-weighted composite of daily samples for each discharge	2 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; 4–16 per year	Settleable solids, TDS, Dissolved Oxygen (DO)
	24-hour composite	Twice during discharge; 4–16 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; 2–8 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; 2–8 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; 4–16 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; 4–16 per year	TDS

[a] Required by SPDES Permit #NY0000973. Results reported in the SPDES DMR and evaluated in the ASER.
[b] WET testing is performed quarterly every 5 years. The second year of quarterly testing was completed in 2017.
[c] WNSP01B is no longer operated.

TABLE A-2 *(continued)*
2017 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	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, 6-24 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, 6-24 per year	TDS, flow rate
Storm Water Outfalls			
Group 1[a] **WNSO04 (S04)**	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. Storm water reports will be appended to the June and December SPDES DMRs.
[b] The waste treatment facility was shutdown in November 2014. WNSP007 is not sampled if there is no discharge.
[c] WET testing at WNSP007 was not required in 2017 since sanitary and industrial discharges have been discontinued.

TABLE A-2 (*continued*)
2017 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. Storm water reports will be appended to the June and December SPDES DMRs.
[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*)
2017 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. Storm water reports will be appended to the June and December DMRs.

TABLE A-2 (*continued*)
2017 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[a]	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[b]	POCs[b], SOCs[b], MTBE[b], vinyl chloride[b]
		Annually; 1 per year (2nd week in August)	Na, NO_3-N, NO_2-N[c]
		Once every 3 years	Ag, As, Ba, Be, Cd, Cr, Hg, Ni, Sb, Se, Tl, cyanide (as free), fluoride
WNDNKMP[d] Main plant shower	Grab liquid	Annually; 1 per year	Gross alpha/beta, H-3
WNDNKRH RHWF drinking water	Grab liquid	Once every 3 years	Total haloacetic acids and total trihalomethanes
Distribution System Sinks: WNDNK06, 15, 23, 24, 25, 26, 27, 28, WNDNKRH and WNDNURSE [e, f, g]	Grab liquid[f,g]	Quarterly[f]; 4 per year	Total coliform, E. coli, residual chlorine[f]
		Twice a year[g]	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] Samples are collected at the wellheads only if bacteriological parameters are detected in the distribution system.

[b] Sampling for Principal Organic Contaminants (POCs) and Specific Organic Chemicals (SOCs) was required only for the first three quarters beginning in 2014. The monitoring waivers from CCHD expire 1/1/2021 for POCs and 12/31/2017 for SOCs.

[c] An initial sample for NO_2-N was collected in 2015. Because the results were less than 50% of the MCL, no additional NO_2-N samples were required thereafter.

[d] Sampling at the MPPB shower for radiological parameters continued in 2017 for screening purposes. However, sampling this location is not a regulatory requirement under the WVDP drinking water monitoring plan.

[e] Distribution system sinks in 2017 include: Guard house (WNDNK06), Parking lot men's room (WNDNK15), 10-plex men's room (WNDNK23), 10-plex kitchenette (WNDNK24), RHWF men's room (WNDNK25), New women's locker room (WNDNK26), New men's locker room - south extension (WNDNK27), New men's locker room - north extension (WNDNK28), RHWF kitchenette (WNDNKRH), and Nurse's office (WNDNURSE).

[f] One sample is collected by CCHD for bacteriological sampling from one of four sinks in the distribution system (WNDNK06, WNDNK23, WNDNKRH or WNDNURSE) on a rotational basis each quarter. Supplemental samples were collected prior to new system hookup.

[g] Pb and Cu were analyzed for at all ten sinks listed above twice a year in 2017 as occurred in 2016.

TABLE A-2 (*continued*)
2017 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), and/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)***
2017 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; 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	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	Twice each sampling event; 8 per year (if quarterly), 2 per year (if annually)	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 2017, will next be sampled in 2022)	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 2017, will next be sampled in 2022)	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

TABLE A-2 *(continued)*
2017 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 2017, will next be sampled in 2022)	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)*
2017 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)*
2017 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 2017, will next be sampled in 2022)	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
BFVNEAAF (apples), **BFVNEAB** (beans), **BFVNEAC** (corn) Food crops from locations near the WVDP **BFVCTRL** Control food crops (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 2017, will next be sampled in 2022)	Gamma isotopic and Sr-90 in edible portions, % moisture, H-3 in free moisture

TABLE A-2 *(concluded)*
2017 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**: Security fence around the WVDP **#32, #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

FIGURE A-1
West Valley Demonstration Project Base Map

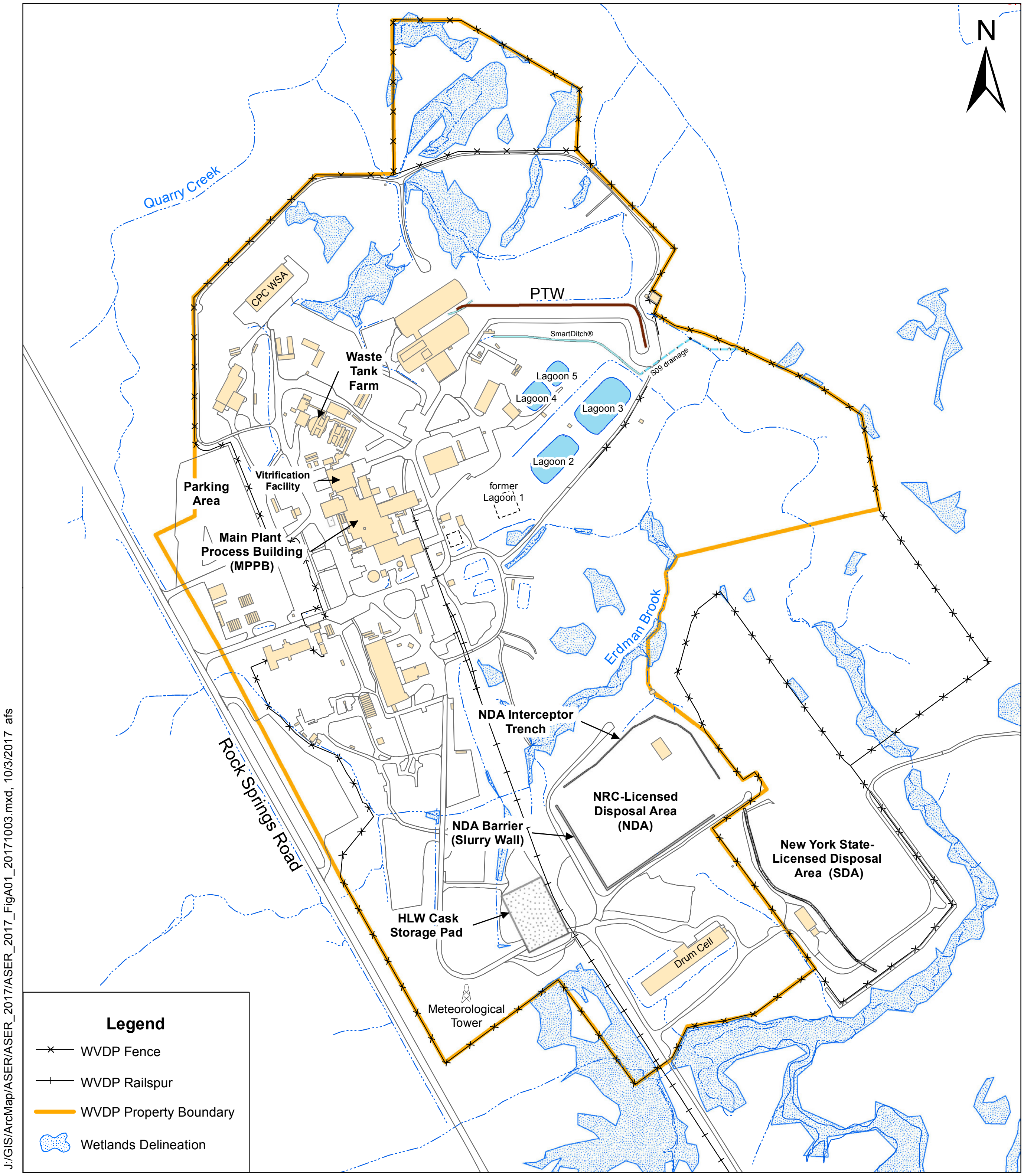

FIGURE A-2
On-Site Liquid Effluent, Surface Water and Soil/Sediment Sampling Locations

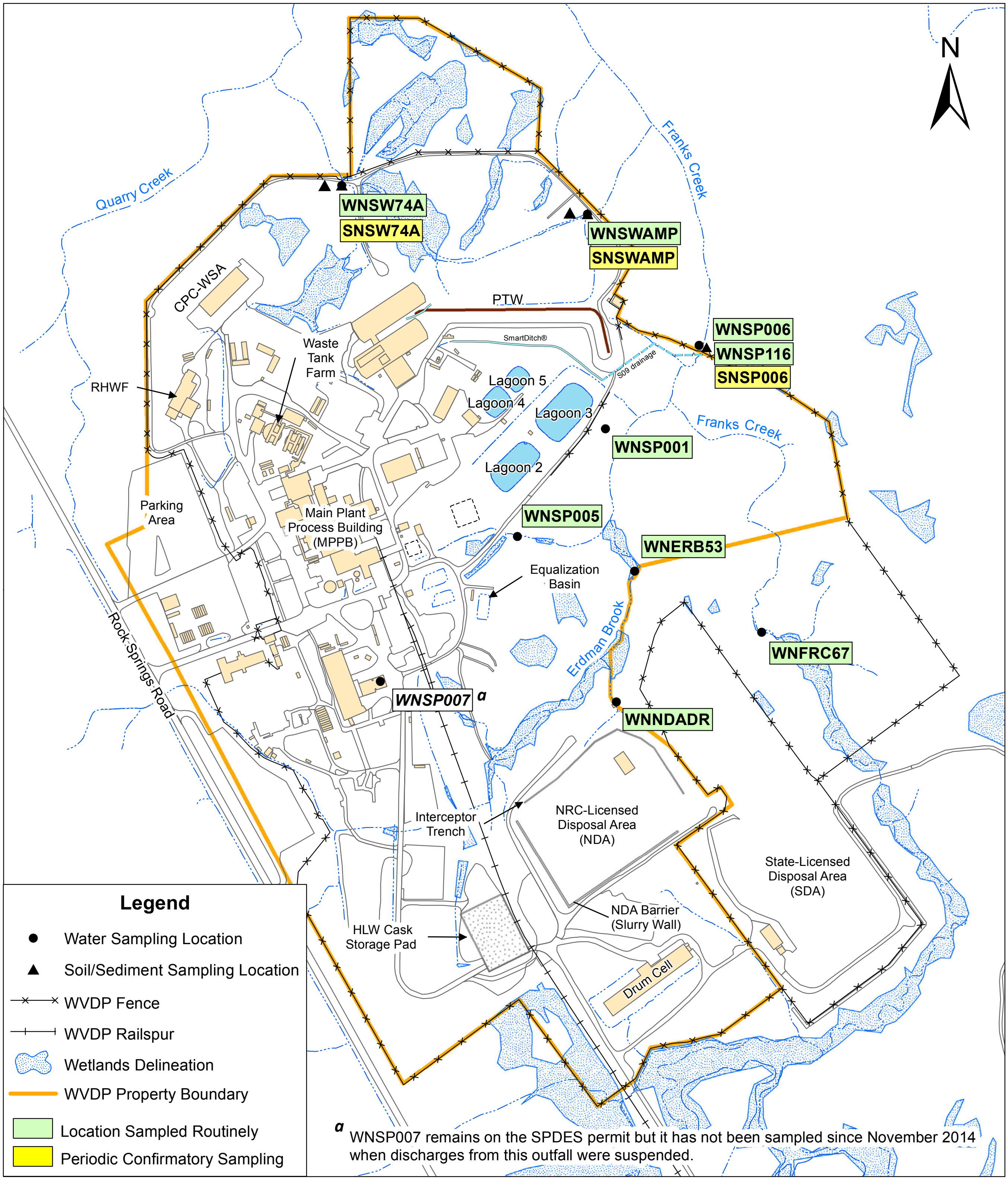

FIGURE A-3
On-Site Storm Water Outfalls

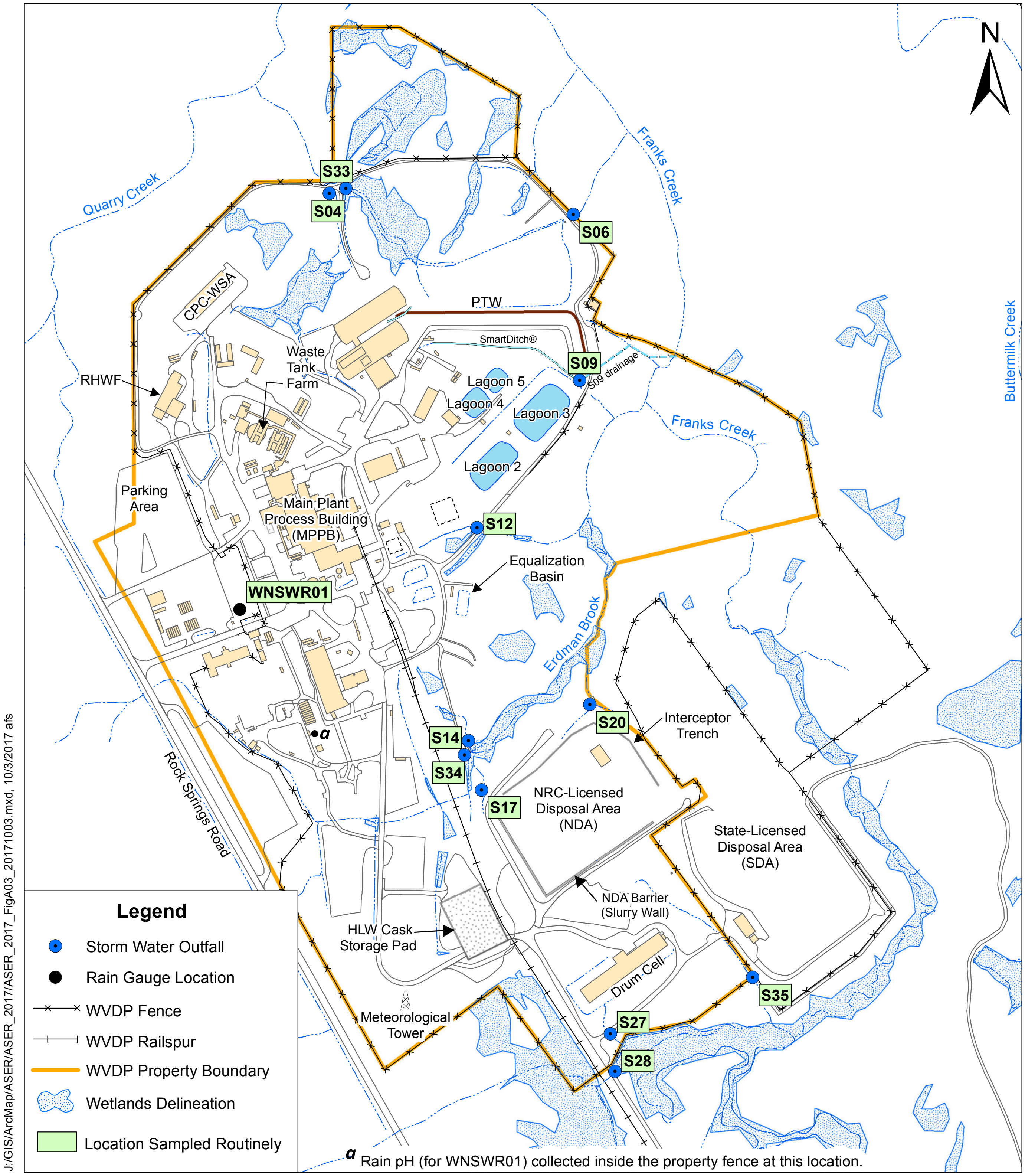

FIGURE A-4
Rail Spur Storm Water Outfalls

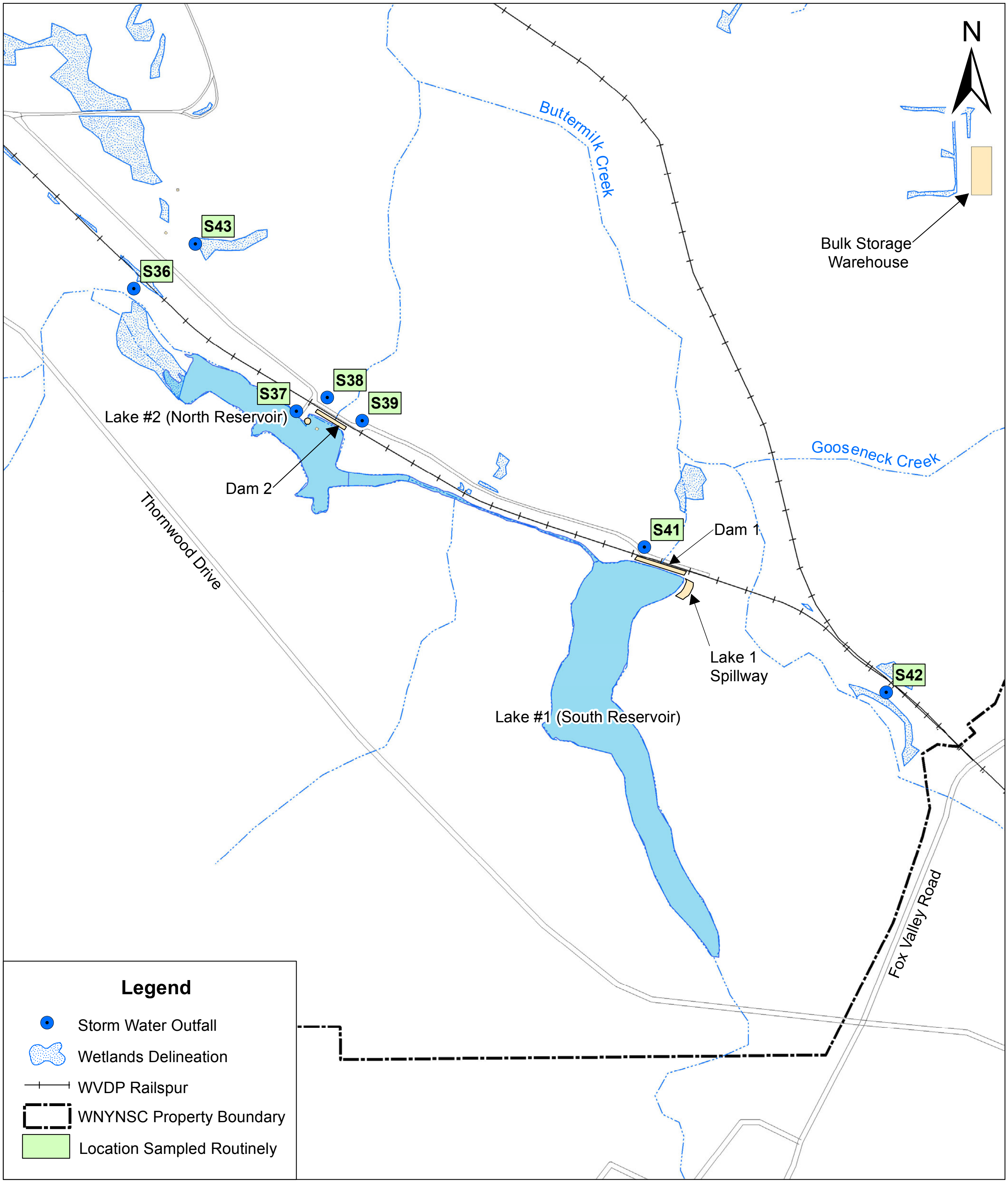

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FIGURE A-5
Off-Site Surface Water and Soil/Sediment Sampling Locations

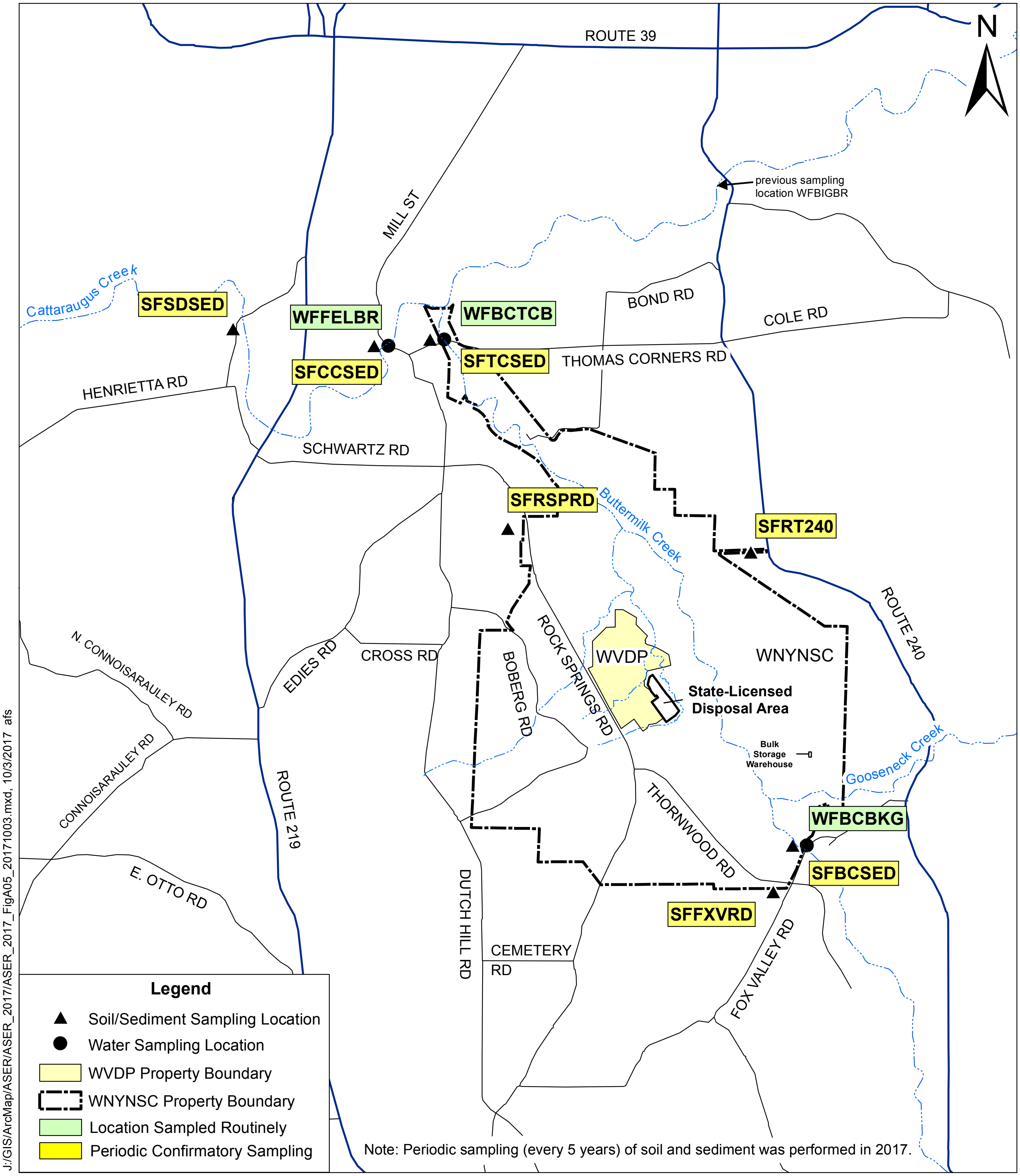
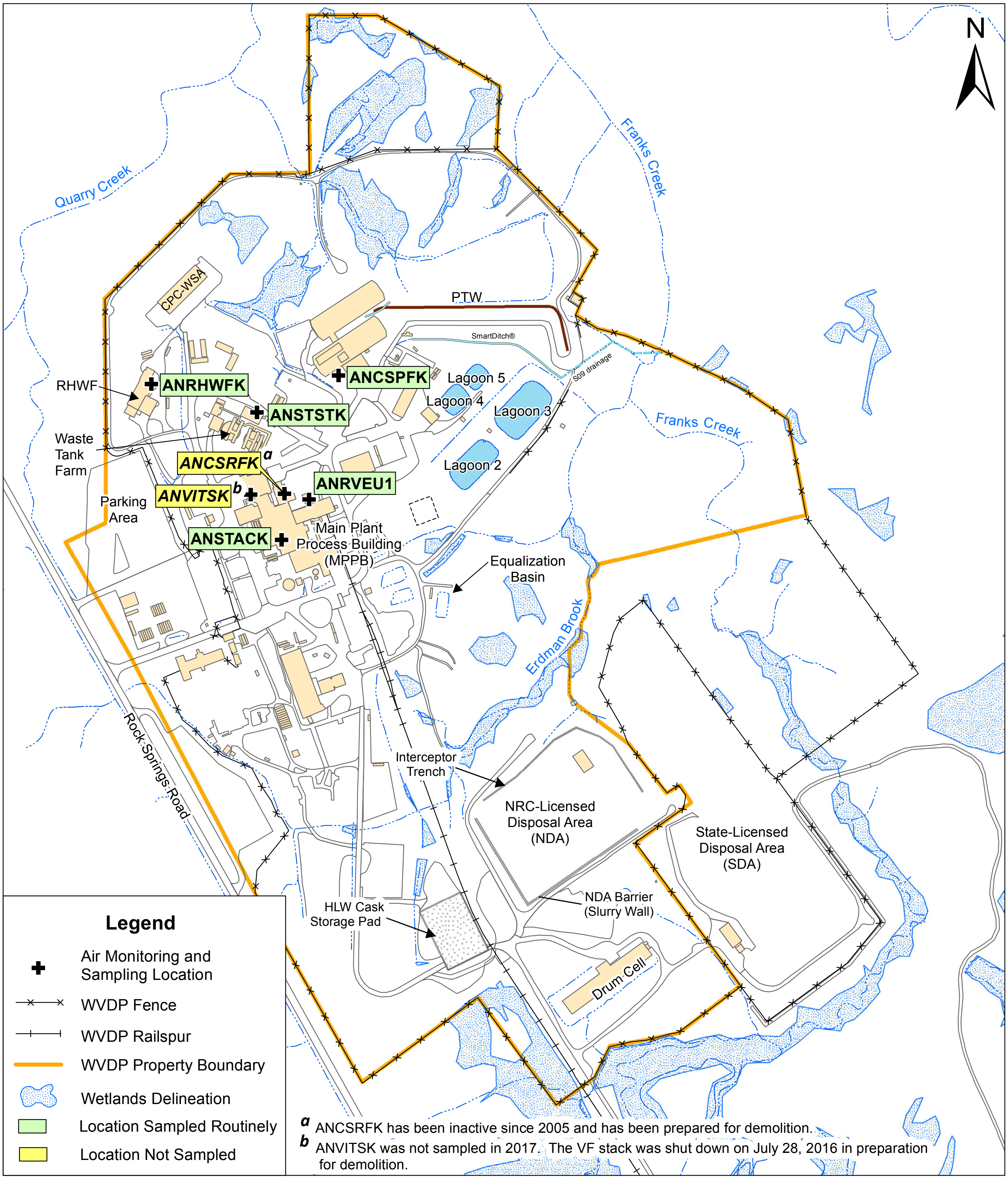


FIGURE A-6
On-Site Air Monitoring and Sampling Locations



[a] ANCSRFK has been inactive since 2005 and has been prepared for demolition.
[b] ANVITSK was not sampled in 2017. The VF stack was shut down on July 28, 2016 in preparation for demolition.

FIGURE A-7
Off-Site Ambient Air Monitoring and Sampling Locations

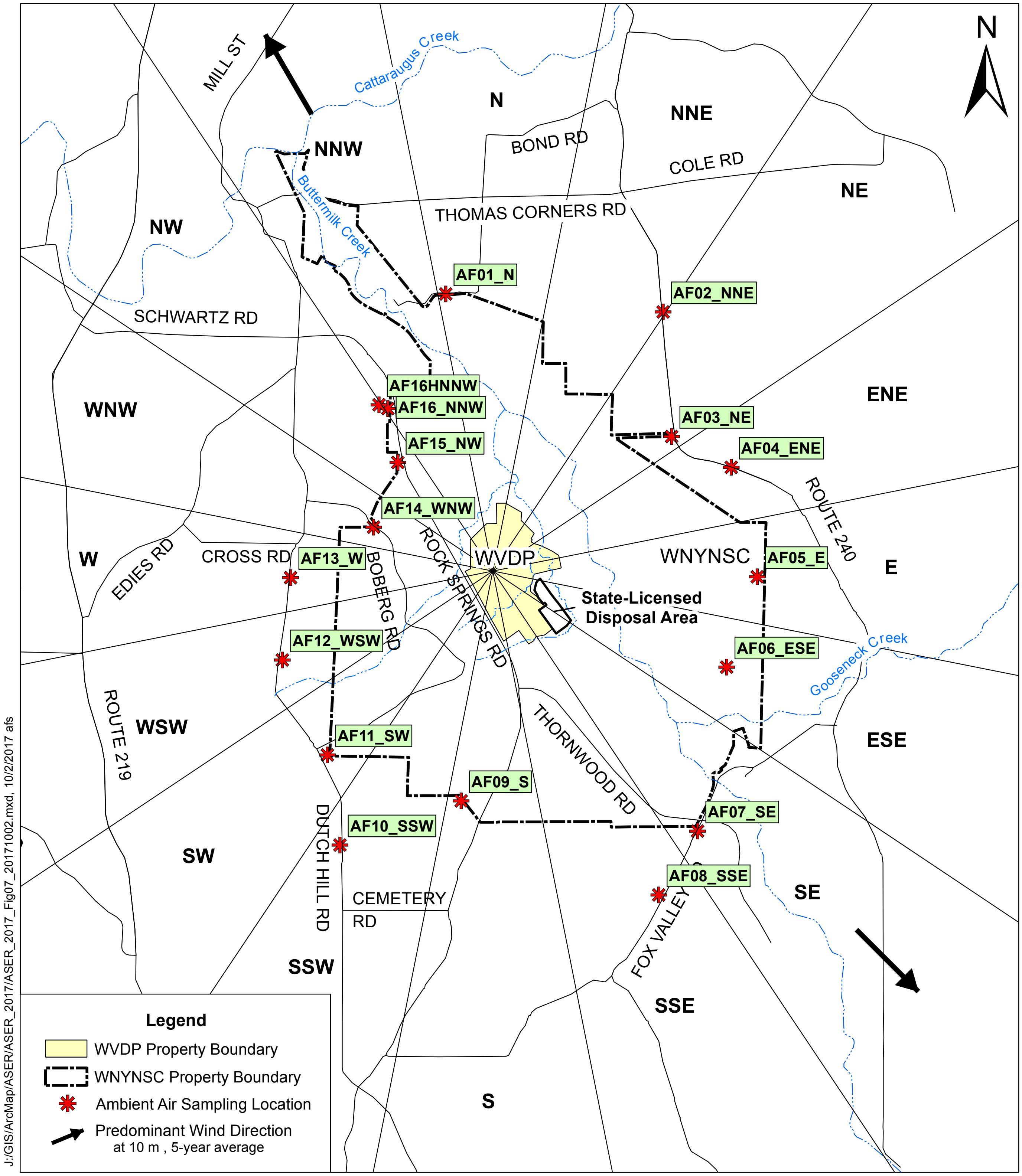


FIGURE A-8
Drinking Water Supply Wells and
Source Water Protection Monitoring Network

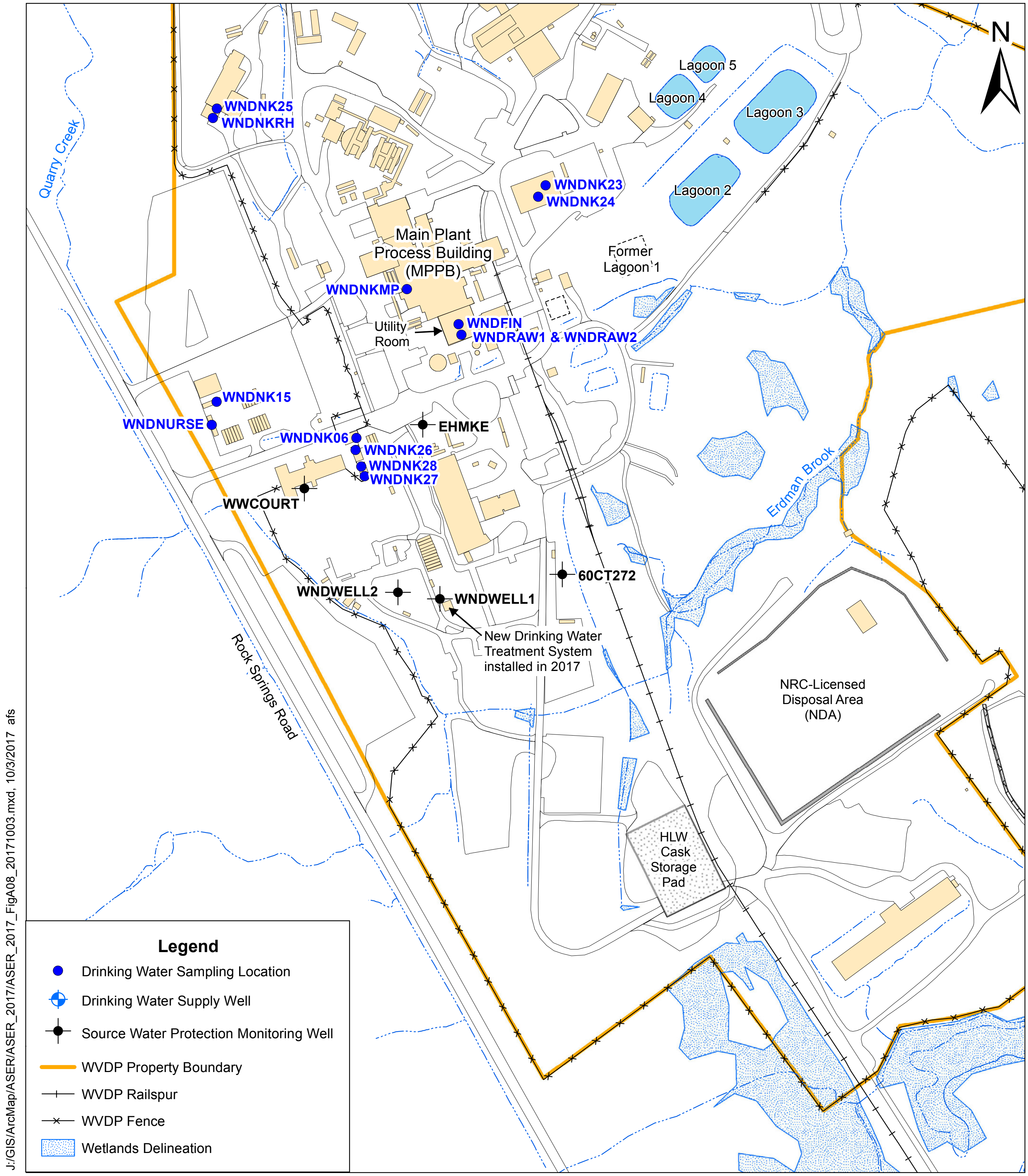


FIGURE A-9
North Plateau Groundwater Monitoring Network

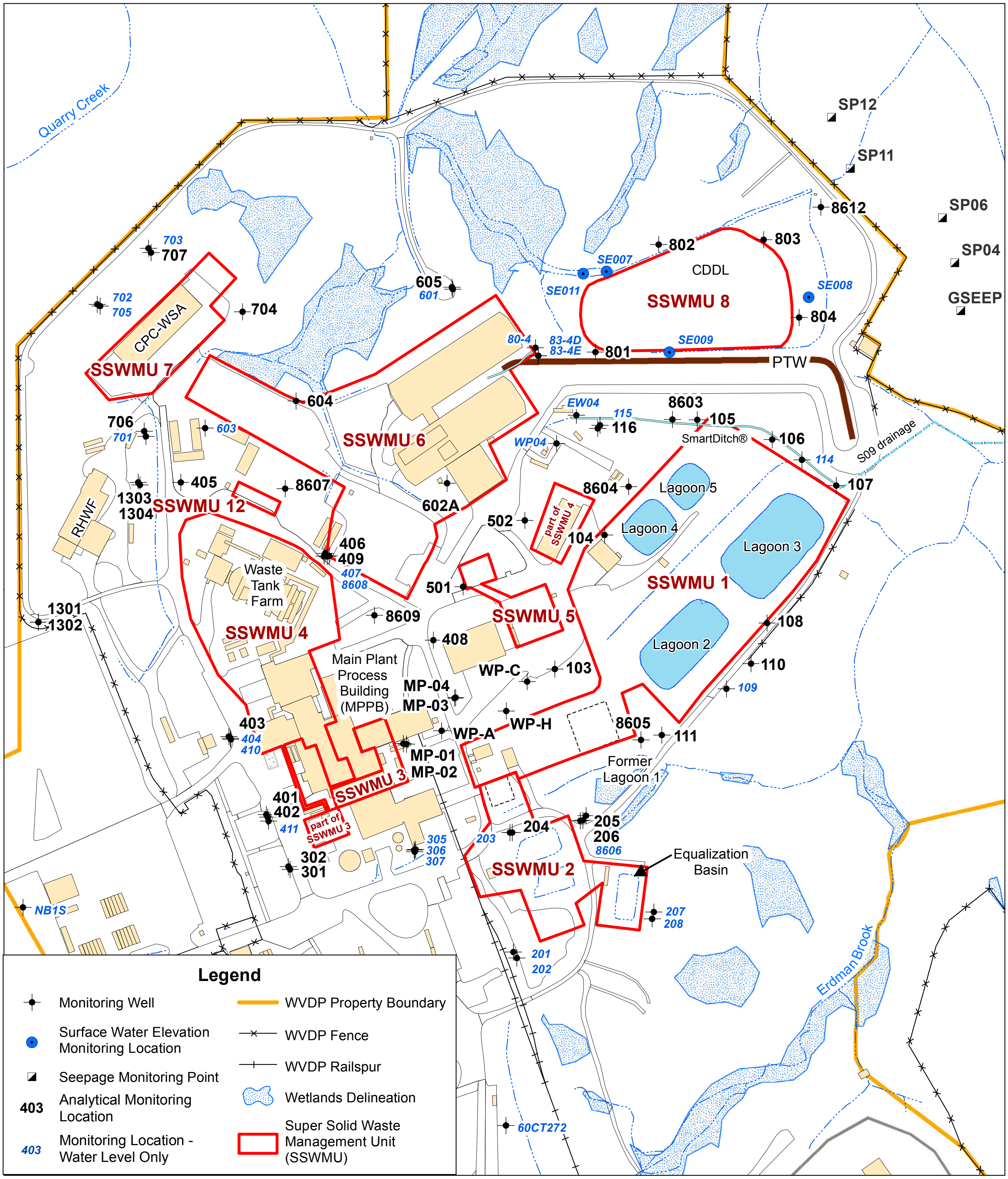


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FIGURE A-10
South Plateau Groundwater Monitoring Network

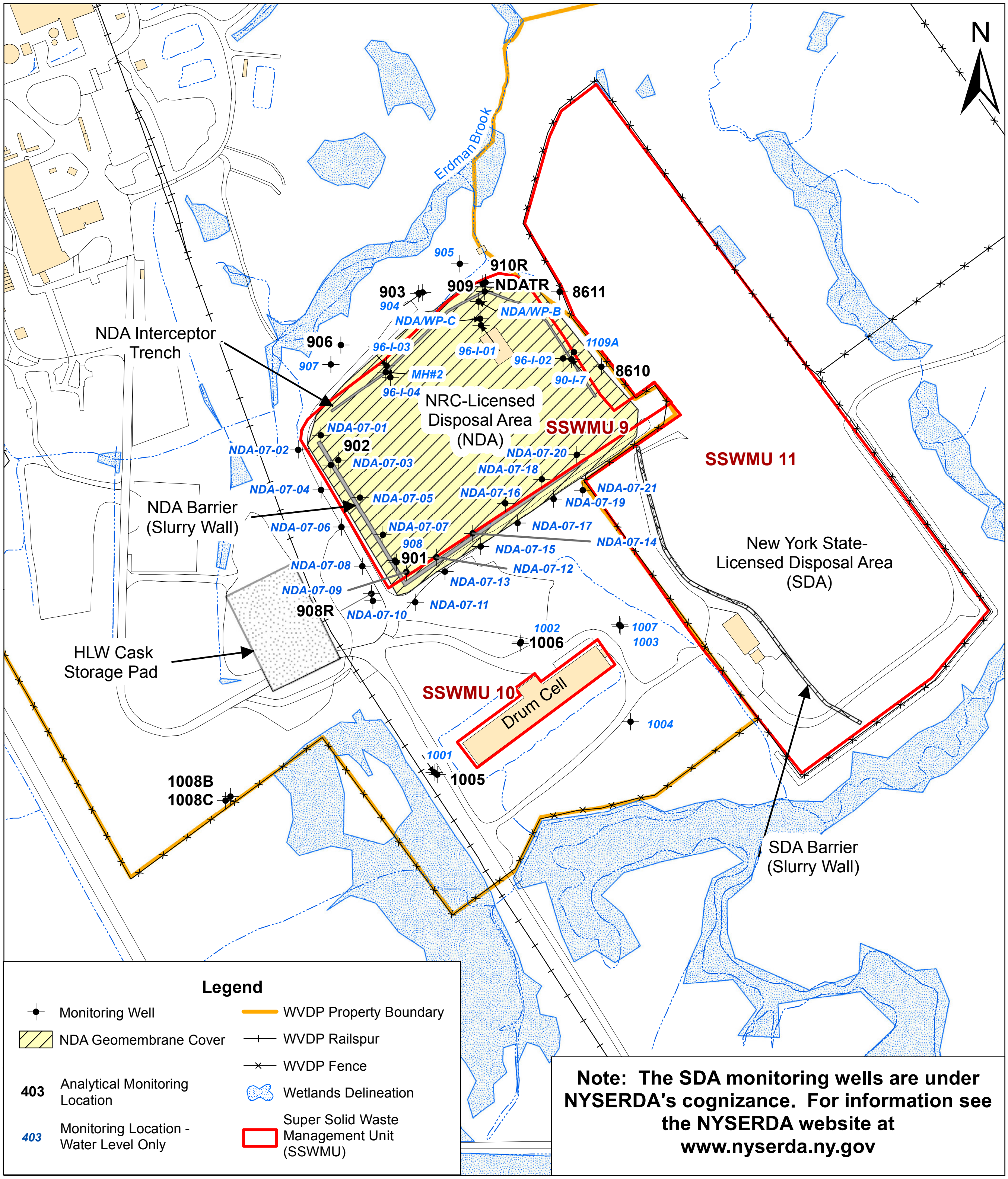

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FIGURE A-11
Biological Sampling Locations

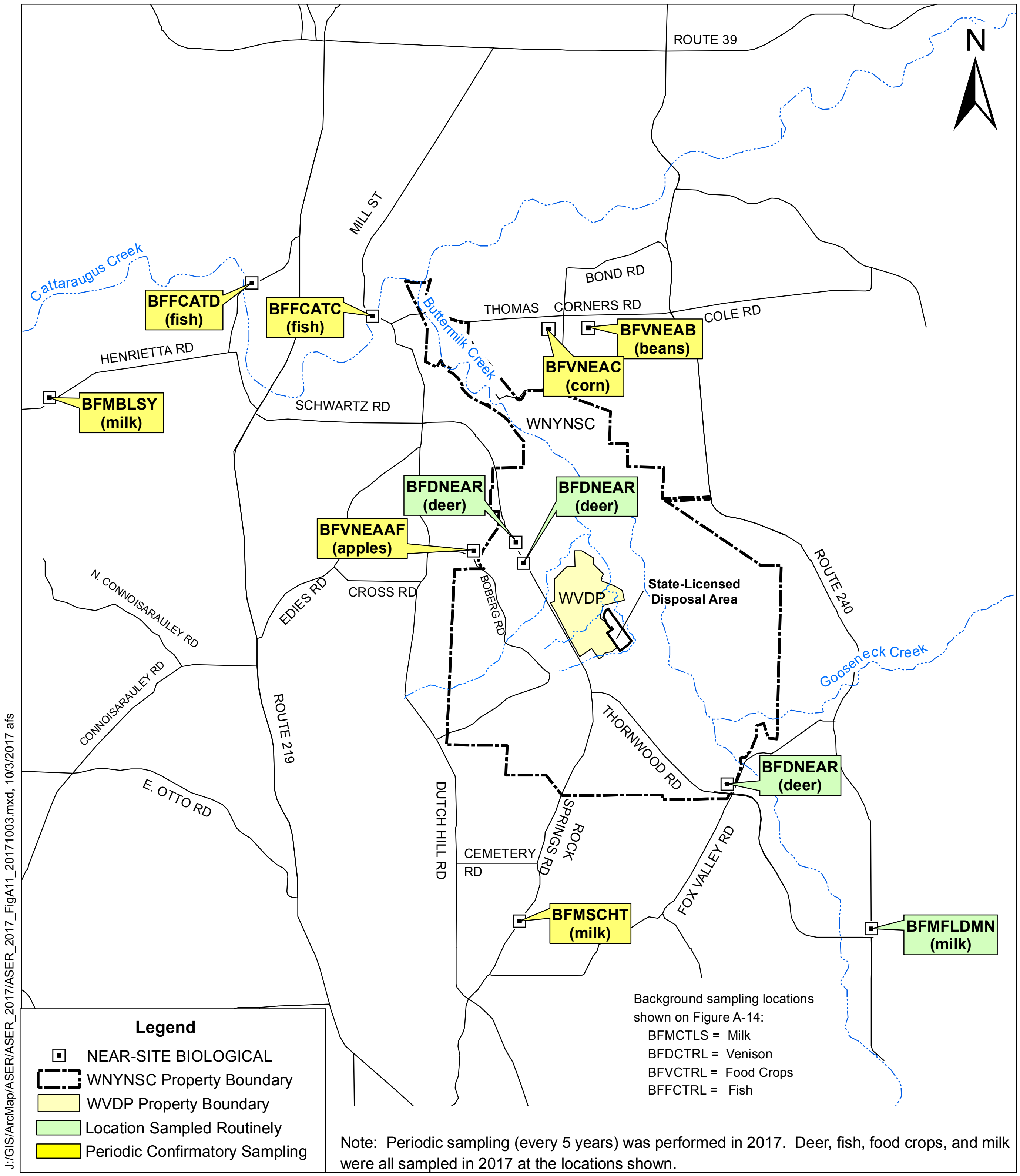


FIGURE A-12
Location of On-Site / Near-Site Thermoluminescent Dosimeters (TLDs)

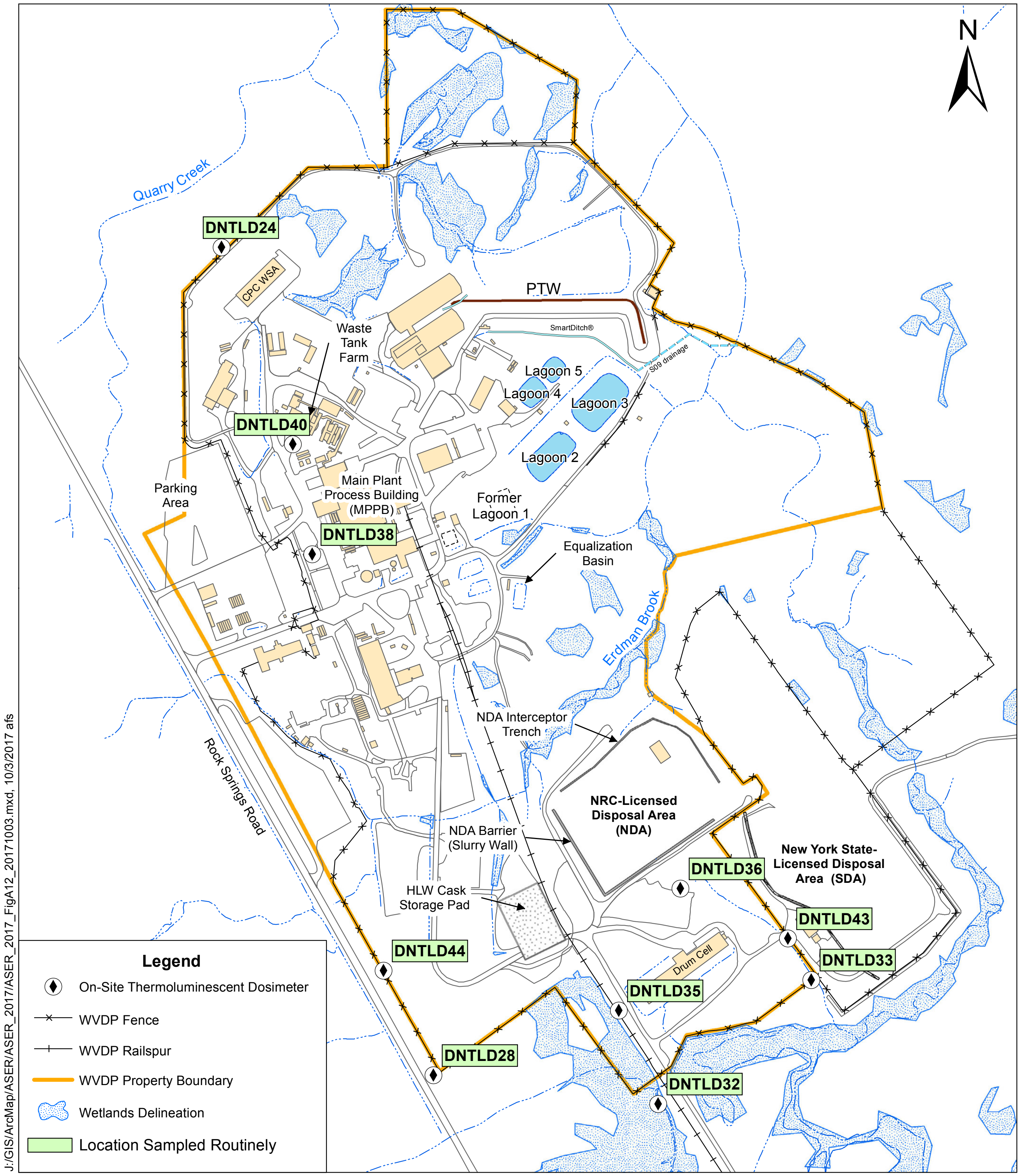
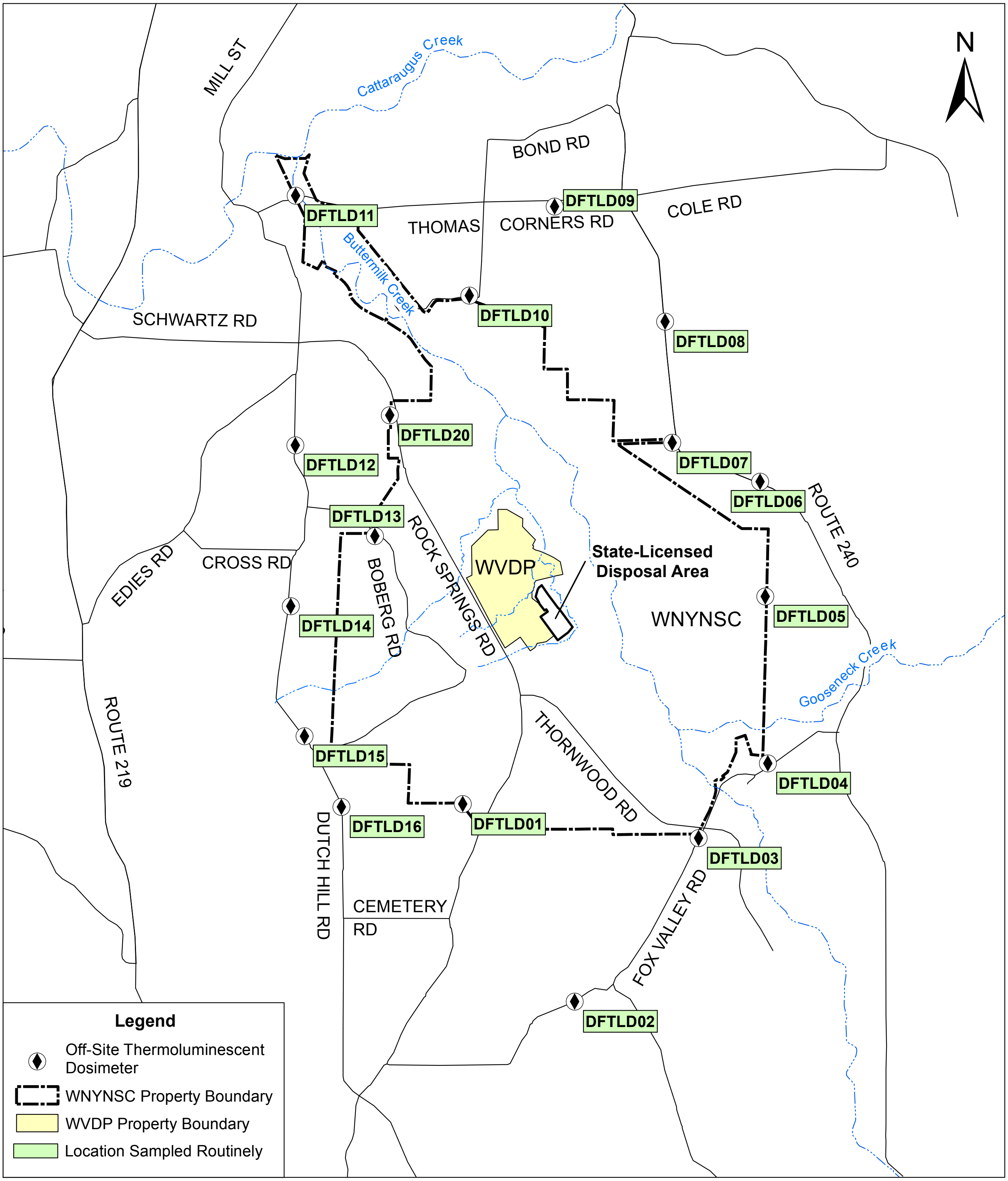
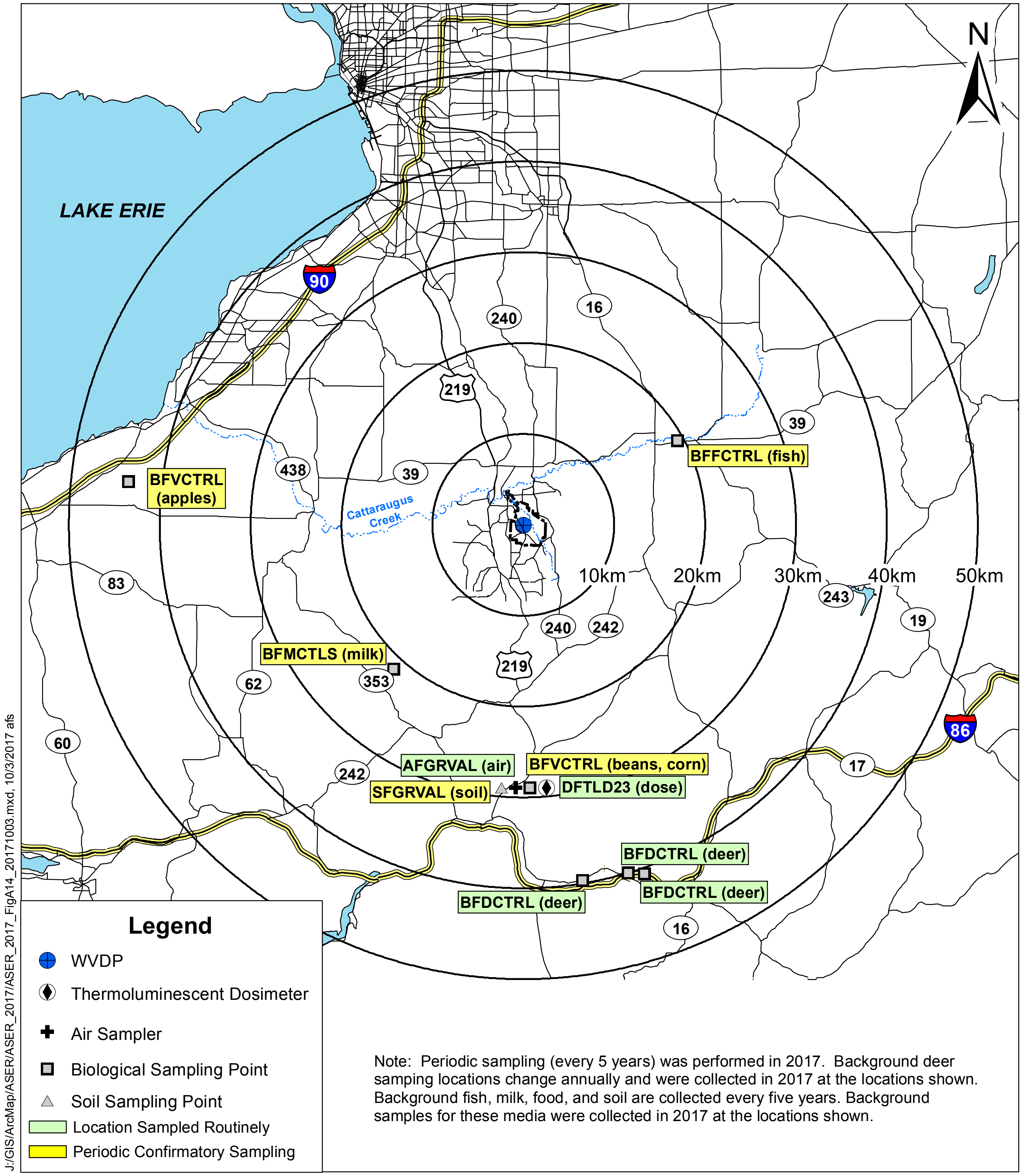


FIGURE A-13
Location of Off-Site Thermoluminescent Dosimeters (TLDs) Within 5 Kilometers of the WVDP



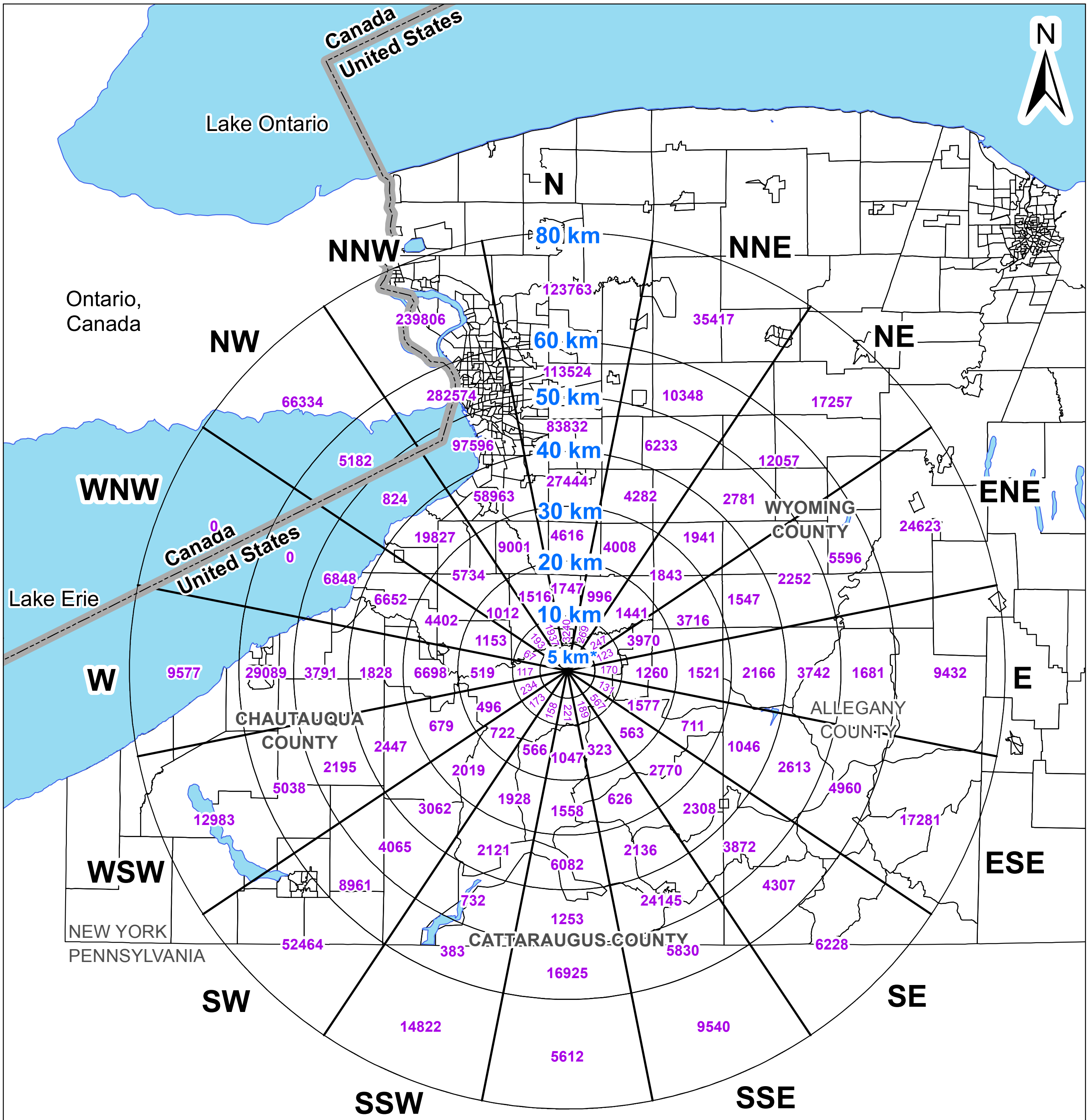
J:/GIS/ArcMap/ASER/ASER_2017/ASER_2017_FigA13_20171003.mxd, 10/3/2017 afs

FIGURE A-14
Environmental Sampling Locations More Than 5 Kilometers From the WVDP



Note: Periodic sampling (every 5 years) was performed in 2017. Background deer samping locations change annually and were collected in 2017 at the locations shown. Background fish, milk, food, and soil are collected every five years. Background samples for these media were collected in 2017 at the locations shown.

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.

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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[b]; 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***
Storm Water 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.

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
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	--	--	--	--	--
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.

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 2017 Lagoon 3 (WNSP001) Liquid Effluent Radioactivity Concentrations With U.S. DOE-Derived Conentration Standards (DCSs)

Isotope [a]	*Discharge Activity* [b]		*Flow-Weighted Mean Concentration (µCi/mL)*	*DCS* [d] *(µCi/mL)*	*Ratio of Mean Concentration to DCS*
	(Ci)	*(Becquerels)* [c]			
Gross Alpha	6.61±0.54E-04	2.45±0.20E+07	2.38±0.19E-08	9.8E-08[e]	NA
Gross Beta	1.15±0.01E-02	4.26±0.03E+08	4.13±0.03E-07	1.1E-06[e]	NA
H-3	1.72±0.18E-02	6.37±0.66E+08	6.19±0.64E-07	1.9E-03	0.0003
C-14	3.69±4.82E-04	1.37±1.78E+07	1.33±1.73E-08	6.2E-05	<0.0003
K-40	3.67±5.18E-04	1.36±1.92E+07	1.32±1.86E-08	NA[f]	NA
Co-60	-0.04±4.03E-05	-0.01±1.49E+06	-0.01±1.45E-09	7.2E-06	<0.0002
Sr-90	5.34±0.10E-03	1.98±0.04E+08	1.92±0.03E-07	1.1E-06	0.1745
Tc-99	2.28±0.36E-04	8.42±1.33E+06	8.17±1.29E-09	4.4E-05	0.0002
I-129	5.55±2.11E-05	2.05±0.78E+06	1.99±0.76E-09	3.3E-07	0.0060
Cs-137	8.65±1.04E-04	3.20±0.38E+07	3.11±0.37E-08	3.0E-06	0.0104
U-232[g]	1.46±0.08E-04	5.41±0.29E+06	5.25±0.29E-09	9.8E-08	0.0536
U-233/234[g]	1.25±0.07E-04	4.61±0.25E+06	4.48±0.25E-09	6.6E-07[h]	0.0068
U-235/236[g]	6.88±1.57E-06	2.55±0.58E+05	2.47±0.57E-10	7.2E-07	0.0003
U-238[g]	9.91±0.61E-05	3.67±0.23E+06	3.56±0.22E-09	7.5E-07	0.0047
Pu-238	1.65±0.87E-06	6.11±3.20E+04	5.93±3.11E-11	1.5E-07	0.0004
Pu-239/240	1.49±0.76E-06	5.52±2.82E+04	5.36±2.73E-11	1.4E-07	0.0004
Am-241	1.79±0.72E-06	6.63±2.65E+04	6.44±2.57E-11	1.7E-07	0.0004
Sum of Ratios					**0.26**

NA – Not applicable; ratio calculated from isotopic data.

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

[b] Total volume released: 2.78E+10 milliliters (mL) (7.35E+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] The representative DCS for gross alpha in water shown is for U-232 and for gross beta is for Sr-90 (selected as the most restrictive) since DCSs do not exist for indicator parameters.

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

[g] Total uranium (g) = 3.34±0.10E+02; Average uranium (µg/mL) = 1.20±0.03E-02.

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

TABLE B-2B
2017 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	0.26	0.30	<2.1	2.1	0.365	0.426	0.04	0.04
February [b]	--	--	--	--	--	--	--	--
March [b]	--	--	--	--	--	--	--	--
April	0.029	0.037	<2.0	<2.0	0.247	0.282	0.02	0.02
May [b]	--	--	--	--	--	--	--	--
June [b]	--	--	--	--	--	--	--	--
July	0.014	0.019	<2.0	<2.0	0.204	0.318	0.01	0.01
August [b]	--	--	--	--	--	--	--	--
September	0.019	0.022	3.1	3.1	0.238	0.320	0.05	0.05
October [b]	--	--	--	--	--	--	--	--
November [b]	--	--	--	--	--	--	--	--
December [b]	--	--	--	--	--	--	--	--

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	11	14	0.94	1.1	0.039	0.039	<0.02	<0.02
February [b]	--	--	--	--	--	--	--	--
March [b]	--	--	--	--	--	--	--	--
April	11	14	0.44	0.45	0.087	0.087	<0.02	<0.02
May [b]	--	--	--	--	--	--	--	--
June [b]	--	--	--	--	--	--	--	--
July	6.5	7.9	0.57	0.61	<0.020	<0.020	<0.02	<0.02
August [b]	--	--	--	--	--	--	--	--
September	8.5	9.3	0.74	0.76	<0.020	<0.020	<0.02	<0.02
October [b]	--	--	--	--	--	--	--	--
November [b]	--	--	--	--	--	--	--	--
December [b]	--	--	--	--	--	--	--	--

Note: No results exceeded the permit limits.
MGD - Million gallons per day.
[a] There was no discharge from outfall 001 during this month in 2017.

TABLE B-2B *(continued)*
2017 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	<1.4	<1.4	7.8	7.8	<0.1	<0.1	720	730
February [b]	--	--	--	--	--	--	--	--
March [b]	--	--	--	--	--	--	--	--
April	<1.6	<1.6	7.8	7.8	<0.1	<0.1	603	643
May [b]	--	--	--	--	--	--	--	--
June [b]	--	--	--	--	--	--	--	--
July	<1.5	<1.5	7.6	7.6	<0.1	<0.1	611	611
August [b]	--	--	--	--	--	--	--	--
September	<1.6	<1.6	7.9	7.9	<0.1	<0.1	889	906
October [b]	--	--	--	--	--	--	--	--
November [b]	--	--	--	--	--	--	--	--
December [b]	--	--	--	--	--	--	--	--

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	< 4.0	< 4.0	81	81	<0.05	<0.05	0.005	0.005
February [b]	--	--	--	--	--	--	--	--
March [b]	--	--	--	--	--	--	--	--
April	< 4.0	< 4.0	54	54	<0.06	<0.06	0.010	0.010
May [b]	--	--	--	--	--	--	--	--
June [b]	--	--	--	--	--	--	--	--
July	< 4.0	< 4.0	69	69	<0.05	<0.05	0.010	0.010
August [b]	--	--	--	--	--	--	--	--
September	5.8	6.0	95	95	<0.05	<0.05	0.010	0.010
October [b]	--	--	--	--	--	--	--	--
November [b]	--	--	--	--	--	--	--	--
December [b]	--	--	--	--	--	--	--	--

Note: No results exceeded the permit limits.
LAS - linear alkylbenzene sulfonate.
[a] There was no discharge from outfall 001 during this month in 2017.

Table B-2B *(concluded)*
2017 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	< 7.37	< 8.03
February [b]	--	--
March [b]	--	--
April	< 5.01	< 5.06
May [b]	--	--
June [b]	--	--
July	< 5.60	< 5.79
August [b]	--	--
September	7.96	7.97
October [b]	--	--
November [b]	--	--
December [b]	--	--

Note: No results exceeded the permit limits.
[a] There was no discharge from outfall 001 during this month in 2017.

TABLE B-2C
2017 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	0.087	0.087	<0.0013	<0.0013	<0.0006	<0.0006	0.310	0.320
February [b]	--	--	--	--	--	--	--	--
March [b]	--	--	--	--	--	--	--	--
April	0.26	0.26	0.00063	0.00063	<0.0006	<0.0006	0.384	0.446
May [b]	--	--	--	--	--	--	--	--
June [b]	--	--	--	--	--	--	--	--
July	0.14	0.14	0.00064	0.00064	<0.0006	<0.0006	0.340	0.540
August [b]	--	--	--	--	--	--	--	--
September	0.22	0.22	0.0016	0.0016	<0.0006	<0.0006	0.487	0.491
October [b]	--	--	--	--	--	--	--	--
November [b]	--	--	--	--	--	--	--	--
December [b]	--	--	--	--	--	--	--	--

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	5.8	5.8	< 0.0004	<0.0004	<0.0015	<0.0015
February [b]	--	--	--	--	--	--
March [b]	--	--	--	--	--	--
April	3.2	3.2	< 0.0004	<0.0004	<0.0015	<0.0015
May [b]	--	--	--	--	--	--
June [b]	--	--	--	--	--	--
July	1.8	1.8	< 0.0004	<0.0004	<0.0015	<0.0015
August [b]	--	--	--	--	--	--
September	3.8	3.8	< 0.0004	<0.0004	<0.0015	<0.0015
October [b]	--	--	--	--	--	--
November [b]	--	--	--	--	--	--
December [b]	--	--	--	--	--	--

Note: No results exceeded the permit limits.
[a] There was no discharge from outfall 001 during this month in 2017.

TABLE B-2D
2017 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	0.31	0.31
February [b]	--	--
March [b]	--	--
April	0.38	0.38
May [b]	--	--
June [b]	--	--
July	0.34	0.34
August [b]	--	--
September	0.49	0.49
October [b]	--	--
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 this month in 2017. Therefore, a calculated total iron is not required.

TABLE B-2E
2017 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	250	265
February [b]	--	--
March [b]	--	--
April	222	230
May [b]	--	--
June [b]	--	--
July	300	300
August [b]	--	--
September	451	479
October [b]	--	--
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 2017. Therefore, a calculated TDS at 116 is not required.

TABLE B-2F
2017 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* [a]
2-Butanone	0.5 mg/L daily maximum	Annual	January 2017	<0.002
3,3-Dichlorobenzidine	0.01 mg/L daily maximum	Annual	January 2017	<0.004
Alpha-BHC	0.01 ug/L daily maximum	Annual	January 2017	<0.007
Cadmium, Total Recoverable	0.002 mg/L daily maximum	Annual	January 2017	<0.00007
Chromium VI, Total Recoverable	0.011 mg/L daily maximum	Annual	January 2017	<0.0050
Chromium, Total Recoverable	0.11 mg/L daily maximum	Semiannual	January 2017 July 2017	0.0014
Copper, Total Recoverable	0.014mg/L daily maximum	Semiannual	January 2017 July 2017	0.0024
Cyanide, Amenable to chlorination	0.005 mg/L daily maximum	Semiannual	January 2017 July 2017	<0.005
Dichlorodifluoromethane	0.01 mg/L daily maximum	Annual	January 2017	<0.0003
Heptachlor	0.01 ug/L daily maximum	Semiannual	January 2017 July 2017	<0.007
Hexachlorobenzene	0.2 ug/L daily maximum	Annual	January 2017	<0.02
Lead, Total Recoverable	0.006 mg/L daily maximum	Semiannual	January 2017 July 2017	0.0003
Manganese, Total	2.0 mg/L daily maximum	Semiannual	January 2017 July 2017	0.050
Nickel, Total	0.079 mg/L daily maximum	Semiannual	January 2017 July 2017	0.0023
Tributyl phosphate	0.1 mg/L daily maximum	Annual	January 2017	<0.004
Trichlorofluoromethane	0.01 mg/L daily maximum	Annual	January 2017	<0.0005
Xylene	0.05 mg/L daily maximum	Annual	January 2017	<0.001
Zinc, Total Recoverable	0.13 mg/L daily maximum	Semiannual	January 2017 July 2017	0.0075

[a] Measured results are reported in the same units as the permit limits shown in this table.

Note: No results exceeded the permit limits.

TABLE B-2G
2017 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* [a]
001	**Antimony, Total**	1.0 mg/L daily maximum	Annual	January 2017	< 0.0068
	Barium, Total	0.5 mg/L daily maximum	Annual	January 2017	0.02
	Boron, Total	2.0 mg/L daily maximum	Semiannual	January 2017 July 2017	0.056
	Bromide, Total	5.0 mg/L daily maximum	Semiannual	January 2017 July 2017	< 0.37
	Chloroform	0.3 mg/L daily maximum	Annual	January 2017	< 0.0005
	Titanium, Total	0.65 mg/L daily maximum	Semiannual	January 2017 July 2017	<0.0011
007	**Chloroform**	0.20 mg/L daily maximum	There were no discharges through the 007 outfall in 2017 (discontinued in November 2014).		

[a] Measured results are reported in the same units as the permit limits shown in this table.
Note: No results exceeded the permit limits.

TABLE B-2H
2017 SPDES Results for Outfall 01B (WNSP01B): Water Quality

Internal process monitoring point did not operate during 2017.

TABLE B-2I
2017 Herbicide Sampling Data

No herbicides were applied at the WVDP during CY 2017. **In accordance with the SPDES permit, no sampling for herbicides from storm water outfalls and process effluent was required in 2017.**

TABLE B-2J
2017 Radioactivity Results for Sewage Treatment Outfall (WNSP007)

There were no discharges from the Sewage Treatment Plant in 2017. **SPDES outfall 007 was discontinued in November 2014.**

TABLE B-2K

2017 SPDES Whole Effluent Toxicity (WET) Testing[a]

SPDES Outfall	*Date*	*Species*	*Acute Toxicity Test*	*Chronic Toxicity Test*	*Interpretation*
001	January 2017	Invertebrate Water Flea *(Ceriodaphnia dubia)*	< 0.3 TUa	< 1.0 TUc	Less than Action Level
		Vertebrate Fathead Minnow *(Pimephales promelas)*	< 0.3 TUa	< 1.0 TUc	Less than Action Level
001	April 2017	Invertebrate Water Flea *(Ceriodaphnia dubia)*	< 0.3 TUa	< 1.0 TUc	Less than Action Level
		Vertebrate Fathead Minnow *(Pimephales promelas)*	< 0.3 TUa	2.0 TUc	Greater than Action Level[b,c]
001	July 2017	Invertebrate Water Flea *(Ceriodaphnia dubia)*	< 0.3 TUa	2.0 TUc	Greater than Action Level[c]
		Vertebrate Fathead Minnow *(Pimephales promelas)*	< 0.3 TUa	< 1.0 TUc	Less than Action Level
001	September 2017	Invertebrate Water Flea *(Ceriodaphnia dubia)*	< 0.3 TUa	< 1.0 TUc	Less than Action Level
		Vertebrate Fathead Minnow *(Pimephales promelas)*	< 0.3 TUa	< 1.0 TUc	Less than Action Level

TUa = Toxicity Unit acute (Action Level = 0.3 TUa).
TUc = Toxicity Unit chronic (Action Level = 1.0 TUc).

[a] Quarterly WET Action Level testing required every 5 years per the SPDES permit.
[b] Minnow result exceeds Action Level believed due to a bacterial/fungus interference.
[c] As a result of two exceedances of an Action Level in 2017, NYSDEC requires the WVDP to continue WET testing in 2018 for four additional quarters.

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APPENDIX B-3

SPDES-Permitted Storm Water Outfall Discharge Data

TABLE B-3A

2017 Storm Water Discharge Monitoring Data for Outfall Group 1

STORM WATER OUTFALL S04

Paramater Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			06/19/17	*06/19/17*
Group A Parameters	BOD_5	mg/L	< 2.0	< 2.0
	Oil & Grease[a]	mg/L	1.6	NR
	pH	SU	7.7	NR
	Phosphorous, Total	mg/L	0.16	0.061
	Solids, Total Dissolved	mg/L	340	270
	Solids, Total Suspended	mg/L	28	27
Group B Parameters	Aluminum, Total	mg/L	1.2	1.4
	Copper, Total Recoverable	mg/L	0.0034	0.0042
	Iron, Total	mg/L	1.5	1.5
	Lead, Total Recoverable	mg/L	0.0026	0.0013
	Zinc, Total Recoverable	mg/L	0.014	0.015
Group C Parameters	Ammonia (as NH_3)	mg/L	0.035	0.029
	Cadmium, Total Recoverable	mg/L	< 0.000071	< 0.000071
	Chromium, Hexavalent, Total Recoverable	mg/L	< 0.0050	< 0.0050
	Chromium, Total Recoverable	mg/L	0.0013	0.0017
	Nitrogen, Nitrate (as N)	mg/L	0.059	0.10
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	0.029
	Nitrogen, Total (as N)	mg/L	< 0.48	0.48
	Nitrogen, Total Kjeldahl	mg/L	0.40	0.35
	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	7.8	
	Rainfall During Sampling Event	inches	0.39	
Flow	Total Flow During Sampling Event	gallons	330,000	
	Maximum Flow Rate During Sampling Event	gpm	4,500	

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)*
2017 Storm Water Discharge Monitoring Data for Outfall Group 1

STORM WATER OUTFALL S04

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			09/14/17	***09/14/17***
Group A Parameters	BOD_5	mg/L	2.4	2.8
	Oil & Grease[a]	mg/L	3.1	NR
	pH	SU	7.9	NR
	Phosphorous, Total	mg/L	0.28	0.22
	Solids, Total Dissolved	mg/L	160	140
	Solids, Total Suspended	mg/L	110	76
Group B Parameters	Aluminum, Total	mg/L	4.5	2.9
	Copper, Total Recoverable	mg/L	0.0077	0.0050
	Iron, Total	mg/L	4.9	3.0
	Lead, Total Recoverable	mg/L	0.0082	0.0070
	Zinc, Total Recoverable	mg/L	0.048	0.033
Group C Parameters	Ammonia (as NH_3)	mg/L	0.044	0.024
	Cadmium, Total Recoverable	mg/L	0.000073	< 0.000071
	Chromium, Hexavalent, Total Recoverable	mg/L	< 0.0050	< 0.0050
	Chromium, Total Recoverable	mg/L	0.0040	0.0029
	Nitrogen, Nitrate (as N)	mg/L	0.23	0.098
	Nitrogen, Nitrite (as N)	mg/L	0.050	< 0.020
	Nitrogen, Total (as N)	mg/L	0.96	< 0.55
	Nitrogen, Total Kjeldahl	mg/L	0.68	0.43
	Selenium, Total Recoverable	mg/L	< 0.00044	< 0.00044
	Vanadium, Total Recoverable	mg/L	0.0041	0.0017
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.4	
	Rainfall During Sampling Event	inches	0.90	
Flow	Total Flow During Sampling Event	gallons	2,500,000	
	Maximum Flow Rate During Sampling Event	gpm	29,000	

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-3B
2017 Storm Water Discharge Monitoring Data for Outfall Group 2

STORM WATER OUTFALL S06

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			06/19/17	***06/19/17***
Group A Parameters	BOD_5	mg/L	1.9	< 1.0
	Oil & Grease[a]	mg/L	< 1.4	NR
	pH	SU	7.4	NR
	Phosphorous, Total	mg/L	0.021	0.022
	Solids, Total Dissolved	mg/L	490	580
	Solids, Total Suspended	mg/L	< 1.0	< 2.3
Group B Parameters	Aluminum, Total	mg/L	< 0.0068	< 0.0068
	Copper, Total Recoverable	mg/L	0.00072	0.00077
	Iron, Total	mg/L	0.094	0.31
	Lead, Total Recoverable	mg/L	< 0.00050	< 0.00050
	Zinc, Total Recoverable	mg/L	< 0.0033	< 0.0033
Group C Parameters	Surfactant (as LAS)	mg/L	0.013	0.011
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.8	
	Rainfall During Sampling Event	inches	0.39	
Flow	Total Flow During Sampling Event	gallons	10,000	
	Maximum Flow Rate During Sampling Event	gpm	60	

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)*
2017 Storm Water Discharge Monitoring Data for Outfall Group 2

STORM WATER OUTFALL S33 / DUPLICATE

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			09/14/17	***09/14/17***
Group A Parameters	BOD_5	mg/L	3.2 / 6.2	2.8
	Oil & Grease[a]	mg/L	< 1.4 / < 1.4	NR
	pH	SU	7.1	NR
	Phosphorous, Total	mg/L	0.95 / 0.94	0.20
	Solids, Total Dissolved	mg/L	260 / 240	210
	Solids, Total Suspended	mg/L	160 / 150	15
Group B Parameters	Aluminum, Total	mg/L	1.4 / 0.97	0.29
	Copper, Total Recoverable	mg/L	0.0031 / 0.0027	0.0011
	Iron, Total	mg/L	34 / 25	3.5
	Lead, Total Recoverable	mg/L	0.0026 / 0.0023	0.00063
	Zinc, Total Recoverable	mg/L	0.028 / 0.023	0.012
Group C Parameters	Surfactant (as LAS)	mg/L	< 0.013 / < 0.013	< 0.013
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.4	
	Rainfall During Sampling Event	inches	0.91	
Flow	Total Flow During Sampling Event	gallons	210,000	
	Maximum Flow Rate During Sampling Event	gpm	1,500	

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.

NOTE: The first flush grab samples were collected and analyzed in duplicate.

TABLE B-3C
2017 Storm Water Discharge Monitoring Data for Outfall Group 3

STORM WATER OUTFALL S09

Paramater Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			06/19/17	*06/19/17*
Group A Parameters	BOD_5	mg/L	5.7	2.9
	Oil & Grease[a]	mg/L	1.4	NR
	pH	SU	8.5	NR
	Phosphorous, Total	mg/L	0.050	0.81
	Solids, Total Dissolved	mg/L	210	210
	Solids, Total Suspended	mg/L	17	470
Group B Parameters	Aluminum, Total	mg/L	0.19	12
	Copper, Total Recoverable	mg/L	0.0058	0.029
	Iron, Total	mg/L	0.26	18
	Lead, Total Recoverable	mg/L	0.00037	0.014
	Zinc, Total Recoverable	mg/L	0.0091	0.12
Group C Parameters	Alpha BHC	mg/L	< 0.0000067	< 0.0000067
	Ammonia (as NH_3)	mg/L	0.060	0.18
	Mercury, Total[b] (1631E)	ng/L	9.4	NR
	Nitrogen, Nitrate (as N)	mg/L	0.12	2.6
	Nitrogen, Nitrite (as N)	mg/L	0.023	0.12
	Nitrogen, Total (as N)	mg/L	1.8	4.4
	Nitrogen, Total Kjeldahl	mg/L	1.7	1.7
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.8	
	Rainfall During Sampling Event	inches	0.39	
Flow	Total Flow During Sampling Event	gallons	315,000	
	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.
[b] The SPDES permit requires that Group 3 outfall grab samples be analyzed for mercury as part of the Mercury Minimization Program.

TABLE B-3C *(concluded)*
2017 Storm Water Discharge Monitoring Data for Outfall Group 3

STORM WATER OUTFALL S12

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			10/11/17	***10/11/17***
Group A Parameters	BOD_5	mg/L	3.6	3.0
	Oil & Grease[a]	mg/L	< 1.5	NR
	pH	SU	7.5	NR
	Phosphorous, Total	mg/L	0.34	0.23
	Solids, Total Dissolved	mg/L	330	230
	Solids, Total Suspended	mg/L	54	61
Group B Parameters	Aluminum, Total	mg/L	1.2	0.93
	Copper, Total Recoverable	mg/L	0.0031	0.0061
	Iron, Total	mg/L	2.5	1.5
	Lead, Total Recoverable	mg/L	0.0016	0.0039
	Zinc, Total Recoverable	mg/L	0.013	0.029
Group C Parameters	Alpha BHC	mg/L	<0.0000065	< 0.0000063
	Ammonia (as NH_3)	mg/L	0.016	0.021
	Mercury, Total[b] (1631E)	ng/L	9.3	NR
	Nitrogen, Nitrate (as N)	mg/L	0.11	0.31
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 0.75	< 0.75
	Nitrogen, Total Kjeldahl	mg/L	0.62	0.42
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.2	
	Rainfall During Sampling Event	inches	0.42	
Flow	Total Flow During Sampling Event	gallons	170,000	
	Maximum Flow Rate During Sampling Event	gpm	1,600	

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.
[b] The SPDES permit requires that Group 3 outfall grab samples be analyzed for mercury as part of the Mercury Minimization Program.

TABLE B-3D
2017 Storm Water Discharge Monitoring Data for Outfall Group 4

STORM WATER OUTFALL S34 / DUPLICATE

Paramater Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			06/26/17	*06/26/17*
Group A Parameters	BOD_5	mg/L	< 2.0 / < 2.0	< 2.0
	Oil & Grease[a]	mg/L	< 1.4 / < 1.6	NR
	pH	SU	7.7	NR
	Phosphorous, Total	mg/L	0.13 / 0.13	0.14
	Solids, Total Dissolved	mg/L	270 / 260	240
	Solids, Total Suspended	mg/L	78 / 73	80
Group B Parameters	Aluminum, Total	mg/L	2.6 / 2.7	1.5
	Copper, Total Recoverable	mg/L	0.0043 / 0.0043	0.0046
	Iron, Total	mg/L	3.4 / 3.4	1.6
	Lead, Total Recoverable	mg/L	0.0025 / 0.0025	0.0028
	Zinc, Total Recoverable	mg/L	0.053 / 0.054	0.043
Group C Parameters	Surfactant (as LAS)	mg/L	0.021 / 0.015	0.029
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.0	
	Rainfall During Sampling Event	inches	0.30	
Flow	Total Flow During Sampling Event	gallons	55,000	
	Maximum Flow Rate During Sampling Event	gpm	1,200	

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.

NOTE: The first flush grab samples were collected and analyzed in duplicate.

TABLE B-3D *(concluded)*
2017 Storm Water Discharge Monitoring Data for Outfall Group 4

STORM WATER OUTFALL S34

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			09/14/17	***09/14/17***
Group A Parameters	BOD_5	mg/L	3.3	< 2.0
	Oil & Grease[a]	mg/L	1.6	NR
	pH	SU	7.6	NR
	Phosphorous, Total	mg/L	0.29	0.24
	Solids, Total Dissolved	mg/L	220	130
	Solids, Total Suspended	mg/L	140	100
Group B Parameters	Aluminum, Total	mg/L	4.1	5.4
	Copper, Total Recoverable	mg/L	0.0088	0.0063
	Iron, Total	mg/L	4.5	7.1
	Lead, Total Recoverable	mg/L	0.0066	0.0062
	Zinc, Total Recoverable	mg/L	0.099	0.063
Group C Parameters	Surfactant (as LAS)	mg/L	0.025	< 0.013
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.4	
	Rainfall During Sampling Event	inches	0.91	
Flow	Total Flow During Sampling Event	gallons	780,000	
	Maximum Flow Rate During Sampling Event	gpm	7,400	

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-3E
2017 Storm Water Discharge Monitoring Data for Outfall Group 5

STORM WATER OUTFALL S28

Paramater Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			05/25/17	05/25/17
Group A Parameters	BOD_5	mg/L	< 2.0	< 3.0
	Oil & Grease[a]	mg/L	1.5	NR
	pH	SU	7.7	NR
	Phosphorous, Total	mg/L	0.37	0.41
	Solids, Total Dissolved	mg/L	450	230
	Solids, Total Suspended	mg/L	200	260
Group B Parameters	Aluminum, Total	mg/L	12	13
	Copper, Total Recoverable	mg/L	0.018	0.019
	Iron, Total	mg/L	13	14
	Lead, Total Recoverable	mg/L	0.012	0.013
	Zinc, Total Recoverable	mg/L	0.076	0.082
Group C Parameters	Ammonia (as NH_3)	mg/L	0.045	0.034
	Nitrogen, Nitrate (as N)	mg/L	0.19	0.074
	Nitrogen, Nitrite (as N)	mg/L	0.020	0.020
	Nitrogen, Total (as N)	mg/L	1.2	0.96
	Nitrogen, Total Kjeldahl	mg/L	1.0	0.87
	Settleable Solids	ml/L	0.3	0.7
	Sulfide	mg/L	< 0.050	< 0.050
	Surfactant (as LAS)	mg/L	< 0.013	< 0.013
	Vanadium, Total Recoverable	mg/L	0.0085	0.0090
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.3	
	Rainfall During Sampling Event	inches	0.68	
Flow	Total Flow During Sampling Event	gallons	260,000	
	Maximum Flow Rate During Sampling Event	gpm	3,200	

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-3E *(concluded)*
2017 Storm Water Discharge Monitoring Data for Outfall Group 5

STORM WATER OUTFALL S17

Paramater Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			10/11/17	10/11/17
Group A Parameters	BOD_5	mg/L	2.0	< 2.0
	Oil & Grease[a]	mg/L	1.6	NR
	pH	SU	7.5	NR
	Phosphorous, Total	mg/L	0.049	0.090
	Solids, Total Dissolved	mg/L	480	230
	Solids, Total Suspended	mg/L	14	32
Group B Parameters	Aluminum, Total	mg/L	0.98	2.9
	Copper, Total Recoverable	mg/L	0.0023	0.0036
	Iron, Total	mg/L	0.53	1.7
	Lead, Total Recoverable	mg/L	0.0030	0.0049
	Zinc, Total Recoverable	mg/L	0.0079	0.014
Group C Parameters	Ammonia (as NH_3)	mg/L	0.023	0.051
	Nitrogen, Nitrate (as N)	mg/L	0.11	0.064
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 0.52	< 0.30
	Nitrogen, Total Kjeldahl	mg/L	0.39	0.22
	Settleable Solids	ml/L	0.2	0.1
	Sulfide	mg/L	0.080	< 0.050
	Surfactant (as LAS)	mg/L	0.037	0.026
	Vanadium, Total Recoverable	mg/L	< 0.0012	0.0014
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.2	
	Rainfall During Sampling Event	inches	0.50	
Flow	Total Flow During Sampling Event	gallons	420,000	
	Maximum Flow Rate During Sampling Event	gpm	3,000	

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-3F
2017 Storm Water Discharge Monitoring Data for Outfall Group 6

STORM WATER OUTFALL S41

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			05/25/17	***05/25/17***
Group A Parameters	BOD_5	mg/L	2.9	< 2.0
	Oil & Grease[a]	mg/L	1.9	NR
	pH	SU	7.8	NR
	Phosphorous, Total	mg/L	0.42	1.1
	Solids, Total Dissolved	mg/L	730	390
	Solids, Total Suspended	mg/L	300	670
Group B Parameters	Aluminum, Total	mg/L	13	29
	Copper, Total Recoverable	mg/L	0.013	0.026
	Iron, Total	mg/L	14	32
	Lead, Total Recoverable	mg/L	0.0057	0.011
	Zinc, Total Recoverable	mg/L	0.18	0.083
Group C Parameters	Ammonia (as NH_3)	mg/L	0.050	0.038
	Nitrogen, Nitrate (as N)	mg/L	0.044	< 0.020
	Nitrogen, Nitrite (as N)	mg/L	0.025	0.027
	Nitrogen, Total (as N)	mg/L	1.4	< 1.5
	Nitrogen, Total Kjeldahl	mg/L	1.3	1.5
	Solids, Settleable	ml/L	2.2	1.1
	Sulfide	mg/L	< 0.050	< 0.050
	Surfactant (as LAS)	mg/L	< 0.013	< 0.013 R
	Vanadium, Total Recoverable	mg/L	0.011	0.022
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.3	
	Rainfall During Sampling Event	inches	0.72	
Flow	Total Flow During Sampling Event	gallons	20,000	
	Maximum Flow Rate During Sampling Event	gpm	220	

gpm - gallons per minute.
NR - Not required by permit.
R - Sample was flagged as unreliable during the data validation process.
[a] The SPDES permit specifies that oil and grease concentration shall not exceed 15 mg/L.

NOTE: Storm water samples collected on May 25, 2017 from outfall S43 in outfall group 6 were also analyzed for total recoverable lead with results of 0.015 mg/L. (Action Level = 0.006 mg/L). A significant amount of sediment was observed in this sample due to recent grading of drainage ditches in the Live Fire Range. When this location was resampled in September, the lead sampling results were below the action level.

TABLE B-3F *(concluded)*
2017 Storm Water Discharge Monitoring Data for Outfall Group 6

STORM WATER OUTFALL S42

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			11/16/17	***11/16/17***
Group A Parameters	BOD_5	mg/L	< 2.0	< 2.0
	Oil & Grease[a]	mg/L	< 1.4	NR
	pH	SU	7.9	NR
	Phosphorous, Total	mg/L	0.019	0.0098
	Solids, Total Dissolved	mg/L	1900	2000
	Solids, Total Suspended	mg/L	< 4.0	< 4.0
Group B Parameters	Aluminum, Total	mg/L	< 0.060	< 0.060
	Copper, Total Recoverable	mg/L	0.0062	0.0061
	Iron, Total	mg/L	0.066	0.063
	Lead, Total Recoverable	mg/L	< 0.00017	< 0.00017
	Zinc, Total Recoverable	mg/L	0.0042	0.0047
Group C Parameters	Ammonia (as NH_3)	mg/L	< 0.0090	< 0.0090
	Nitrogen, Nitrate (as N)	mg/L	0.72	0.68
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 0.91	< 0.89
	Nitrogen, Total Kjeldahl	mg/L	0.17	0.19
	Solids, Settleable	ml/L	< 0.1	< 0.1
	Sulfide	mg/L	< 0.050	< 0.050
	Surfactant (as LAS)	mg/L	0.016	0.017
	Vanadium, Total Recoverable	mg/L	< 0.0012	< 0.0012
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	6.0	
	Rainfall During Sampling Event	inches	0.27	
Flow	Total Flow During Sampling Event	gallons	5,000	
	Maximum Flow Rate During Sampling Event	gpm	30	

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.

NOTE: Storm water samples collected on September 14, 2017 from outfall S43 in outfall group 6 were also analyzed for total recoverable lead with results of 0.002 mg/L. (Action Level = 0.006 mg/L).

TABLE B-3G
2017 Storm Water Discharge Monitoring Data for Outfall Group 7

STORM WATER OUTFALL S20

Paramater Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			06/15/17	*06/15/17*
Group A Parameters	BOD_5	mg/L	16	3.9
	Oil & Grease[a]	mg/L	< 1.4	NR
	pH	SU	7.7	NR
	Phosphorous, Total	mg/L	0.56	0.068
	Solids, Total Dissolved	mg/L	220	30
	Solids, Total Suspended	mg/L	480	39
Group B Parameters	Aluminum, Total	mg/L	11	1.2
	Copper, Total Recoverable	mg/L	0.015	0.0023
	Iron, Total	mg/L	14	1.2
	Lead, Total Recoverable	mg/L	0.0080	0.00096
	Zinc, Total Recoverable	mg/L	0.078	0.0096
Group C Parameters	Ammonia (as NH_3)	mg/L	0.77	0.29
	Nitrogen, Nitrate (as N)	mg/L	4.0	0.85
	Nitrogen, Nitrite (as N)	mg/L	0.11	0.041
	Nitrogen, Total (as N)	mg/L	8.2	2.1
	Nitrogen, Total Kjeldahl	mg/L	4.1	1.2
	Sulfide	mg/L	<0.050	< 0.050
	Surfactant (as LAS)	mg/L	0.023	0.024
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	7.8	
	Rainfall During Sampling Event	inches	0.19	
Flow	Total Flow During Sampling Event	gallons	83,000	
	Maximum Flow Rate During Sampling Event	gpm	710	

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)*

2017 Storm Water Discharge Monitoring Data for Outfall Group 7

STORM WATER OUTFALL S20

Paramater Group	*Analyte*	*Units*	*First Flush Grab*	*Flow-weighted Composite*
			08/21/17	*08/21/17*
Group A Parameters	BOD_5	mg/L	6.3	2.2
	Oil & Grease[a]	mg/L	1.5	NR
	pH	SU	7.5	NR
	Phosphorous, Total	mg/L	0.97	0.065
	Solids, Total Dissolved	mg/L	32	46
	Solids, Total Suspended	mg/L	210	25
Group B Parameters	Aluminum, Total	mg/L	6.2	1.3
	Copper, Total Recoverable	mg/L	0.0073	0.0017
	Iron, Total	mg/L	7.4	1.2
	Lead, Total Recoverable	mg/L	0.0048	0.00095
	Zinc, Total Recoverable	mg/L	0.044	0.0086
Group C Parameters	Ammonia (as NH_3)	mg/L	0.20	0.20
	Nitrogen, Nitrate (as N)	mg/L	0.93	0.60
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	8.2	< 1.1
	Nitrogen, Total Kjeldahl	mg/L	7.2	0.45
	Sulfide	mg/L	< 0.050	0.050
	Surfactant (as LAS)	mg/L	< 0.013	< 0.013
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	9.9	
	Rainfall During Sampling Event	inches	0.23	
Flow	Total Flow During Sampling Event	gallons	54,000	
	Maximum Flow Rate During Sampling Event	gpm	840	

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
2017 Storm Water Discharge Monitoring Data for Outfall Group 8

STORM WATER OUTFALL S27

Paramater Group	Analyte	Units	First Flush Grab	Flow-weighted Composite
			05/25/17	05/25/17
Group A Parameters	BOD_5	mg/L	< 2.0	< 2.0
	Oil & Grease[a]	mg/L	2.0	NR
	pH	SU	7.5	NR
	Phosphorous, Total	mg/L	0.15	0.22
	Solids, Total Dissolved	mg/L	220	160
	Solids, Total Suspended	mg/L	95	120
Group B Parameters	Aluminum, Total	mg/L	6.9	6.4
	Copper, Total Recoverable	mg/L	0.0065	0.0066
	Iron, Total	mg/L	5.7	5.3
	Lead, Total Recoverable	mg/L	0.0056	0.0062
	Zinc, Total Recoverable	mg/L	0.025	0.028
Group C Parameters	Ammonia (as NH_3)	mg/L	0.059	0.041
	Nitrogen, Nitrate (as N)	mg/L	0.12	0.052
	Nitrogen, Nitrite (as N)	mg/L	0.027	0.026
	Nitrogen, Total (as N)	mg/L	1.1	0.84
	Nitrogen, Total Kjeldahl	mg/L	0.96	0.76
	Surfactant (as LAS)	mg/L	0.020	0.014
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.3	
	Rainfall During Sampling Event	inches	0.70	
Flow	Total Flow During Sampling Event	gallons	32,000	
	Maximum Flow Rate During Sampling Event	gpm	260	

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)*
2017 Storm Water Discharge Monitoring Data for Outfall Group 8

STORM WATER OUTFALL S35

Paramater Group	***Analyte***	***Units***	***First Flush Grab***	***Flow-weighted Composite***
			09/14/17	***09/14/17***
Group A Parameters	BOD_5	mg/L	2.9	< 2.0
	Oil & Grease[a]	mg/L	1.5	NR
	pH	SU	8.1	NR
	Phosphorous, Total	mg/L	0.88	0.16
	Solids, Total Dissolved	mg/L	170	180
	Solids, Total Suspended	mg/L	620	52
Group B Parameters	Aluminum, Total	mg/L	16	2.6
	Copper, Total Recoverable	mg/L	0.021	0.0044
	Iron, Total	mg/L	19	1.8
	Lead, Total Recoverable	mg/L	0.021	0.0026
	Zinc, Total Recoverable	mg/L	0.12	0.031
Group C Parameters	Ammonia (as NH_3)	mg/L	0.043	0.031
	Nitrogen, Nitrate (as N)	mg/L	0.18	0.080
	Nitrogen, Nitrite (as N)	mg/L	< 0.020	< 0.020
	Nitrogen, Total (as N)	mg/L	< 2.0	< 0.58
	Nitrogen, Total Kjeldahl	mg/L	1.8	0.48
	Surfactant (as LAS)	mg/L	< 0.013	< 0.013
Rain Event Summary				
Rainfall	pH of Rainfall During Sampling Event	SU	8.4	
	Rainfall During Sampling Event	inches	0.92	
Flow	Total Flow During Sampling Event	gallons	120,000	
	Maximum Flow Rate During Sampling Event	gpm	930	

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.

APPENDIX B-4

Surface Water Data

TABLE B-4A
Comparison of 2017 Radioactivity Concentrations in Surface Water at the Northeast Swamp (WNSWAMP) With U.S. DOE-Derived Concentration Standards (DCSs)

Isotope [a]	*N*	*Discharge Activity* [b]		*Flow-Weighted Mean Concentration*	*DCS* [d]	*Ratio of Mean Concentration to DCS*
		(Ci)	*(Becquerels)* [c]	*(µCi/mL)*	*(µCi/mL)*	
Gross Alpha	26	2.68±7.11E-05	0.99±2.63E+06	2.73±7.24E-10	9.8E-08[e]	NA
Gross Beta	26	1.30±0.01E-01	4.79±0.01E+09	1.32±0.01E-06	1.1E-06[e]	NA
Tritium	26	5.12±2.74E-03	1.89±1.01E+08	5.21±2.79E-08	1.9E-03	< 0.0001
C-14	2	0.04±2.11E-03	0.15±7.80E+07	0.04±2.15E-08	6.2E-05	< 0.0003
Sr-90	12	6.58±0.08E-02	2.43±0.03E+09	6.70±0.08E-07	1.1E-06	0.61
I-129	2	3.45±4.50E-05	1.28±1.67E+06	3.52±4.59E-10	3.3E-07	< 0.0014
Cs-137	12	-0.98±7.74E-05	-0.36±2.87E+06	-1.00±7.89E-10	3.0E-06	< 0.0003
U-232[f]	2	-2.03±3.91E-06	-0.75±1.45E+05	-2.06±3.99E-11	9.8E-08	< 0.0004
U-233/234[f]	2	1.47±0.67E-05	5.42±2.47E+05	1.49±0.68E-10	6.6E-07[g]	0.0002
U-235/236[f]	2	2.38±3.42E-06	0.88±1.26E+05	2.43±3.48E-11	7.2E-07	< 0.0001
U-238[f]	2	9.27±5.55E-06	3.43±2.05E+05	9.44±5.65E-11	7.5E-07	0.0001
Pu-238	2	1.66±2.46E-06	6.14±9.09E+04	1.69±2.50E-11	1.5E-07	< 0.0002
Pu-239/240	2	3.25±4.09E-06	1.20±1.51E+05	3.31±4.17E-11	1.4E-07	< 0.0003
Am-241	2	0.98±2.30E-06	3.63±8.51E+04	1.00±2.34E-11	1.7E-07	< 0.0001
Sum of Ratios						**0.61**

Notes: Average concentrations represent sample composite concentrations weighted to monthly stream flow.
The average pH at this location was 7.3 Standard Units (SU).

N - Number of samples.

NA – Not applicable; ratio calculated from isotopic data.

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

[b] Total estimated volume released: 9.82E+10 mL (2.59+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] The representative DCS for gross alpha in water shown is for U-232 and for gross beta is for Sr-90 (selected as the most restrictive) since DCSs do not exist for indicator parameters.

[f] Total Uranium (g) = 4.71±0.30E+01 ; Average Total Uranium (µg/mL) = 4.80±0.30E-04.

[g] The DCS for Uranium-233 is used for this comparison.

TABLE B-4B
Comparison of 2017 Radioactivity Concentrations in Surface Water at the North Swamp (WNSW74A) With U.S. DOE-Derived Concentration Standards (DCSs)

Isotope [a]	N	Discharge Activity [b]		Flow-Weighted Mean Concentration	DCS [d]	Ratio of Average Concentration to DCS
		(Ci)	(Becquerels) [c]	(µCi/mL)	(µCi/mL)	
Gross Alpha	26	-2.28±3.26E-05	-0.85±1.20E+06	-4.88±6.95E-10	9.8E-08[e]	NA
Gross Beta	26	4.44±0.24E-04	1.64±0.09E+07	9.49±0.51E-09	1.1E-06[e]	NA
Tritium	26	1.68±1.26E-03	6.22±4.67E+07	3.59±2.70E-08	1.9E-03	< 0.0001
C-14	2	-1.53±9.82E-04	-0.56±3.63E+07	-0.33±2.10E-08	6.2E-05	< 0.0003
Sr-90	12	1.49±0.16E-04	5.51±0.59E+06	3.18±0.34E-09	1.1E-06	0.0029
I-129	2	0.45±1.94E-05	1.66±7.16E+05	0.96±4.13E-10	3.3E-07	< 0.0013
Cs-137	12	0.08±3.33E-05	0.03±1.23E+06	0.18±7.10E-10	3.0E-06	< 0.0002
U-232[f]	2	-1.36±1.63E-06	-5.05±6.04E+04	-2.92±3.49E-11	9.8E-08	< 0.0004
U-233/234[f]	2	5.63±3.17E-06	2.08±1.17E+05	1.20±0.68E-10	6.6E-07[g]	0.0002
U-235/236[f]	2	1.95±2.24E-06	7.22±8.29E+04	4.17±4.79E-11	7.2E-07	< 0.0001
U-238[f]	2	5.92±3.35E-06	2.19±1.24E+05	1.26±0.71E-10	7.5E-07	0.0002
Pu-238	2	0.42±1.02E-06	1.57±3.78E+04	0.90±2.18E-11	1.5E-07	< 0.0001
Pu-239/240	2	0.42±1.07E-06	1.54±3.95E+04	0.89±2.28E-11	1.4E-07	< 0.0002
Am-241	2	2.86±9.85E-07	1.06±3.64E+04	0.61±2.10E-11	1.7E-07	< 0.0001
Sum of Ratios						< **0.0059**

Notes: Average concentrations represent sample composite concentrations weighted to monthly stream flow.
The average pH at this location was 7.5 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] The representative DCS for gross alpha in water shown is for U-232 and for gross beta is for Sr-90 (selected as the most restrictive) since DCSs do not exist for indicator parameters.

[f] Total Uranium (g) = 1.02±0.08E+01 ; Average Total Uranium (µg/mL) = 2.18±0.16E-04.

[g] The DCS for Uranium-233 is used for this comparison.

TABLE B-4C
2017 Radioactivity and pH in Surface Water at Facility Yard Drainage (WNSP005)

Analyte	Units	N	WNSP005 Concentrations		Guideline [a] or Standard [b]
			Average	Maximum	
Gross Alpha	µCi/mL	4	2.72±2.54E-09	4.17E-09	9.8E-08[c]
Gross Beta	µCi/mL	4	6.86±0.08E-07	1.03E-06	1.1E-06[d]
Tritium	µCi/mL	4	6.09±9.34E-08	1.10E-07	1.9E-03
Sr-90	µCi/mL	2	3.40±0.09E-07	3.51E-07	1.1E-06
Cs-137	µCi/mL	2	0.42±2.35E-09	< 2.73E-09	3.0E-06
pH	SU	4	7.5-7.8		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
2017 Radioactivity of Surface Water Downstream of the WVDP at Franks Creek (WNSP006)

Analyte	Units	N	WNSP006 Concentrations		N	Reference Values	
						WFBCBKG [a] Background Range	Guideline [b]
			Average	Maximum			
Gross Alpha	µCi/mL	26	0.76±1.40E-09	4.01E-09	12	< 4.91E-10 - 1.30E-09	9.8E-08[c]
Gross Beta	µCi/mL	26	4.61±0.18E-08	9.47E-08	12	1.12E-09 - 3.35E-09	1.1E-06[d]
Tritium	µCi/mL	26	5.82±9.34E-08	2.60E-07	12	< 6.94E-08 - < 1.11E-07	1.9E-03
C-14	µCi/mL	4	-1.29±2.96E-08	< 3.38E-08	2	< 2.67E-08 - < 3.20E-08	6.2E-05
Sr-90	µCi/mL	12	2.24±0.24E-08	3.67E-08	2	< 5.37E-10 - < 9.42E-10	1.1E-06
Tc-99	µCi/mL	4	0.82±2.34E-09	< 2.51E-09	2	< 1.84E-09 - < 2.07E-09	4.4E-05
I-129	µCi/mL	4	1.16±5.83E-10	< 7.17E-10	2	< 3.81E-10 - < 6.24E-10	3.3E-07
Cs-137	µCi/mL	12	-0.11±2.74E-09	3.24E-09	2	< 2.32E-09 - < 3.03E-09	3.0E-06
U-232	µCi/mL	4	1.08±0.96E-10	2.36E-10	2	< 4.79E-11 - < 8.07E-11	9.8E-08
U-233/234	µCi/mL	4	3.10±1.43E-10	4.82E-10	2	< 8.12E-11 - 1.69E-10	6.6E-07[e]
U-235/236	µCi/mL	4	5.32±6.42E-11	8.92E-11	2	< 4.27E-11 - < 5.67E-11	7.2E-07
U-238	µCi/mL	4	2.10±1.20E-10	3.30E-10	2	< 5.43E-11 - 1.11E-10	7.5E-07
Total U	µg/mL	4	5.63±0.39E-04	8.35E-04	2	1.21E-04 - 4.14E-04	--
Pu-238	µCi/mL	4	-0.38±3.25E-11	< 4.17E-11	2	< 3.16E-11 - < 3.62E-11	1.5E-07
Pu-239/240	µCi/mL	4	-0.07±3.13E-11	< 3.29E-11	2	< 4.45E-11 - < 4.68E-11	1.4E-07
Am-241	µCi/mL	4	0.78±4.39E-11	< 7.69E-11	2	< 2.24E-11 - < 3.30E-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
2017 Radioactivity in Surface Water Drainage Between the NDA and SDA (WNNDADR)

Analyte	Units	N	WNNDADR Concentrations		Guideline [a]
			Average	Maximum	
Gross Alpha	µCi/mL	12	0.98±1.04E-09	1.62E-09	9.8E-08[b]
Gross Beta	µCi/mL	12	2.75±0.12E-08	3.76E-08	1.1E-06[c]
Tritium	µCi/mL	12	2.86±1.09E-07	9.34E-07	1.9E-03
Sr-90	µCi/mL	2	1.12±0.18E-08	1.25E-08	1.1E-06
I-129	µCi/mL	2	4.20±7.99E-10	< 1.05E-09	3.3E-07
Cs-137	µCi/mL	12	-0.05±2.53E-09	2.31E-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
2017 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	4.21±8.69E-10	1.37E-09	12	< 4.91E-10 - 1.30E-09	9.8E-08[d]
Gross Beta	µCi/mL	4	4.44±0.69E-09	5.49E-09	12	1.12E-09 - 3.35E-09	1.1E-06[e]
Tritium	µCi/mL	4	2.45±9.05E-08	< 1.02E-07	12	< 6.94E-08 - < 1.11E-07	1.9E-03
Sr-90	µCi/mL	2	1.16±0.94E-09	1.32E-09	2	< 5.37E-10 - < 9.42E-10	1.1E-06
Cs-137	µCi/mL	2	1.50±2.17E-09	< 2.25E-09	2	< 2.32E-09 - < 3.03E-09	3.0E-06
pH	SU	4	Range: 7.7-7.9		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
2017 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	3.06±8.34E-10	< 9.99E-10	12	< 4.91E-10 - 1.30E-09	9.8E-08[d]
Gross Beta	µCi/mL	4	1.92±0.69E-09	2.85E-09	12	1.12E-09 - 3.35E-09	1.1E-06[e]
Tritium	µCi/mL	4	9.99±8.05E-08	3.69E-07	12	< 6.94E-08 - < 1.11E-07	1.9E-03
Sr-90	µCi/mL	2	2.92±7.84E-10	< 9.13E-10	2	< 5.37E-10 - < 9.42E-10	1.1E-06
Cs-137	µCi/mL	2	0.05±2.60E-09	< 2.85E-09	2	< 2.32E-09 - < 3.03E-09	3.0E-06
pH	SU	4	Range: 7.4-7.9		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 Class "D" surface waters as a standard for non-radiological results.
[d] Alpha as U-232.
[e] Beta as Sr-90.

TABLE B-4H
2017 Water Quality of Surface Water Downstream of the WVDP in Buttermilk Creek at Thomas Corners Bridge (WFBCTCB)

Analyte	Units	N	WFBCTCB Concentrations		N	Reference Values	
			Average	Maximum		WFBCBKG [a] Background Range	Guideline [b]
Gross Alpha	µCi/mL	12	3.28±2.00E-09	1.28E-08	12	< 4.91E-10 - 1.30E-09	9.8E-08[c]
Gross Beta	µCi/mL	12	7.51±1.07E-09	1.26E-08	12	1.12E-09 - 3.35E-09	1.1E-06[d]
Tritium	µCi/mL	12	1.81±8.95E-08	1.26E-07	12	< 6.94E-08 - < 1.11E-07	1.9E-03
Sr-90	µCi/mL	2	1.92±0.98E-09	2.37E-09	2	< 5.37E-10 - < 9.42E-10	1.1E-06
Cs-137	µCi/mL	2	1.54±2.50E-09	< 2.93E-09	2	< 2.32E-09 - < 3.03E-09	3.0E-06

N - Number of samples.
[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.

TABLE B-4I
2017 Radioactivity and pH in Surface Water Downstream of the WVDP in Cattaraugus Creek at Felton Bridge (WFFELBR)

Analyte	Units	N	WFFELBR Concentrations[a]		N	Reference Values	
			Average	Maximum		WFBIGBR Background Range	Guideline[b] or Standard[c]
Gross Alpha	µCi/mL	12	0.99±1.15E-09	1.67E-09	98	<3.59E-10–4.62E-09	9.8E-08[d]
Gross Beta	µCi/mL	12	2.96±0.75E-09	3.90E-09	98	<9.03E-10–1.37E-08	1.1E-06[e]
Tritium	µCi/mL	12	1.49±8.99E-08	1.21E-07	98	<4.46E-08–2.65E-07	1.9E-03
Sr-90	µCi/mL	12	1.27±7.87E-10	< 9.83E-10	98	<3.57E-10–1.10E-08	1.1E-06
Cs-137	µCi/mL	12	-0.11±2.50E-09	< 3.37E-09	98	<1.34E-09–5.29E-09	3.0E-06
pH	SU	26	7.1-8.2		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] Except for pH, values represent composite concentrations weighted to monthly stream flow.

[b] DOE ingestion-based DCSs for 100 mrem/yr dose limit are provided as a guideline for radiological results.

[c] New York Water Quality Standards for Class "B" as a comparative reference for non-radiological results.

[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 Concentrations		Reference Values Guideline[a] or Standard[b]
			Average	Maximum	
Gross Alpha	µCi/mL	98	0.45±1.05E-09	4.62E-09	9.8E-08[c]
Gross Beta	µCi/mL	98	2.64±1.35E-09	1.37E-08	1.1E-06[d]
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

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.

[b] The New York Water Quality Standard for Class "B" is provided as a comparative reference for pH

[c] Alpha as U-232.

[d] Beta as Sr-90.

TABLE B-4K
2017 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	3.98±9.77E-10	1.30E-09	9.8E-08[d]
Gross Beta	µCi/mL	12	2.20±0.67E-09	3.35E-09	1.1E-06[e]
Tritium	µCi/mL	12	1.81±8.98E-08	< 1.11E-07	1.9E-03
C-14	µCi/mL	2	-0.43±2.94E-08	< 3.20E-08	6.2E-05
Sr-90	µCi/mL	2	-0.64±7.67E-10	< 9.42E-10	1.1E-06
Tc-99	µCi/mL	2	0.59±1.96E-09	< 2.07E-09	4.4E-05
I-129	µCi/mL	2	0.66±5.17E-10	< 6.24E-10	3.3E-07
Cs-137	µCi/mL	2	-0.85±2.70E-09	< 3.03E-09	3.0E-06
U-232	µCi/mL	2	0.25±6.64E-11	< 8.07E-11	9.8E-08
U-233/234	µCi/mL	2	1.16±0.88E-10	1.69E-10	6.6E-07[f]
U-235/236	µCi/mL	2	0.90±5.02E-11	< 5.67E-11	7.2E-07
U-238	µCi/mL	2	6.52±6.76E-11	1.11E-10	7.5E-07
Total U	µg/mL	2	2.67±0.29E-04	4.14E-04	--
Pu-238	µCi/mL	2	-1.61±3.40E-11	< 3.62E-11	1.5E-07
Pu-239/240	µCi/mL	2	-2.25±4.57E-11	< 4.68E-11	1.4E-07
Am-241	µCi/mL	2	-0.56±2.82E-11	< 3.30E-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
2017 Water Quality Results in Drinking Water
at Tap Water Locations Inside the MPPB and RHWF

Analyte	*Units*	*N*	*WNDNKMP [a] (Main Plant)*	*WNDNKRH (RHWF)*	*Standard [b]*
Gross Alpha	µCi/mL	1	-0.64±1.56E-09	NA	1.5E-08
Gross Beta	µCi/mL	1	3.05±1.19E-09	NA	1.5E-08
Tritium	µCi/mL	1	2.28±8.23E-08	NA	2.0E-05
Disinfection Byproducts [c]					
Haloacetic Acids-Five (5)	mg/L	0	NA	NR[c]	0.060
Total Trihalomethanes	mg/L	0	NA	NR[c]	0.080

N - Number of samples.
NA - Not applicable, constituent not analyzed.
NR - Not required to be sampled in 2017.
[a] Annual sampling for radiological parameters at the MPPB shower continued in 2017 for screening purposes. However, this sampling is not a regulatory requirement under the WVDP drinking water sampling plan.
[b] New York State Department of Health (NYSDOH) MCLs or screening levels for drinking water used as a comparative reference (see Table B-1C).
[c] NYSDOH changed the required sampling frequency for disinfection byproducts in 2016 from annually to once every three years. Disinfection byproducts were last sampled for in August 2015 and will next be sampled for in 2018.

TABLE B-5B
2017 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	4	0 Positive: 4 Negative	one positive sample
Total Coliform[b]	NA	4	0 Positive: 4 Negative	two or more positive samples
Free Residual Chlorine[b]	mg/L	5	Range: 0.48 - 2.20	greater than 0.2 and less than 4.0

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
2017 Copper and Lead Results from On-Site Tap Water Locations at the WVDP
(drinking water supplied by groundwater)

Analyte	*Date Collected*	*Units*	*N*	*Range*	*Average*	*90th Percentile* [a]	*Action Level* [a]
Copper, total	7/16/2017	mg/L	5	0.041 - 0.39	0.19	0.36	1.3
Lead, total	7/16/2017	mg/L	5	<0.0010 - 0.0021	0.0014	0.0018	0.015

N - Number of samples

[a] The 90th percentile calculation is used to evaluate exceedance of the action level.

The five on-site tap water locations sampled for copper and lead in 2017 included: Guard house (WNDNK06), 10-plex kitchenette (WNDNK24), Guard house men's locker room - south extension (WNDNK27), RHWF kitchenette (WNDNKRH), and Nurse's office (WNDNURSE).

TABLE B-5D
2017 Metals and Water Quality Results in Treated Potable Water

Analyte	*Date Collected*	*Units*	*N*	*Average Concentration*	*Standard or Guideline* [a]
Metals [b, c]					
Sodium, Total[c]	11/16/2017	mg/L	1	46	20/270[d]
Water Quality					
Nitrate-N[c]	4/4/2017	mg/L	1	1.13	10
Free Residual Chlorine[e]	daily	mg/L	365	Range: 0.21 - 3.89	0.2 - 4.0

Note: Sample is collected in the utility room at sampling location WNDFIN after chlorination and sequestration, and prior to distribution into the water supply system.

N - Number of samples.
[a] New York State Department of Health (NYSDOH) MCLs for drinking water.
[b] Inorganic chemicals (IOCs) including metals, cyanide and fluoride are analyzed for once every three years. Samples were collected for IOCs in 2015 and will next be sampled for in 2018.
[c] Sodium and Nitrate are analyzed for once every year.
[d] Although there is no designated limit for sodium, recommended limits are provided for people on severely sodium restricted diets (20 mg/L limit) and moderately sodium restricted diets (270 mg/L limit).
[e] Samples of finished water are collected and analyzed for chlorine daily.

TABLE B-5E
2017 Water Quality Results for Organic Parameters in Treated Potable Water

Waivers were received from CCHD such that Principal Organic Contaminants (POCs) are not required to be sampled again until 2021 and Specific Organic Contaminants (SOCs) were not required to be sampled in 2017. SOCs waiver extended through 2020.

TABLE B-5F
2017 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	1/9/2017	-1.22±1.26E-09	3.37±0.71E-09	0.68±8.90E-08
WNDRAW1	2/7/2017	1.11±1.29E-09	3.36±0.73E-09	1.64±8.02E-08
WNDRAW1	3/8/2017	0.86±1.86E-09	4.74±1.23E-09	-3.93±6.39E-08
WNDRAW1	4/4/2017	1.81±1.47E-09	4.28±0.86E-09	2.76±8.52E-08
WNDRAW1	5/2/2017	3.14±2.06E-09	3.91±1.12E-09	4.50±7.81E-08
WNDRAW1	6/7/2017	1.17±1.04E-09	3.17±0.71E-09	7.54±8.35E-08
WNDRAW1	7/3/2017	9.15±9.66E-10	2.74±0.67E-09	4.90±8.03E-08
WNDRAW1	8/2/2017	1.44±1.01E-09	2.79±0.85E-09	5.31±7.03E-08
WNDRAW1	9/13/2017	1.09±1.48E-09	2.37±0.71E-09	4.20±6.96E-08
WNDRAW1	10/4/2017	0.66±1.00E-09	2.50±0.66E-09	-4.19±7.04E-08
WNDRAW1	11/1/2017	-1.00±8.99E-10	2.26±0.72E-09	-1.03±7.12E-08
WNDRAW1	12/14/2017	1.80±1.30E-09	5.21±1.12E-09	0.20±1.01E-07
Supply Well #2 Pumping				
WNDRAW2	1/9/2017	-0.70±1.57E-09	3.23±0.70E-09	3.91±9.17E-08
WNDRAW2	2/7/2017	1.58±1.15E-09	3.60±0.69E-09	1.90±8.07E-08
WNDRAW2	3/8/2017	0.23±1.39E-09	4.00±0.88E-09	2.76±7.09E-08
WNDRAW2	4/4/2017	1.08±1.40E-09	3.70±0.65E-09	4.13±8.65E-08
WNDRAW2	5/2/2017	1.94±2.28E-09	3.22±1.15E-09	2.96±7.67E-08
WNDRAW2	6/7/2017	1.66±1.14E-09	3.41±0.71E-09	4.07±7.99E-08
WNDRAW2	7/3/2017	3.46±3.82E-09	2.62±1.94E-09	2.78±7.90E-08
WNDRAW2	8/2/2017	-0.42±1.12E-09	-2.90±7.75E-10	6.08±7.20E-08
WNDRAW2	9/13/2017	1.44±1.05E-09	3.36±0.70E-09	6.34±7.27E-08
WNDRAW2	10/4/2017	0.82±1.02E-09	2.95±0.64E-09	-1.14±7.42E-08
WNDRAW2	11/1/2017	0.32±1.05E-09	3.83±0.90E-09	6.49±7.71E-08
WNDRAW2	12/14/2017	0.73±1.15E-09	3.39±0.91E-09	-4.47±7.38E-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-5G

2017 RadioisotopIc 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	3/8/2017	1.04±2.54E-09	-1.24±4.58E-10
Supply Well #2 Pumping			
WNDRAW2	3/8/2017	-1.17±2.04E-09	0.89±3.46E-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-5H

2017 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	0.55±1.11E-09	1.68E-09	7.61E-09
Gross Beta	µCi/mL	26	3.01±0.75E-09	4.81E-09	1.56E-08
Conductivity	µmhos/cm@ 25ºC	26	423	459	NA
pH	SU	26	Range: 7.0-8.1		6.5-8.5
WNEHMKE					
Gross Alpha	µCi/mL	26	1.05±1.19E-09	2.09E-09	7.61E-09
Gross Beta	µCi/mL	26	3.19±0.74E-09	6.36E-09	1.56E-08
Conductivity	µmhos/cm@ 25ºC	26	496	582	NA
pH	SU	26	Range: 7.5-8.1		6.5-8.5
WWCOURT					
Gross Alpha	µCi/mL	26	1.13±2.13E-09	4.89E-09	7.61E-09
Gross Beta	µCi/mL	26	3.62±1.32-09	7.47E-09	1.56E-08
Conductivity	µmhos/cm@ 25ºC	26	814	1237	NA
pH	SU	26	Range: 6.9-7.8		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 2017
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	6.72±0.15E-06	9.05±0.20E-15	1.53E-13	NA[d]	NA
Gross Beta	26	5.56±0.05E-05	7.49±0.06E-14	1.15E-12	NA[d]	NA
H-3	26	1.91±0.80E-04	2.57±1.08E-13	9.96E-13	2.1E-07	<0.0001
Co-60	2	2.71±3.62E-08	3.65±4.88E-17	6.18E-17	3.6E-10	<0.0001
Sr-90	2	1.60±0.05E-05	2.16±0.06E-14	4.09E-14	1.0E-10	0.0002
I-129	2	7.91±0.35E-06	1.07±0.05E-14	1.19E-14	1.0E-10	0.0001
Cs-137	2	1.82±0.03E-05	2.45±0.04E-14	4.59E-14	8.8E-10	<0.0001
Eu-154	2	1.06±1.00E-07	1.43±1.35E-16	1.88E-16	7.5E-11	<0.0001
U-232[e]	2	3.22±7.37E-09	4.34±9.93E-18	< 1.64E-17	4.7E-13	<0.0001
U-233/234[e]	2	3.51±1.10E-08	4.72±1.48E-17	5.75E-17	1.0E-12[f]	<0.0001
U-235/236[e]	2	7.05±5.88E-09	9.50±7.93E-18	1.54E-17	1.2E-12	<0.0001
U-238[e]	2	1.49±0.78E-08	2.01±1.06E-17	2.09E-17	1.3E-12	<0.0001
Pu-238	2	1.01±0.08E-06	1.37±0.11E-15	2.62E-15	8.8E-14	0.0155
Pu-239/240	2	1.69±0.10E-06	2.28±0.14E-15	4.37E-15	8.1E-14	0.0282
Am-241	2	3.12±0.13E-06	4.21±0.18E-15	8.00E-15	9.7E-14	0.0434
Sum of Ratios						**0.088**

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 = 6.33±0.24E-02 g; average = 8.53±0.32E-11 µg/mL, includes uranium contribution from glass fiber filter matrix.
[f] DCS for Uranium-233 used for this comparison.

TABLE C-2
2017 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	26	0.66±5.46E-09	0.29±2.40E-17	< 1.63E-16	NA[b]
Gross Beta	26	0.88±1.65E-08	3.88±7.26E-17	3.79E-16	NA[b]
Co-60	2	0.31±1.71E-08	1.34±7.49E-17	8.82E-17	3.6E-10
Sr-90	2	0.13±1.34E-08	0.57±5.90E-17	< 1.01E-16	1.0E-10
I-129	2	1.31±0.12E-06	5.75±0.52E-15	8.58E-15	1.0E-10
Cs-137	2	1.35±1.31E-08	5.93±5.75E-17	1.37E-16	8.8E-10
Eu-154	2	0.43±4.86E-08	0.19±2.13E-16	< 3.14E-16	7.5E-11
U-232[c]	2	-0.56±1.03E-09	-2.47±4.52E-18	< 7.59E-18	4.7E-13
U-233/234[c]	2	8.74±2.67E-09	3.84±1.17E-17	4.21E-17	1.0E-12[d]
U-235/236[c]	2	2.27±1.55E-09	9.95±6.79E-18	1.02E-17	1.2E-12
U-238[c]	2	7.51±2.55E-09	3.30±1.12E-17	3.75E-17	1.3E-12
Pu-238	2	1.17±1.43E-09	5.15±6.28E-18	< 1.08E-17	8.8E-14
Pu-239/240	2	0.61±1.50E-09	2.68±6.56E-18	< 1.23E-17	8.1E-14
Am-241	2	1.28±1.41E-09	5.60±6.20E-18	< 9.51E-18	9.7E-14

N - Number of samples.
NA - Not applicable.
[a] DCSs 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 = 2.02±0.07E-02 g; average = 8.89±0.32E-11 µg/mL, includes uranium contribution from glass fiber filter matrix.
[d] DCS for Uranium-233 used for this comparison.

TABLE C-3
2017 Effluent Airborne Radioactivity at Vitrification System HVAC (ANVITSK)

Stack Ventilation Shut Down on July 28, 2016.[a] **VF Demolition Began September 11, 2017.**

[a] When needed, building air was ventilated and monitored with a PVU in 2017.

TABLE C-4
2017 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	-1.58±1.27E-09	-2.36±1.91E-17	< 1.21E-16	NA[b]
Gross Beta	26	1.52±0.42E-08	2.28±0.63E-16	2.48E-15	NA[b]
H-3	26	2.79±0.73E-05	4.17±1.09E-13	1.35E-12	2.1E-07
Co-60	2	-1.65±3.31E-09	-2.46±4.95E-17	< 7.63E-17	3.6E-10
Sr-90	2	0.08±3.32E-09	0.12±4.98E-17	< 9.02E-17	1.0E-10
I-129	2	7.06±0.09E-06	1.06±0.01E-13	1.23E-13	1.0E-10
Cs-137	2	6.34±6.01E-09	9.49±9.00E-17	1.90E-16	8.8E-10
Eu-154	2	-0.81±1.00E-08	-1.21±1.50E-16	< 2.37E-16	7.5E-11
U-232[c]	2	-0.38±4.24E-10	-0.58±6.35E-18	< 9.60E-18	4.7E-13
U-233/234[c]	2	2.59±0.68E-09	3.88±1.02E-17	4.11E-17	1.0E-12[d]
U-235/236[c]	2	9.34±4.15E-10	1.40±0.62E-17	1.69E-17	1.2E-12
U-238[c]	2	1.69±0.55E-09	2.53±0.83E-17	2.84E-17	1.3E-12
Pu-238	2	0.25±1.85E-10	0.38±2.76E-18	< 3.93E-18	8.8E-14
Pu-239/240	2	-0.77±2.47E-10	-1.16±3.69E-18	< 5.93E-18	8.1E-14
Am-241	2	3.61±4.18E-10	5.41±6.26E-18	< 1.06E-17	9.7E-14

N - Number of samples.
NA - Not applicable.
[a] DCSs 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 = 4.40±0.16E-03 g; average = 6.59±0.24E-11 µg/mL, includes uranium contribution from glass fiber filter matrix.
[d] DCS for Uranium-233 used for this comparison.

TABLE C-5
2017 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	5.54±3.96E-09	5.13±3.67E-17	2.59E-16	NA[b]
Gross Beta	26	-1.34±1.12E-08	-1.24±1.03E-16	< 5.87E-16	NA[b]
Co-60	2	-1.39±1.58E-08	-1.29±1.46E-16	< 2.15E-16	3.6E-10
Sr-90	2	-4.71±7.48E-09	-4.37±6.94E-17	< 1.10E-16	1.0E-10
I-129	2	9.50±4.07E-08	8.81±3.78E-16	1.56E-15	1.0E-10
Cs-137	2	0.82±1.15E-08	0.76±1.07E-16	< 1.71E-16	8.8E-10
Eu-154	2	-2.97±3.27E-08	-2.76±3.03E-16	< 4.29E-16	7.5E-11
U-232[c]	2	-2.32±8.39E-10	-2.15±7.78E-18	< 1.16E-17	4.7E-13
U-233/234[c]	2	1.09±0.24E-08	1.01±0.22E-16	1.08E-16	1.0E-12[d]
U-235/236[c]	2	2.82±1.25E-09	2.61±1.16E-17	4.41E-17	1.2E-12
U-238[c]	2	5.82±1.84E-09	5.39±1.70E-17	5.54E-17	1.3E-12
Pu-238	2	3.50±9.03E-10	3.24±8.37E-18	< 1.24E-17	8.8E-14
Pu-239/240	2	0.73±1.14E-09	0.68±1.05E-17	< 1.97E-17	8.1E-14
Am-241	2	0.73±1.03E-09	6.79±9.52E-18	< 1.65E-17	9.7E-14

N - Number of samples.
NA - Not applicable.
[a] DCSs 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 = 1.52±0.05E-02 g; average = 1.41±0.05E-10 µg/mL, includes uranium contribution from glass fiber filter matrix.
[d] DCS for Uranium-233 used for this comparison.

TABLE C-6
2017 Effluent Airborne Radioactivity at Contact Size-Reduction Facility (ANCSRFK)

Permanent Stack Ventilation Inoperable. Facility Undergoing Demolition.

TABLE C-7
2017 Effluent Airborne Radioactivity at Container Sorting and Packaging Facility (ANCSPFK)

Isotope	*N*	*Total Activity Released (Ci)*	*Average Concentration (µCi/mL)*	*Maximum Concentration (µCi/mL)*	*DCS[a] (µCi/mL)*
Gross Alpha	17	1.46±0.37E-09	1.32±0.33E-16	5.57E-16	NA[b]
Gross Beta	17	1.28±0.93E-09	1.15±0.84E-16	4.57E-16	NA[b]
Co-60	2	-0.13±1.15E-09	-0.11±1.04E-16	< 2.22E-16	3.6E-10
Sr-90	2	-4.48±9.40E-10	-4.05±8.49E-17	< 2.46E-16	1.0E-10
I-129	2	6.20±0.54E-08	5.61±0.49E-15	7.13E-15	1.0E-10
Cs-137	2	7.71±9.95E-10	6.97±8.99E-17	2.32E-16	8.8E-10
Eu-154	2	2.26±3.27E-09	2.04±2.95E-16	< 7.08E-16	7.5E-11
U-232[c]	2	0.48±1.11E-10	0.43±1.00E-17	< 2.48E-17	4.7E-13
U-233/234[c]	2	5.44±1.73E-10	4.92±1.56E-17	9.44E-17	1.0E-12[d]
U-235/236[c]	2	1.50±1.04E-10	1.35±0.94E-17	2.71E-17	1.2E-12
U-238[c]	2	4.11±1.48E-10	3.71±1.34E-17	5.39E-17	1.3E-12
Pu-238	2	2.31±1.46E-10	2.09±1.32E-17	2.56E-17	8.8E-14
Pu-239/240	2	1.09±1.35E-10	0.98±1.22E-17	< 1.74E-17	8.1E-14
Am-241	2	4.08±1.81E-10	3.69±1.64E-17	4.12E-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 = 7.84±0.38E-04 g; average = 7.09±0.35E-11 µg/mL, includes uranium contribution from glass fiber filter matrix.

[d] DCS for Uranium-233 used for this comparison.

TABLE C-8
2017 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	89	2.25±1.15E-09	1.03±0.53E-17	6.20E-15	NA[c]
Gross Beta	89	2.51±0.36E-08	1.15±0.17E-16	3.17E-15	NA[c]
Co-60	2	0.30±2.05E-09	1.39±9.39E-18	< 1.33E-17	3.6E-10
Sr-90	2	-0.90±1.23E-09	-4.14±5.66E-18	< 9.39E-18	1.0E-10
Cs-137	2	1.90±2.29E-09	0.87±1.05E-17	< 1.62E-17	8.8E-10
Eu-154	2	4.69±5.64E-09	2.15±2.59E-17	< 3.94E-17	7.5E-11
U-232[d]	2	-0.42±1.52E-10	-1.90±6.97E-19	< 9.88E-19	4.7E-13
U-233/234[d]	2	2.77±0.44E-09	1.27±0.20E-17	1.57E-17	1.0E-12[e]
U-235/236[d]	2	4.41±1.79E-10	2.02±0.82E-18	3.33E-18	1.2E-12
U-238[d]	2	2.73±0.42E-09	1.25±0.19E-17	1.70E-17	1.3E-12
Pu-238	2	2.55±2.00E-10	1.17±0.92E-18	2.02E-18	8.8E-14
Pu-239/240	2	0.51±1.70E-10	2.33±7.81E-19	< 1.15E-18	8.1E-14
Am-241	2	4.34±2.77E-10	1.99±1.27E-18	2.99E-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] DCSs 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 = 7.35±0.22E-03 g; average = 3.37±0.10E-11 µg/mL, includes uranium contribution from glass fiber filter matrix.
[e] DCS for Uranium-233 used for this comparison.

TABLE C-9
2017 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	8.27±1.82E-16	1.18E-15	1.65±0.07E-14	2.57E-14
AF02_NNE	26	7.90±1.77E-16	1.31E-15	1.59±0.07E-14	2.54E-14
AF03_NE	26	7.56±1.77E-16	1.21E-15	1.56±0.07E-14	2.48E-14
AF04_ENE	26	7.62±1.67E-16	1.05E-15	1.55±0.06E-14	2.42E-14
AF05_E	26	8.23±1.80E-16	1.25E-15	1.62±0.07E-14	2.55E-14
AF06_ESE	26	8.32±1.83E-16	1.25E-15	1.58±0.07E-14	2.67E-14
AF07_SE	26	7.88±1.81E-16	1.30E-15	1.52±0.07E-14	2.56E-14
AF08_SSE	26	8.56±1.78E-16	1.48E-15	1.60±0.07E-14	2.56E-14
AF09_S	26	8.29±1.74E-16	1.34E-15	1.57±0.06E-14	2.46E-14
AF10_SSW	26	8.31±2.23E-16	1.53E-15	1.60±0.08E-14	2.70E-14
AF11_SW	26	8.36±1.84E-16	1.41E-15	1.61±0.07E-14	2.67E-14
AF12_WSW	26	8.14±1.88E-16	1.27E-15	1.56±0.07E-14	2.38E-14
AF13_W	26	8.41±1.81E-16	1.53E-15	1.60±0.07E-14	2.75E-14
AF14_WNW	26	8.30±1.85E-16	1.29E-15	1.53±0.07E-14	2.42E-14
AF15_NW	26	8.82±2.00E-16	1.26E-15	1.54±0.07E-14	2.40E-14
AF16_NNW	26	8.07±1.79E-16	1.35E-15	1.46±0.06E-14	2.42E-14
AF16HNNW	26	7.17±1.35E-16	1.15E-15	1.41±0.05E-14	2.11E-14
AFGRVAL	26	9.48±1.88E-16	1.43E-15	1.62±0.07E-14	2.41E-14

N - Number of samples.

TABLE C-10
2017 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	7.17±9.48E-17	0.58±7.25E-17	-0.20±1.44E-16	0.00±1.06E-17
AF02_NNE	4	0.30±1.06E-16	1.24±6.74E-17	0.02±1.07E-16	3.54±9.50E-18
AF03_NE	4	3.87±7.89E-17	-2.80±8.17E-17	-1.47±9.76E-17	-0.35±1.12E-17
AF04_ENE	4	0.20±8.53E-17	-2.38±6.28E-17	0.09±1.00E-16	-3.91±9.33E-18
AF05_E	4	4.69±9.48E-17	-1.44±8.34E-17	0.05±1.07E-16	0.28±1.04E-17
AF06_ESE	4	1.31±8.41E-17	0.23±8.45E-17	0.25±1.01E-16	0.17±1.03E-17
AF07_SE	4	3.83±9.45E-17	-0.81±9.43E-17	0.31±1.01E-16	-2.71±9.31E-18
AF08_SSE	4	0.88±9.09E-17	1.80±7.26E-17	3.98±9.11E-17	0.46±1.14E-17
AF09_S	4	0.75±7.91E-17	-0.41±6.76E-17	1.42±8.76E-17	0.20±8.38E-18
AF10_SSW	4	0.73±1.08E-16	1.82±6.79E-17	0.72±9.94E-17	0.00±1.58E-17
AF11_SW	4	2.10±9.73E-17	-2.75±7.89E-17	0.27±1.15E-16	0.49±1.18E-17
AF12_WSW	4	0.26±1.10E-16	-2.56±7.14E-17	0.39±9.50E-17	0.02±1.27E-17
AF13_W	4	4.27±9.14E-17	-3.52±9.42E-17	0.38±1.24E-16	-0.50±7.68E-18
AF14_WNW	4	0.67±1.02E-16	1.58±6.67E-17	0.98±9.35E-17	-2.30±9.76E-18
AF15_NW	4	0.32±1.02E-16	0.05±6.56E-17	2.02±8.50E-17	-0.50±1.19E-17
AF16_NNW	4	0.15±8.76E-17	1.89±8.25E-17	2.95±8.26E-17	0.45±1.17E-17
AF16HNNW[c]	4	1.60±1.77E-17	1.89±8.25E-17[d]	0.82±2.89E-17	0.78±2.31E-18
AFGRVAL[e]	4	6.88±9.85E-17	-0.70±6.41E-17	-0.51±9.86E-17	0.23±1.33E-17

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	4.14±9.20E-18	2.02±8.23E-18	0.47±1.03E-17	< 0.043
AF02_NNE	4	0.62±1.03E-17	0.42±1.15E-17	0.81±7.26E-18	< 0.040
AF03_NE	4	3.10±7.79E-18	1.88±8.29E-18	3.39±8.62E-18	< 0.039
AF04_ENE	4	1.63±7.71E-18	0.19±9.71E-18	4.37±8.73E-18	< 0.037
AF05_E	4	0.61±1.04E-17	-1.12±9.28E-18	3.74±8.01E-18	< 0.042
AF06_ESE	4	2.73±8.22E-18	-0.87±7.47E-18	6.14±8.48E-18	< 0.039
AF07_SE	4	3.03±8.81E-18	-0.39±8.52E-18	0.92±6.97E-18	< 0.040
AF08_SSE	4	1.65±6.17E-18	4.95±7.77E-18	0.51±6.13E-18	< 0.036
AF09_S	4	0.63±1.02E-17	-0.85±7.63E-18	3.03±6.55E-18	< 0.035
AF10_SSW	4	-0.56±1.11E-17	0.65±9.92E-18	0.00±9.38E-18	**< 0.046**
AF11_SW	4	-0.08±7.86E-18	0.10±1.01E-17	3.73±8.09E-18	< 0.042
AF12_WSW	4	0.96±7.05E-18	-1.28±7.18E-18	3.64±9.00E-18	< 0.040
AF13_W	4	2.98±9.09E-18	0.40±1.03E-17	1.94±7.52E-18	< 0.041
AF14_WNW	4	1.39±8.65E-18	2.94±8.60E-18	1.70±9.02E-18	< 0.038
AF15_NW	4	-1.43±5.92E-18	0.07±9.33E-18	-0.86±7.30E-18	< 0.038
AF16_NNW	4	1.33±7.02E-18	-1.54±8.56E-18	0.37±5.87E-18	< 0.038
AF16HNNW[c]	4	0.39±1.27E-18	0.49±1.50E-18	0.66±1.62E-18	< 0.016
AFGRVAL[e]	4	0.36±1.02E-17	0.37±1.32E-17	3.04±8.79E-18	< 0.044

<= Max ratio in 2017.

[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
2017 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 (2017 Dose < 0.44 mrem/year)
Compliance Network Samplers		
AF01_N	< 0.043	
AF02_NNE	< 0.040	
AF03_NE	< 0.039	
AF04_ENE	< 0.037	
AF05_E	< 0.042	
AF06_ESE	< 0.039	
AF07_SE	< 0.040	
AF08_SSE	< 0.036	
AF09_S	< 0.035	
AF10_SSW	**< 0.046**	**Critical Receptor** (for reporting purposes) **(2017 Dose < 0.46 mrem/year)**
AF11_SW	< 0.042	
AF12_WSW	< 0.040	
AF13_W	< 0.041	
AF14_WNW	< 0.038	
AF15_NW	< 0.038	
AF16_NNW	< 0.038	
Non-Network Sampler		
AF16HNNW[d]	< 0.016	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
2017 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-17	6.80	1439	0.90±5.25E-09	6.01±2.49E-09	-5.26±8.98E-08
301	UP	Jun-17	6.76	2261	0.84±4.58E-09	7.94±3.57E-09	-0.64±1.04E-07
301	UP	Sep-17	6.67	2891	-0.24±5.42E-09	7.69±2.78E-09	2.03±7.44E-08
301	UP	Dec-17	6.70	1525	-2.69±2.79E-09	6.36±2.38E-09	0.85±7.28E-08
302	UP	Jun-17	6.90	5692	-0.45±1.29E-08	-0.41±8.18E-09	-7.34±9.97E-08
302	UP	Dec-17	6.96	5595	-6.77±6.71E-09	-6.11±6.79E-09	6.01±7.66E-08
401	UP	Mar-17	7.12	5828	-0.11±1.25E-08	2.37±0.66E-08	-3.87±9.11E-08
401	UP	Jun-17	7.12	4600	0.41±1.02E-08	5.25±5.23E-09	-0.37±1.04E-07
401	UP	Sep-17	6.70	5052	5.95±6.28E-09	4.97±6.28E-09	7.87±7.77E-08
401	UP	Dec-17	7.12	4913	-5.44±7.67E-09	1.26±5.18E-09	5.70±7.40E-08
402	UP	Jun-17	7.08	6167	0.06±1.26E-08	6.71±7.69E-09	0.06±1.05E-07
402	UP	Dec-17	7.07	6162	-7.00±7.46E-09	4.53±6.85E-09	9.85±8.08E-08
403	UP	Jun-17	7.15	1741	0.51±4.09E-09	6.11±3.17E-09	-1.11±1.08E-07
403	UP	Dec-17	7.16	1604	-2.38±2.69E-09	1.81±0.30E-08	0.07±7.37E-08
706	UP	Mar-17	7.58	740	0.12±2.25E-09	5.20±1.36E-09	-0.11±9.93E-08
706	UP	Jun-17	7.50	913	1.83±2.02E-09	7.10±1.72E-09	0.61±1.16E-07
706	UP	Sep-17	7.03	984	1.83±2.11E-09	5.83±1.38E-09	9.62±7.59E-08
706	UP	Dec-17	7.16	654	-0.52±1.20E-09	5.42±1.25E-09	9.09±8.01E-08
1302	UP	Dec-17	7.00	558	-1.50±1.00E-09	2.71±0.91E-09	-0.06±7.46E-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*)
2017 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*
103	DOWN	Mar-17	7.83	7572	-0.26±1.11E-08	1.85±0.12E-07	-1.89±8.62E-08
103	DOWN	Jun-17	7.83	7407	1.35±1.36E-08	1.47±0.13E-07	0.70±1.08E-07
103	DOWN	Sep-17	7.68	4173	-5.04±9.99E-09	6.99±0.86E-08	9.61±7.91E-08
103	DOWN	Dec-17	7.91	2491	-0.85±5.46E-09	3.56±0.55E-08	0.64±9.52E-08
104	DOWN	Mar-17	7.06	2176	-1.21±3.47E-09	**5.02±0.01E-05**	0.22±1.07E-07
104	DOWN	Jun-17	7.16	2316	-1.82±3.09E-09	**5.24±0.01E-05**	0.69±1.08E-07
104	DOWN	Sep-17	7.04	2157	4.64±4.27E-09	**5.71±0.01E-05**	4.49±7.58E-08
104	DOWN	Dec-17	7.10	1919	-0.74±3.03E-09	**4.39±0.01E-05**	7.59±8.11E-08
105	DOWN	Mar-17	7.14	2610	0.29±5.84E-09	**5.14±0.01E-05**	0.53±1.08E-07
105	DOWN	Jun-17	7.28	2474	1.10±6.31E-09	**4.59±0.01E-05**	0.92±1.18E-07
105	DOWN	Sep-17	7.14	2441	2.86±4.76E-09	**4.81±0.01E-05**	1.75±0.88E-07
105	DOWN	Dec-17	7.19	2450	-3.24±4.38E-09	**4.79±0.01E-05**	9.74±8.04E-08
106	DOWN	Mar-17	6.85	2406	-1.08±3.56E-09	**4.91±0.03E-06**	**4.56±1.15E-07**
106	DOWN	Jun-17	7.02	2080	-2.35±5.99E-09	**5.09±0.03E-06**	**3.66±1.25E-07**
106	DOWN	Sep-17	6.89	1926	8.43±5.90E-09	**4.30±0.03E-06**	**4.24±1.00E-07**
106	DOWN	Dec-17	7.08	1979	0.19±3.65E-09	**5.37±0.03E-06**	**4.51±1.02E-07**
111	DOWN	Mar-17	6.58	548	0.12±1.03E-09	**2.43±0.01E-06**	4.89±8.82E-08
111	DOWN	Jun-17	6.91	776	1.29±0.24E-08	**3.85±0.02E-06**	0.80±1.12E-07
111	DOWN	Sep-17	6.43	1330	5.08±3.48E-09	**4.75±0.02E-06**	6.10±7.93E-08
111	DOWN	Dec-17	6.61	831	6.36±1.81E-09	**3.95±0.02E-06**	2.59±7.97E-08
116	DOWN	Jun-17	7.17	2420	4.52±4.20E-09	**2.79±0.01E-05**	1.25±1.12E-07
116	DOWN	Dec-17	7.13	2368	-0.49±2.81E-09	**2.97±0.01E-05**	5.23±8.13E-08
205	DOWN	Jun-17	6.87	4773	9.58±9.20E-09	2.30±0.75E-08	0.44±1.12E-07
205	DOWN	Dec-17	7.15	3221	-0.25±4.92E-09	6.99±3.69E-09	5.02±7.51E-08
406	DOWN	Mar-17	6.94	1628	-0.11±1.70E-09	6.90±1.53E-09	-1.13±9.60E-08
406	DOWN	Jun-17	7.17	1076	0.22±2.13E-09	7.00±1.53E-09	0.15±1.07E-07
406	DOWN	Sep-17	6.90	1259	2.99±3.73E-09	7.65±1.39E-09	4.45±7.80E-08
406	DOWN	Dec-17	7.15	982	0.39±1.41E-09	6.76±1.42E-09	1.58±9.53E-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*)
2017 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*
408	DOWN	Mar-17	7.31	3752	3.42±7.03E-09	**1.31±0.01E-04**	5.93±9.03E-08
408	DOWN	Jun-17	7.29	3834	0.94±1.35E-08	**1.35±0.01E-04**	1.35±1.12E-07
408	DOWN	Sep-17	7.22	3970	6.82±8.19E-09	**1.41±0.01E-04**	8.47±8.11E-08
408	DOWN	Dec-17	7.29	3706	-0.33±5.36E-09	**1.01±0.01E-04**	6.92±8.20E-08
501	DOWN	Mar-17	7.47	2674	-4.15±6.31E-09	**6.34±0.01E-05**	9.27±9.53E-08
501	DOWN	Jun-17	7.42	2868	-1.12±5.31E-09	**8.18±0.01E-05**	0.44±1.16E-07
501	DOWN	Sep-17	7.21	2960	2.20±4.87E-09	**7.10±0.01E-05**	8.80±8.12E-08
501	DOWN	Dec-17	7.42	2826	1.82±5.84E-09	**7.17±0.01E-05**	8.41±8.22E-08
502	DOWN	Mar-17	7.39	2850	-5.89±6.61E-09	**4.75±0.01E-05**	2.26±8.57E-08
502	DOWN	Jun-17	7.35	2753	5.31±6.32E-09	**5.57±0.01E-05**	0.47±1.07E-07
502	DOWN	Sep-17	7.21	2855	-4.64±7.73E-09	**5.20±0.01E-05**	8.99±8.13E-08
502	DOWN	Dec-17	7.36	2938	-1.59±4.69E-09	**5.21±0.01E-05**	4.67±7.75E-08
602A	DOWN	Jun-17	6.95	1096	-1.83±1.90E-09	1.12±0.16E-08	1.13±1.15E-07
602A	DOWN	Dec-17	7.04	797	-1.06±1.49E-09	5.87±1.60E-09	**1.96±0.92E-07**
604	DOWN	Jun-17	6.45	1566	-1.44±3.67E-09	6.69±2.41E-09	-0.07±1.11E-07
604	DOWN	Dec-17	6.37	1634	0.53±2.42E-09	8.76±2.39E-09	-3.11±9.47E-08
605	DOWN	Jun-17	7.28	1054	1.76±2.12E-09	1.94±0.17E-08	0.26±1.11E-07
605	DOWN	Dec-17	7.12	895	-0.55±1.05E-09	1.82±0.15E-08	1.31±0.84E-07
801	DOWN	Mar-17	6.70	2374	-3.61±6.03E-09	**3.58±0.03E-06**	6.35±9.05E-08
801	DOWN	Jun-17	6.59	2104	8.98±5.82E-09	**3.05±0.02E-06**	0.77±1.16E-07
801	DOWN	Sep-17	6.57	2162	2.03±3.92E-09	**3.80±0.03E-06**	6.83±7.74E-08
801	DOWN	Dec-17	6.77	1943	-0.44±3.27E-09	**3.56±0.02E-06**	4.00±8.00E-08
802	DOWN	Mar-17	7.23	150	2.09±1.32E-09	1.59±0.16E-08	-2.48±9.38E-08
802	DOWN	Jun-17	6.81	296	0.35±1.07E-09	1.54±0.02E-07	0.27±1.08E-07
802	DOWN	Sep-17	6.85	1182	0.00±2.33E-09	**1.15±0.01E-06**	8.20±8.13E-08
802	DOWN	Dec-17	6.89	521	0.87±7.59E-10	3.38±0.04E-07	5.44±8.09E-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)*
2017 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*
803	DOWN	Mar-17	7.22	2580	-4.21±7.39E-09	**1.23±0.02E-06**	1.12±0.94E-07
803	DOWN	Jun-17	7.14	2436	0.89±4.85E-09	**1.63±0.02E-06**	-0.33±1.10E-07
803	DOWN	Sep-17	7.29	2603	2.69±4.60E-09	**1.49±0.02E-06**	9.19±8.18E-08
803	DOWN	Dec-17	7.30	2636	0.00±4.17E-09	**1.15±0.02E-06**	-0.43±7.65E-08
804	DOWN	Mar-17	7.06	1492	-0.53±8.62E-09	1.96±0.07E-07	-1.58±9.53E-08
804	DOWN	Jun-17	6.85	1700	0.74±3.84E-09	1.99±0.06E-07	0.72±1.14E-07
804	DOWN	Sep-17	6.66	2009	3.76±4.74E-09	2.14±0.06E-07	4.53±7.53E-08
804	DOWN	Dec-17	6.96	1678	0.90±3.03E-09	1.71±0.06E-07	5.76±7.69E-08
1304	DOWN	Mar-17	7.27	2628	1.30±0.96E-08	2.08±4.15E-09	-2.04±9.32E-08
1304	DOWN	Jun-17	7.15	2973	-1.28±4.05E-09	6.41±3.26E-09	-0.01±1.16E-07
1304	DOWN	Sep-17	7.28	2459	1.13±4.93E-09	5.90±3.20E-09	3.63±7.49E-08
1304	DOWN	Dec-17	7.26	1598	0.53±2.40E-09	6.24±2.29E-09	-0.11±7.50E-08
8603	DOWN	Jun-17	7.30	2512	0.29±4.68E-09	**5.55±0.01E-05**	1.47±1.14E-07
8603	DOWN	Dec-17	7.27	2422	-4.81±3.60E-09	**5.71±0.01E-05**	1.31±0.88E-07
8604	DOWN	Jun-17	7.20	2392	4.39±5.47E-09	**4.20±0.01E-05**	-0.22±1.11E-07
8604	DOWN	Dec-17	7.09	2200	3.48±4.26E-09	**4.23±0.01E-05**	8.41±8.22E-08
8605	DOWN	Mar-17	6.78	646	7.51±1.54E-09	**4.00±0.01E-06**	6.04±9.11E-08
8605	DOWN	Jun-17	6.87	879	**4.89±0.71E-08**	**9.28±0.03E-06**	-0.01±1.13E-07
8605	DOWN	Sep-17	6.72	2100	**2.02±0.60E-08**	**6.21±0.03E-06**	8.66±8.03E-08
8605	DOWN	Dec-17	6.76	875	**3.39±0.36E-08**	**6.67±0.02E-06**	4.84±8.00E-08
8607	DOWN	Mar-17	6.69	1572	3.46±5.55E-09	3.40±0.37E-08	3.02±9.94E-08
8607	DOWN	Jun-17	6.81	1110	-0.90±3.54E-09	3.94±0.26E-08	-0.34±1.05E-07
8607	DOWN	Sep-17	6.83	866	2.83±2.63E-09	2.08±0.21E-08	9.51±8.05E-08
8607	DOWN	Dec-17	6.79	842	-1.11±1.39E-09	2.20±0.18E-08	1.56±9.42E-08
8609	DOWN	Mar-17	7.08	2938	-0.56±5.74E-09	**1.57±0.02E-06**	0.74±1.08E-07
8609	DOWN	Jun-17	7.24	2867	-0.92±5.87E-09	**1.07±0.02E-06**	-0.29±1.10E-07
8609	DOWN	Sep-17	6.74	2578	-2.87±8.53E-09	8.74±0.14E-07	1.20±0.86E-07
8609	DOWN	Dec-17	7.09	2060	3.80±5.06E-09	9.03±0.15E-07	1.41±0.88E-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)*
2017 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***
8612	DOWN	Mar-17	7.23	2479	3.72±7.22E-09	8.52±0.60E-08	0.43±1.03E-07
8612	DOWN	Jun-17	7.13	2313	0.00±5.46E-09	8.41±0.49E-08	0.30±1.13E-07
8612	DOWN	Sep-17	7.11	2400	1.96±4.41E-09	7.92±0.50E-08	5.50±8.11E-08
8612	DOWN	Dec-17	7.05	2526	-3.08±2.92E-09	1.06±0.05E-07	1.65±9.69E-08
MP-01	DOWN	Mar-17	7.31	4014	-3.67±8.53E-09	**2.22±0.01E-04**	1.11±0.99E-07
MP-01	DOWN	Jun-17	7.28	4212	0.34±1.52E-08[c]	**3.29±0.01E-04**	-0.67±1.10E-07
MP-01	DOWN	Sep-17	7.24	3747	3.14±7.54E-09	**2.05±0.01E-04**	9.29±8.12E-08
MP-01	DOWN	Dec-17	7.35	3440	-5.39±8.26E-09	**1.69±0.01E-04**	5.23±8.03E-08
MP-02	DOWN	Mar-17	7.03	3504	-0.57±1.68E-08[c]	**3.44±0.01E-04**	1.50±1.02E-07
MP-02	DOWN	Jun-17	7.18	3513	-3.32±5.23E-09	**2.48±0.01E-04**	-0.54±1.11E-07
MP-02	DOWN	Sep-17	7.16	3042	-6.14±6.29E-09	**2.36±0.01E-04**	1.07±0.84E-07
MP-02	DOWN	Dec-17	7.13	2702	4.16±6.73E-09	**1.95±0.01E-04**	8.44±8.06E-08
MP-03	DOWN	Mar-17	7.40	1874	-5.03±7.13E-09	**1.77±0.01E-04**	1.04±0.95E-07
MP-03	DOWN	Jun-17	7.28	2040	5.02±5.09E-09	**2.24±0.01E-04**	-0.80±1.09E-07
MP-03	DOWN	Sep-17	7.24	2323	4.18±9.26E-09	**1.88±0.01E-04**	1.30±0.87E-07
MP-03	DOWN	Dec-17	7.41	1568	1.05±1.87E-09	**1.08±0.01E-04**	6.96±7.81E-08
MP-04	DOWN	Mar-17	7.34	2648	-1.02±3.69E-09	**2.48±0.01E-04**	1.21±1.13E-07
MP-04	DOWN	Jun-17	7.27	2827	4.60±4.90E-09	**2.69±0.01E-04**	0.01±1.12E-07
MP-04	DOWN	Sep-17	7.26	2626	4.42±6.12E-09	**2.23±0.01E-04**	1.07±0.82E-07
MP-04	DOWN	Dec-17	7.45	2070	0.14±2.68E-09	**1.49±0.01E-04**	9.96±8.35E-08
WP-A	DOWN	Sep-17	7.13	162	-6.23±6.22E-10	1.24±0.09E-08	**7.25±0.30E-06**
WP-C	DOWN	Sep-17	7.08	1966	0.00±3.04E-10	2.61±0.66E-09	**1.68±0.05E-05**
WP-H	DOWN	Sep-17	6.50	1516	1.01±0.49E-08	**5.80±0.03E-06**	**5.33±1.09E-07**
GSEEP	DOWN	Mar-17	6.89	2306	2.69±6.41E-09	1.15±0.05E-07	1.45±0.92E-07
GSEEP	DOWN	Jun-17	6.97	2146	-3.43±3.80E-09	1.34±0.05E-07	1.24±1.06E-07
GSEEP	DOWN	Sep-17	7.53	2250	2.00±3.86E-09	1.41±0.05E-07	1.75±0.88E-07
GSEEP	DOWN	Dec-17	6.98	1967	-0.15±2.90E-09	1.35±0.05E-07	1.34±1.05E-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).

[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-2A *(concluded)*
2017 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***
SP04	DOWN	Jun-17	NS	NS	-2.23±3.94E-09	1.73±0.06E-07	0.41±1.05E-07
SP04	DOWN	Dec-17	NS	NS	2.65±2.78E-09	1.62±0.06E-07	6.49±8.03E-08
SP06	DOWN	Jun-17	NS	NS	-0.61±3.71E-09	3.43±0.08E-07	0.45±1.12E-07
SP06	DOWN	Dec-17	NS	NS	-4.12±2.78E-09	2.98±0.07E-07	3.89±9.75E-08
				.			
SP11	DOWN	Jun-17	NS	NS	2.63±4.83E-09	9.08±0.14E-07	0.79±1.09E-07
SP11	DOWN	Dec-17	NS	NS	3.35±4.34E-09	**1.01±0.01E-06**	2.56±9.55E-08
SP12	DOWN	Jun-17	7.20	2305	0.25±4.14E-09	2.71±0.08E-07	0.48±1.07E-07
SP12	DOWN	Dec-17	7.34	2237	-0.20±2.53E-09	3.41±0.08E-07	1.27±1.06E-07

Note: Bolding indicates radiological concentration that exceeds the GSL.

NA - Not applicable.

NS - Not sampled.

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
2017 Indicator Results From the Lavery Till-Sand 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*
204	DOWN	Mar-17	7.52	1940	0.45±3.95E-09	2.52±2.57E-09	2.51±9.75E-08
204	DOWN	Jun-17	7.22	1985	5.39±4.97E-09	3.52±2.40E-09	0.27±1.13E-07
204	DOWN	Sep-17	7.17	2048	3.38±4.69E-09	1.31±2.87E-09	0.66±7.51E-08
204	DOWN	Dec-17	7.41	1939	-2.47±3.19E-09	-0.76±2.89E-09	6.97±7.95E-08
206	DOWN	Jun-17	7.17	2233	4.86±4.64E-09	0.29±2.51E-09	-0.16±1.13E-07
206	DOWN	Dec-17	7.39	2172	-1.99±2.51E-09	3.34±2.19E-09	3.03±7.70E-08

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
2017 indicator Results From the Weathered Lavery Till 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
908R	UP	Jun-17	Not sampled - insufficient volume				
908R	UP	Dec-17	7.03	1161	2.01±2.75E-09	1.32±0.24E-08	3.31±9.81E-08
1005	UP	Jun-17	7.10	750	1.68±2.20E-09	2.44±1.36E-09	-0.13±1.01E-07
1005	UP	Dec-17	7.22	740	1.62±1.35E-09	2.62±1.13E-09	3.39±7.48E-08
1008C	UP	Jun-17	7.58	568	0.24±2.14E-09	1.33±1.45E-09	0.18±1.06E-07
1008C	UP	Dec-17	7.70	498	0.81±1.48E-09	0.94±1.21E-09	2.57±7.75E-08
906	DOWN	Jun-17	7.43	675	1.67±2.23E-09	2.66±1.21E-09	-0.23±1.11E-07
906	DOWN	Dec-17	7.43	672	1.82±1.89E-09	3.21±1.14E-09	0.73±7.57E-08
909	DOWN	Jun-17	6.65	1326	1.24±3.09E-09	2.23±0.06E-07	**6.83±1.31E-07**
909	DOWN	Dec-17	6.66	1466	-0.28±2.60E-09	2.10±0.06E-07	**5.30±1.03E-07**
1006	DOWN	Jun-17	7.07	1442	4.67±4.28E-09	5.28±2.68E-09	-0.26±1.05E-07
1006	DOWN	Dec-17	7.03	1463	2.60±3.47E-09	6.42±2.58E-09	0.84±7.28E-08
NDATR	DOWN	Mar-17	7.82	880	2.09±2.75E-09	4.19±0.06E-07	9.88±8.41E-08
NDATR	DOWN	Jun-17	7.73	962	2.64±2.99E-09	6.14±0.09E-07	0.18±1.14E-07
NDATR	DOWN	Sep-17	7.28	968	1.72±2.52E-09	6.83±0.09E-07	9.00±8.15E-08
NDATR	DOWN	Dec-17	8.10	683	8.42±9.74E-10	4.38±0.05E-07	6.41±8.01E-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
2017 Indicator Results From the Unweathered Lavery Till

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*
405	UP	Mar-17	7.66	1185	-1.08±1.92E-09	6.25±1.50E-09	2.45±9.94E-08
405	UP	Jun-17	7.48	1166	0.54±3.48E-09	2.60±2.25E-09	0.25±1.13E-07
405	UP	Sep-17	7.31	1604	1.62±3.05E-09	4.33±2.12E-09	1.05±0.82E-07
405	UP	Dec-17	7.35	1382	0.56±2.65E-09	6.10±2.39E-09	0.94±9.42E-08
1303	UP	Mar-17	8	332	1.06±1.18E-09	1.46±0.65E-09	-6.61±8.88E-08
1303	UP	Jun-17	7.84	422	0.86±1.04E-09	8.72±5.86E-10	0.55±1.14E-07
1303	UP	Sep-17	7.89	337	0.84±1.18E-09	2.77±0.72E-09	-1.04±7.10E-08
1303	UP	Dec-17	7.94	252	2.33±7.97E-10	1.15±0.52E-09	1.03±7.62E-08
107	DOWN	Mar-17	7.69	704	-0.30±2.42E-09	1.65±0.19E-08	0.48±9.47E-08
107	DOWN	Jun-17	7.5	663	-0.32±2.02E-09	1.48±0.17E-08	0.40±1.11E-07
107	DOWN	Sep-17	7.31	729	0.20±1.69E-09	1.10±0.16E-08	2.51±7.57E-08
107	DOWN	Dec-17	7.67	624	-1.15±1.40E-09	1.53±0.15E-08	5.26±9.84E-08
108	DOWN	Jun-17	7.41	606	0.33±1.31E-09	3.38±0.94E-09	**1.96±1.16E-07**
108	DOWN	Dec-17	7.64	604	1.17±0.90E-09	2.40±0.78E-09	**1.82±1.05E-07**
110	DOWN	Mar-17	7.54	578	-0.74±2.45E-09	3.30±1.28E-09	**6.23±1.47E-07**
110	DOWN	Jun-17	7.33	574	1.37±1.61E-09	1.22±1.28E-09	**6.32±1.28E-07**
110	DOWN	Sep-17	6.94	567	1.66±1.41E-09	4.59±1.06E-09	**5.97±1.11E-07**
110	DOWN	Dec-17	7.41	537	-0.18±1.08E-09	3.50±1.06E-09	**3.61±1.14E-07**
409	DOWN	Mar-17	8.1	336	3.28±8.31E-10	1.25±0.51E-09	-1.08±0.85E-07
409	DOWN	Jun-17	8.12	322	1.44±1.07E-09	1.72±0.69E-09	-0.20±1.07E-07
409	DOWN	Sep-17	8.06	335	-0.72±1.11E-09	2.88±0.69E-09	3.79±7.59E-08
409	DOWN	Dec-17	7.75	324	2.48±8.18E-10	8.90±6.38E-10	-1.44±8.97E-08
704	DOWN	Mar-17	6.67	886	0.14±2.77E-09	5.86±1.77E-09	-4.85±9.20E-08
704	DOWN	Jun-17	6.77	826	1.76±3.11E-09	5.34±1.69E-09	0.04±1.06E-07
704	DOWN	Sep-17	6.6	891	0.75±2.44E-09	5.31±1.70E-09	2.82±7.70E-08
704	DOWN	Dec-17	6.71	868	-0.65±1.81E-09	6.74±1.75E-09	0.38±9.37E-08
707	DOWN	Jun-17	6.88	522	1.20±1.61E-09	7.78±1.29E-09	0.10±1.07E-07
707	DOWN	Dec-17	6.99	504	-0.33±1.11E-09	3.26±1.06E-09	8.17±7.88E-08
910R	DOWN	Jun-17	7.09	1350	6.66±5.55E-09	5.71±2.39E-09	0.37±1.10E-07
910R	DOWN	Dec-17	7.17	1345	2.34±3.03E-09	6.50±2.35E-09	-1.48±7.50E-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
2017 Indicator Results From the Kent Recessional Sequence

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**
901	UP	Jun-17	7.28	416	-0.80±1.04E-09	2.60±0.74E-09	-0.25±1.11E-07
901	UP	Dec-17	7.22	380	4.73±6.28E-10	4.56±0.64E-09	2.94±7.94E-08
902	UP	Jun-17	8.02	426	-0.64±1.13E-09	1.85±0.67E-09	0.55±1.14E-07
902	UP	Dec-17	8.04	412	1.30±5.90E-10	3.12±0.63E-09	1.79±7.90E-08
1008B	UP	Dec-17	7.70	395	-4.25±8.81E-10	2.12±0.78E-09	1.58±7.52E-08
903	DOWN	Jun-17	7.44	918	0.61±1.44E-09	1.61±1.50E-09	-0.19±1.11E-07
903	DOWN	Dec-17	7.61	902	-1.15±1.23E-09	2.20±1.12E-09	-1.27±7.30E-08
8610	DOWN	Jun-17	7.65	1409	0.00±3.35E-09	3.14±2.34E-09	-0.19±1.10E-07
8610	DOWN	Dec-17	7.68	1464	0.49±2.87E-09	4.78±2.49E-09	0.71±7.56E-08
8611	DOWN	Jun-17	7.37	1434	3.26±3.39E-09	4.71±1.79E-09	-0.38±1.12E-07
8611	DOWN	Dec-17	7.35	1402	-2.69±2.73E-09	2.52±1.64E-09	-6.26±7.16E-08

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
2017 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-17	<3	<10	<200	<1	<5	17	<50	<25
706	UP	Jun-17	<3	<10	<200	<1	<5	16	<50	<25
706	UP	Sep-17	<3	<10	<200	<1	<5	14	<50	<25
706	UP	Dec-17	<3	<10	<200	<1	<5	33	<50	<25
1302	UP	Dec-17	<3	<10	<200	<1	<5	<10	<50	<25
111	DOWN	Dec-17	<3	<10	<200	<1	<5	**327**	<50	<25
1304	DOWN	Mar-17	<3	<10	<200	<1	<5	<10	<50	<25
1304	DOWN	Jun-17	<3	<10	<200	<1	<5	<10	<50	<25
1304	DOWN	Sep-17	<3	<10	<200	<1	<5	<10	<50	<25
1304	DOWN	Dec-17	<3	<10	<200	<1	<5	<10	<50	<25
8605	DOWN	Dec-17	<3	11	<200	<1	<5	<10	<50	<25
MP-01	DOWN	Mar-17	<3	<10	437	<1	<5	<10	<50	<25
MP-01	DOWN	Jun-17	<3	<10	443	<1	<5	<10	<50	<25
MP-01	DOWN	Sep-17	<3	<10	358	<1	<5	<10	<50	<25
MP-01	DOWN	Dec-17	<3	<10	315	<1	<5	<10	<50	<25
MP-02	DOWN	Mar-17	<3	<10	243	<1	<5	<10	<50	<25
MP-02	DOWN	Jun-17	<3	<10	211	<1	<5	<10	<50	<25
MP-02	DOWN	Sep-17	<3	<10	<200	<1	<5	16	<50	<25
MP-02	DOWN	Dec-17	<3	<10	<200	<1	<5	<10	<50	<25
MP-03	DOWN	Mar-17	<3	<10	232	<1	<5	<10	<50	<25
MP-03	DOWN	Jun-17	<3	<10	253	<1	<5	<10	<50	<25
MP-03	DOWN	Sep-17	<3	<10	290	<1	<5	<10	<50	<25
MP-03	DOWN	Dec-17	<3	<10	<200	<1	<5	<10	<50	<25
MP-04	DOWN	Mar-17	<3	<10	275	<1	<5	<10	<50	<25
MP-04	DOWN	Jun-17	<3	<10	284	<1	<5	<10	<50	<25
MP-04	DOWN	Sep-17	<3	<10	229	<1	<5	<10	<50	<25
MP-04	DOWN	Dec-17	<3	<10	<200	<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-2F (*continued*)
2017 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-17	<3	<0.2	**130**	<5	<10	<0.5	<3000	<50	<20
706	UP	Jun-17	<3	<0.2	**190**	<5	<10	<0.5	<3000	<50	<20
706	UP	Sep-17	<3	<0.2	**260**	<5	<10	<0.5	<3000	<50	<20
706	UP	Dec-17	<3	<0.2	**110**	<5	<10	<0.5	<3000	<50	<20
1302	UP	Dec-17	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
111	DOWN	Dec-17	<3	<0.2	84.8	<5	<10	<2	<3000	<50	<20
1304	DOWN	Mar-17	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
1304	DOWN	Jun-17	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
1304	DOWN	Sep-17	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
1304	DOWN	Dec-17	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
8605	DOWN	Dec-17	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-01	DOWN	Mar-17	<3	<0.2[b]	<40	<5	<10	<2	<3000	<50	<20
MP-01	DOWN	Jun-17	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-01	DOWN	Sep-17	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-01	DOWN	Dec-17	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-02	DOWN	Mar-17	<3	<0.2[b]	<40	<5	<10	<2	<3000	<50	<20
MP-02	DOWN	Jun-17	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-02	DOWN	Sep-17	<3	<0.2	<40	<5	<10	<2	<3000	<50	28.9
MP-02	DOWN	Dec-17	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-03	DOWN	Mar-17	<3	<0.2[b]	<40	<5	<10	<2	<3000	<50	<20
MP-03	DOWN	Jun-17	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-03	DOWN	Sep-17	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-03	DOWN	Dec-17	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-04	DOWN	Mar-17	<3	<0.2[b]	<40	<5	<10	<2	<3000	<50	<20
MP-04	DOWN	Jun-17	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-04	DOWN	Sep-17	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
MP-04	DOWN	Dec-17	<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).

[b] The mercury results for the "MP-" wells reported for March 2017 were from a duplicate sample collected in April 2017. Re-sampling was required due to a missed laboratory hold time on the original sample collected in March.

TABLE D-2F (*continued*)
2017 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-17	<3	14	250	<1	<5	<10	<50	<25
NDATR	DOWN	Mar-17	<3	<10	<200	<1	<5	<10	<50	<25
NDATR	DOWN	Jun-17	<3	<10	<200	<1	<5	<10	<50	<25
NDATR	DOWN	Sep-17	<3	<10	<200	<1	<5	<10	<50	<25
NDATR	DOWN	Dec-17	<3	<10	<200	<1	<5	<10	<50	<25
Unweathered Lavery Till Unit										
405	UP	Mar-17	<3	<10	<200	<1	<5	**74**	<50	<25
405	UP	Jun-17	<3	<10	<200	<1	<5	26	<50	<25
405	UP	Sep-17	<3	<10	<200	<1	<5	**80**	<50	<25
405	UP	Dec-17	<3	<10	<200	<1	<5	**62**	<50	<25
1303	UP	Mar-17	<3	<10	<200	<1	<5	<10	<50	<25
1303	UP	Jun-17	<3	<10	<200	<1	<5	<10	<50	<25
1303	UP	Sep-17	<3	<10	<200	<1	<5	<10	<50	<25
1303	UP	Dec-17	<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-2F (*concluded*)
2017 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-17	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
NDATR	DOWN	Mar-17	<3	<0.2[b]	<40	<5	<10	<2	<3000	<50	<20
NDATR	DOWN	Jun-17	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
NDATR	DOWN	Sep-17	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
NDATR	DOWN	Dec-17	<3	<0.2	<40	<5	<10	<2	<3000	<50	<20
Unweathered Lavery Till Unit											
405	UP	Mar-17	<3	<0.2	**390**	<5	<10	<0.5	<3000	<50	<20
405	UP	Jun-17	<3	<0.2	**255**	<5	<10	<0.5	<3000	<50	<20
405	UP	Sep-17	<3	<0.2	**520**	<5	<10	<0.5	<3000	<50	<20
405	UP	Dec-17	<3	<0.2	**660**	<5	<10	<0.5	<3000	<50	<20
1303	UP	Mar-17	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
1303	UP	Jun-17	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
1303	UP	Sep-17	<3	<0.2	<40	<5	<10	<0.5	<3000	<50	<20
1303	UP	Dec-17	<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-2G
2017 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-17	-0.63±3.15E-08	5.20±7.21E-10	-1.51±2.83E-09	-2.39±3.87E-10	0.75±2.67E-09	**1.53±0.30E-09**
406	DOWN	Dec-17	2.29±3.30E-08	7.30±6.81E-10	2.31±2.08E-09	1.10±4.19E-10	0.82±1.92E-09	2.89±1.45E-10
408	DOWN	Dec-17	0.63±3.32E-08	**4.97±0.01E-05**	**1.40±0.24E-08**	0.00±2.04E-09	3.68±2.49E-09	4.73±2.05E-10
501	DOWN	Dec-17	NS	**3.64±0.01E-05**	NS	NS	NS	NS
502	DOWN	Dec-17	NS	**2.51±0.01E-05**	NS	NS	NS	NS
801	DOWN	Dec-17	NS	**1.82±0.02E-06**	NS	NS	NS	NS
1304	DOWN	Dec-17	-0.09±3.20E-08	4.78±7.21E-10	0.18±1.98E-09	-1.04±3.48E-10	0.71±1.91E-09	3.92±1.52E-10
8609	DOWN	Dec-17	NS	**3.63±0.09E-07**	NS	NS	NS	NS
MP-01	DOWN	Dec-17	-0.37±3.32E-08	**7.29±0.01E-05**	**2.54±0.27E-08**	0.00±2.06E-09	-0.17±2.54E-09	NS
MP-02	DOWN	Dec-17	-1.67±3.30E-08	**9.91±0.02E-05**	**4.25±0.31E-08**	0.00±2.00E-09	5.38±3.36E-09	NS
MP-03	DOWN	Dec-17	0.76±3.35E-08	**4.86±0.01E-05**	**1.95±0.29E-08**	-1.78±8.70E-10	-1.31±3.96E-09	NS
MP-04	DOWN	Dec-17	-1.45±3.31E-08	**7.05±0.01E-05**	**2.71±0.26E-08**	0.00±1.86E-09	-1.29±2.46E-09	NS
Weathered Lavery Till Unit								
909	DOW	Dec-17	-0.39±3.20E-08	**1.20±0.06E-07**	-0.43±2.10E-09	**1.36±0.31E-08**	-0.75±1.70E-09	2.32±1.21E-10
NDATR	DOW	Jun-17	-1.03±2.65E-08	**2.90±0.08E-07**	0.03±2.33E-09	**1.87±0.27E-08**	0.63±2.02E-09	1.75±1.00E-10
NDATR	DOW	Dec-17	0.98±3.27E-08	**1.93±0.07E-07**	3.42±2.25E-09	**2.52±0.34E-08**	-0.20±1.81E-09	1.02±1.11E-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).

TABLE D-2G (*continued*)
2017 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-17	5.01±2.99E-10	-3.01±9.62E-11	3.37±1.60E-10	0.07±5.26E-11	1.41±1.04E-10	5.66±0.52E-04
406	DOWN	Dec-17	0.56±2.52E-10	-4.72±8.35E-11	1.46±1.21E-10	0.60±6.60E-11	1.24±1.13E-10	2.85±0.37E-04
408	DOWN	Dec-17	1.88±0.44E-09	3.31±6.53E-11	**6.32±1.89E-10**	**1.09±0.83E-10**	3.16±1.35E-10	1.08±0.09E-03
1304	DOWN	Dec-17	0.69±2.24E-10	0.12±1.40E-10	1.65±1.08E-10	4.86±7.54E-11	1.34±0.93E-10	4.09±0.40E-04
MP-01	DOWN	Dec-17	NS	1.61±6.22E-11	5.58±2.17E-10	2.76±8.66E-11	1.57±1.24E-10	NS
MP-02	DOWN	Dec-17	NS	2.10±8.72E-11	**6.85±1.91E-10**	**1.18±0.86E-10**	**5.26±1.65E-10**	NS
MP-03	DOWN	Dec-17	NS	0.94±6.04E-11	**7.15±2.20E-10**	**1.59±1.10E-10**	**8.85±2.41E-10**	NS
MP-04	DOWN	Dec-17	NS	5.59±7.41E-11	**1.32±0.28E-09**	**1.28±0.91E-10**	**8.35±2.20E-10**	NS
Weathered Lavery Till Unit								
909	DOWN	Dec-17	**4.73±0.94E-09**	-0.04±7.50E-11	**8.05±1.85E-10**	7.80±6.78E-11	4.05±1.34E-10	1.30±0.11E-03
NDATR	DOWN	Jun-17	1.36±2.87E-10	-0.27±1.10E-10	**1.68±0.37E-09**	**1.42±1.18E-10**	**6.09±2.30E-10**	**2.81±0.23E-03**
NDATR	DOWN	Dec-17	2.43±2.73E-10	-2.12±6.07E-11	**1.27±0.22E-09**	**8.98±7.14E-11**	**9.02±1.89E-10**	**2.52±0.20E-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-2G (*concluded)*
2017 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-17	-3.17±7.90E-11	-1.64±2.54E-11	0.51±3.30E-11	3.57±9.57E-09	-0.24±1.14E-11	0.00±1.53E-11
MP-02	DOWN	Dec-17	0.69±1.01E-10	-1.98±2.34E-11	1.38±3.01E-11	0.27±1.02E-08	-0.86±2.07E-11	-1.40±1.73E-11
MP-03	DOWN	Dec-17	1.48±7.77E-11	1.08±2.70E-11	0.86±2.32E-11	2.59±8.56E-09	-3.12±3.45E-11	-1.03±2.28E-11
MP-04	DOWN	Dec-17	-1.38±1.26E-10	0.92±3.60E-11	-1.47±2.06E-11	-3.09±9.83E-09	0.64±1.87E-11	0.31±1.95E-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.

APPENDIX E

Summary of Biological Data

TABLE E-1

2017 Radioactivity Concentrations in Milk

Location	*K-40 (µCi/mL)*	*Sr-90 (µCi/mL)*	*I-129 (µCi/mL)*	*Cs-137 (µCi/mL)*
BFMBLSY Once every five years	1.55±0.18E-06	2.63±7.70E-10	0.58±2.23E-10	0.78±3.99E-09

Note: This milk sample (BFMBLSY) was collected from a dairy farm 5.5 km westnorthwest of the site. It was previously sampled in 2012.

Location	*K-40 (µCi/mL)*	*Sr-90 (µCi/mL)*	*I-129 (µCi/mL)*	*Cs-137 (µCi/mL)*
BFMSCHT Once every five years	1.34±0.21E-06	0.42±7.87E-10	-1.22±2.01E-10	-1.48±4.30E-09

Note: This milk sample (BFMSCHT) was collected from a dairy farm 4.9 km south of the site. It was previously sampled in 2012.

Location	*K-40 (µCi/mL)*	*Sr-90 (µCi/mL)*	*I-129 (µCi/mL)*	*Cs-137 (µCi/mL)*
BFMFLDMN Annual	1.15±0.14E-06	-2.67±5.81E-10	-0.98±2.90E-10	-2.25±3.86E-09

Note: The near-site milk sample (BFMFLDMN) is located 5.1 km southeast of the site. It was previously sampled in 2016.

Location	*K-40 (µCi/mL)*	*Sr-90 (µCi/mL)*	*I-129 (µCi/mL)*	*Cs-137 (µCi/mL)*
BFMCTLS (Background) Once every five years	1.32±0.18E-06	3.46±6.87E-10	0.78±2.88E-10	-0.12±4.78E-09

Note: The control milk sample (BFMCTLS) is located 22 km south of the site. It was previously sampled in 2012.

TABLE E-2
2017 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)
BFDCTRL (Background)	73.7	-0.39±1.01E-07	1.08±0.10E-05	0.53±2.60E-09	3.86±2.58E-08
BFDCTRL (Background)	74.4	0.93±1.06E-07	1.15±0.10E-05	0.17±2.59E-09	2.02±1.94E-08
BFDCTRL (Background)	73.4	0.84±1.06E-07	1.11±0.11E-05	-3.51±2.32E-09	4.31±4.20E-08
BFDNEAR (Near-Site)	73.5	9.04±8.48E-08	9.66±0.56E-06	0.18±1.93E-09	2.09±2.02E-08
BFDNEAR (Near-Site)	72.3	1.29±0.88E-07	8.65±0.55E-06	-3.03±2.33E-09	2.44±1.85E-08
BFDNEAR (Near-Site)	71.4	7.16±9.12E-08	8.56±0.59E-06	-3.50±2.44E-09	5.50±2.12E-08

Note: The venison samples are collected on an annual basis.

TABLE E-3
2017 Radioactivity Concentrations in Food Crops

Location*	% Moisture	H-3	K-40	Sr-90	Cs-137
CORN					
Location*	**% Moisture**	**H-3 (µCi/mL - Dry)**	**K-40 (µCi/g - Dry)**	**Sr-90 (µCi/g - Dry)**	**Cs-137 (µCi/g - Dry)**
BFVCTRC (Background)	77.8	1.37±1.10E-07	1.14±0.06E-05	5.47±3.00E-09	0.73±1.20E-08
BFVNEAC (Near Site)	68.0	9.56±9.68E-08	7.07±0.68E-06	3.60±2.79E-09	0.84±1.34E-08
BEANS					
Location*	**% Moisture**	**H-3 (µCi/mL- Dry)**	**K-40 (µCi/g - Dry)**	**Sr-90 (µCi/g - Dry)**	**Cs-137 (µCi/g - Dry)**
BFVCTRB (Background)	89.3	0.66±1.04E-07	2.75±0.12E-05	1.19±0.36E-08	0.38±1.65E-08
BFVNEAB (Near Site)	86.2	9.48±9.63E-08	2.22±0.09E-05	3.59±0.49E-08	0.14±1.80E-08
APPLES					
Location*	**% Moisture**	**H-3 (µCi/mL- Dry)**	**K-40 (µCi/g - Dry)**	**Sr-90 (µCi/g - Dry)**	**Cs-137 (µCi/g - Dry)**
BFVCTRA (Background)	88.2	-0.20±1.96E-07	8.13±0.53E-06	1.86±2.83E-09	-0.74±1.23E-08
BFVNEAAF (Near Site)	85.6	0.74±1.04E-07	7.41±0.61E-06	-8.23±2.85E-09	0.54±1.35E-08

*Food crops are sampled once every five years, consistent with guidance on periodic confirmatory sampling in DOE-HDBK-1216-2015. Food crop samples were previously collected in 2012.

TABLE E-4A
2017 Radioactivity Concentrations in Edible Portions of Fish from Cattaraugus Creek Above the Springville Dam (BFFCATC)

Species (ABOVE DAM)	% Moisture	Sr-90 (µCi/g - dry)	Cs-137 (µCi/g - dry)
Brown Trout -13"	78.5	0.24±1.58E-09	5.33±3.45E-08
Hog Nosed Sucker - 8"	76.4	1.06±1.01E-08	0.56±1.03E-07
Hog Nosed Sucker - 9"	75.7	-5.95±0.75E-08	0.76±1.80E-07
Hog Nosed Sucker - 9"	75.6	-6.16±3.80E-09	2.13±4.03E-08
Hog Nosed Sucker - 9"	75.7	2.36±4.32E-09	-0.98±1.88E-07
Hog Nosed Sucker - 10"	76.8	8.00±2.58E-09	-8.32±8.76E-08
Hog Nosed Sucker - 10"	76.5	2.82±3.40E-09	-0.04±7.09E-08
Hog Nosed Sucker - 11"	76.1	7.43±0.76E-08	2.23±4.51E-08
Hog Nosed Sucker - 13"	74.7	0.99±3.08E-09	0.00±9.45E-08
White Sucker - 9"	78.0	3.28±3.72E-09	5.75±5.52E-08
Average % Moisture	76.4		
	Median	<4.06E-09	<7.93E-08
	Maximum	7.43E-08	5.75E-08
	Minimum	<1.58E-09	<4.03E-08

Note: Fish samples are collected once every five years, consistent with guidance on periodic confirmatory sampling in DOE-HDBK-1216-2015. Fish samples were previously collected in 2012.

TABLE E-4B
2017 Radioactivity Concentrations in Edible Portions of Fish from Cattaraugus Creek Below the Springville Dam (BFFCATD)

Species (BELOW DAM)	% Moisture	Sr-90 (µCi/g - dry)	Cs-137 (µCi/g - dry)
Creek Chub - 8"	74.9	-1.07±0.50E-08	-0.46±1.42E-07
Creek Chub - 8.5"	77.0	2.45±6.03E-09	6.00±7.73E-08
Steel Head Trout - 19"	71.0	-1.92±2.52E-09	0.73±1.66E-08
Steel Head Trout - 20"	70.8	-1.99±2.47E-09	1.36±0.97E-08
Steel Head Trout - 20"	74.6	-3.47±2.81E-09	-0.51±2.64E-08
Steel Head Trout - 21"	79.5	-3.24±2.32E-09	1.84±2.31E-08
Steel Head Trout - 21"	75.1	-0.52±2.04E-09	2.11±2.36E-08
Steel Head Trout - 22"	74.9	0.86±1.90E-09	0.09±1.26E-08
Steel Head Trout - 22"	74.8	-1.13±2.42E-09	1.85±1.93E-08
Steel Head Trout - 22"	76.2	-2.68±2.77E-09	0.27±1.59E-08
Average % Moisture	74.9		
	Median	<2.50E-09	<2.12E-08
	Maximum	<6.03E-09	1.36E-08
	Minimum	<1.90E-09	<1.26E-08

Note: Fish samples are collected once every five years, consistent with guidance on periodic confirmatory sampling in DOE-HDBK-1216-2015. Fish samples were previously collected in 2012.

TABLE E-4C
2017 Radioactivity Concentrations in Edible Portions of Fish from Cattaraugus Creek Background (BFFCTRL)

Species (UPSTREAM)	% Moisture	Sr-90 (µCi/g - dry)	Cs-137 (µCi/g - dry)
Brown Trout - 8"	73.8	-5.30±4.68E-09	-1.50±3.76E-08
Brown Trout - 9"	77.3	0.64±3.92E-09	-2.87±5.45E-08
Brown Trout - 12"	74.9	-1.98±1.68E-09	2.29±5.23E-08
Brown Trout - 12"	78.1	-1.97±2.84E-09	2.25±4.31E-08
Brown Trout - 12"	74.9	1.39±1.50E-09	5.17±4.99E-08
Hog Nosed Sucker - 11"	79.0	1.61±4.36E-09	1.31±4.76E-08
White Sucker - 8"	80.8	-1.20±0.80E-08	1.27±9.62E-08
White Sucker - 9"	80.1	-8.15±6.44E-09	-0.06±7.24E-08
White Sucker - 9"	78.4	-2.81±4.95E-09	0.01±5.74E-08
White Sucker - 10"	77.7	0.84±3.46E-09	4.11±5.42E-08
Average % Moisture	77.5		
	Median	<4.14E-09	<5.33E-08
	Maximum	<7.96E-09	5.17E-08
	Minimum	<1.50E-09	<3.76E-08

Note: Fish samples are collected once every five years, consistent with guidance on periodic confirmatory sampling in DOE-HDBK-1216-2015. Fish samples were previously collected in 2012.

APPENDIX F

Summary of Soil and Sediment Monitoring Data

TABLE F-1A
Radionuclide Comparison Values for Soils

Radionuclide	*Units*	*EPA / NRC Consultation Triggers for Soil Contamination* [a]		*NRC NUREG-1757 Screening Values of Common Radionuclides for Soil Surface Contamination Levels* [b]	*WVDP Site-Specific Soil Cleanup Goals* [c]
		Residential Soil Concentration	*Industrial/ Commercial Concentration*		
Co-60	µCi/g	4E-06	6E-06	3.8E-06	--
Sr-90	µCi/g	--	--	1.7E-06	3.7E-06
Sr-90+D [d]	µCi/g	2.3E-05	1.07E-03	--	--
Cs-137	µCi/g	--	--	1.1E-05	1.4E-05
Cs-137+D [d]	µCi/g	6E-06	1.1E-05	--	--
U-232	µCi/g	--	--	--	1.4E-06
U-233	µCi/g	--	--	--	7.5E-06
U-234	µCi/g	4.01E-04	3.31E-03	1.3E-05	7.6E-06
U-235	µCi/g	--	--	8E-06	3.1E-06
U-235+D [d]	µCi/g	2.0E-05	3.9E-05	2.9E-07	--
U-238	µCi/g	--	--	1.4E-05	8.9E-06
U-238+D [d]	µCi/g	7.4E-05	1.79E-04	5E-07	--
Total U	µg/g	4.7E+01	1.23E+03	--	--
Pu-238	µCi/g	2.97E-04	1.64E-03	2.5E-06	3.6E-05
Pu-239	µCi/g	2.59E-04	1.43E-03	2.3E-06	2.3E-05
Pu-240	µCi/g	--	--	--	2.4E-05
Am-241	µCi/g	1.87E-04	5.68E-04	2.1E-06	2.6E-05

-- No criteria established.

[a] Memorandum of Understanding between the EPA and the NRC "Consultation and Finality on Decommissioning and Decontamination of Contaminated Sites", October 9, 2002.
[b] NRC. "Consolidated Decommissioning Guidance: Characterization, Survey and Determination of Radiological Criteria." NUREG-1757, Vol. 2, Rev. 1. September 2006.
[c] Soil Cleanup goals developed from site-specific data for the WVDP Phase 1 Decommissioning Plan (DP), Rev. 2, Table 5-14, December 2009 (most restrictive soil/sediment criteria).
[d] Concentrations apply to the parent radionuclide but assume that the daughter products are in equilibrium.

TABLE F-2A
2017 Radioactivity in On-Site Surface Soils
at Franks Creek (SNSP006)

Isotope	*Units*	*N*	*SNSP006*	*NRC NUREG-1757 Soil Screening Contamination Levels* [a]	*WVDP Site-Specific Soil Cleanup Goals* [b]
Gross Alpha	µCi/g	1	1.02±0.43E-05	--	--
Gross Beta	µCi/g	1	2.92±0.30E-05	--	--
K-40	µCi/g	1	1.49±0.08E-05	--	--
Co-60	µCi/g	1	-0.90±1.86E-08	3.8E-06	--
Sr-90	µCi/g	1	8.61±0.68E-07	1.7E-06	3.7E-06
Cs-137	µCi/g	1	4.50±0.12E-06	1.1E-05	1.4E-05
U-232	µCi/g	1	-0.92±3.84E-08	--	1.4E-06
U-233/234	µCi/g	1	6.16±0.98E-07	1.3E-05	7.6E-06[d]
U-235/236	µCi/g	1	1.02±0.43E-07	8.0E-06[c]	3.1E-06[d]
U-238	µCi/g	1	5.94±0.95E-07	1.4E-05[c]	8.9E-06
Total U	µg/g	1	1.88±0.55E+00	--	--
Pu-238	µCi/g	1	4.86±2.86E-08	2.5E-06	3.6E-05
Pu-239/240	µCi/g	1	1.84±1.77E-08	2.3E-06	2.4E-05[d]
Am-241	µCi/g	1	2.84±2.54E-08	2.1E-06	2.6E-05

N - number of samples.

-- No reference standard available.

[a] NRC. "Consolidated Decommissioning Guidance: Characterization, Survey and Determination of Radiological Criteria." NUREG-1757, Vol. 2, Rev. 1. September 2006.

[b] Soil Cleanup goals developed from site-specific data for the WVDP Phase 1 Decommissioning Plan (DP), Rev. 2, Table 5-14, December 2009 (CG_w for surface soil).

[c] WVDP-related uranium isotopes are not assumed to be in equilibrium with daughter products because of their relatively recent origin as processed nuclear materials. Therefore, the single-nuclide screening levels for U-235 and U-238 were selected for comparison with radionuclide concentrations.

[d] The site-specific cleanup goals selected for Pu-239/240 and U-233/U234 is the maxima of Pu-239 and Pu-240, and U-233 and U-234, respectively from Table 5-14 of the DP. Only criteria for U-235 (not U-236) are provided in DP Table 5-14.

TABLE F-2B
2017 Radioactivity in On-Site Soils
at the North Swamp (SNSW74A)

Isotope	*Units*	*N*	*SNSW74A*	*NRC NUREG-1757 Soil Screening Contamination Levels* [a]	*WVDP Site-Specific Soil Cleanup Goals* [b]
Gross Alpha	µCi/g	1	1.41±0.48E-05	--	--
Gross Beta	µCi/g	1	2.30±0.30E-05	--	--
K-40	µCi/g	1	1.28±0.09E-05	--	--
Co-60	µCi/g	1	0.22±1.95E-08	3.8E-06	--
Sr-90	µCi/g	1	7.06±2.70E-08	1.7E-06	3.7E-06
Cs-137	µCi/g	1	1.01±0.06E-06	1.1E-05	1.4E-05
U-232	µCi/g	1	2.50±3.66E-08	--	1.4E-06
U-233/234	µCi/g	1	7.01±1.18E-07	1.3E-05	7.6E-06[d]
U-235/236	µCi/g	1	1.30±0.51E-07	8.0E-06[c]	3.1E-06[d]
U-238	µCi/g	1	7.92±1.23E-07	1.4E-05[c]	8.9E-06
Total U	µg/g	1	2.38±0.57E+00	--	--
Pu-238	µCi/g	1	2.79±2.13E-08	2.5E-06	3.6E-05
Pu-239/240	µCi/g	1	3.34±2.36E-08	2.3E-06	2.4E-05[d]
Am-241	µCi/g	1	0.47±1.13E-08	2.1E-06	2.6E-05

N - number of samples.

-- No reference standard available.

[a] NRC. "Consolidated Decommissioning Guidance: Characterization, Survey and Determination of Radiological Criteria." NUREG-1757, Vol. 2, Rev. 1. September 2006.

[b] Soil Cleanup goals developed from site-specific data for the WVDP Phase 1 Decommissioning Plan (DP), Rev. 2, Table 5-14, December 2009 (CG_w for surface soil).

[c] WVDP-related uranium isotopes are not assumed to be in equilibrium with daughter products because of their relatively recent origin as processed nuclear materials. Therefore, the single-nuclide screening levels for U-235 and U-238 were selected for comparison with radionuclide concentrations.

[d] The site-specific cleanup goals selected for Pu-239/240 and U-233/U234 is the maxima of Pu-239 and Pu-240, and U-233 and U-234, respectively from Table 5-14 of the DP. Only criteria for U-235 (not U-236) are provided in DP Table 5-14.

TABLE F-2C
2017 Radioactivity in On-Site Soils
at the Northeast Swamp (SNSWAMP)

Isotope	Units	N	SNSWAMP	NRC NUREG-1757 Soil Screening Contamination Levels [a]	WVDP Site-Specific Soil Cleanup Goals [b]
Gross Alpha	µCi/g	1	2.82±0.27E-05	--	--
Gross Beta	µCi/g	1	4.91±0.05E-04	--	--
K-40	µCi/g	1	9.89±0.81E-06	--	--
Co-60	µCi/g	1	1.75±2.49E-08	3.8E-06	--
Sr-90	µCi/g	1	2.01±0.01E-04	1.7E-06	3.7E-06
Cs-137	µCi/g	1	1.48±0.07E-06	1.1E-05	1.4E-05
U-232	µCi/g	1	-1.69±7.12E-08	--	1.4E-06
U-233/234	µCi/g	1	1.10±0.15E-06	1.3E-05	7.6E-06[d]
U-235/236	µCi/g	1	1.41±0.56E-07	8.0E-06[c]	3.1E-06[d]
U-238	µCi/g	1	9.86±1.39E-07	1.4E-05[c]	8.9E-06
Total U	µg/g	1	1.67±0.10E+00	--	--
Pu-238	µCi/g	1	3.82±2.87E-08	2.5E-06	3.6E-05
Pu-239/240	µCi/g	1	5.23±3.22E-08	2.3E-06	2.4E-05[d]
Am-241	µCi/g	1	7.07±5.39E-08	2.1E-06	2.6E-05

N - number of samples.
-- No reference standard available.
[a] NRC. "Consolidated Decommissioning Guidance: Characterization, Survey and Determination of Radiological Criteria." NUREG-1757, Vol. 2, Rev. 1. September 2006.
[b] Soil Cleanup goals developed from site-specific data for the WVDP Phase 1 Decommissioning Plan (DP), Rev. 2, Table 5-14, December 2009 (CG_w for surface soil).
[c] WVDP-related uranium isotopes are not assumed to be in equilibrium with daughter products because of their relatively recent origin as processed nuclear materials. Therefore, the single-nuclide screening levels for U-235 and U-238 were selected for comparison with radionuclide concentrations.
[d] The site-specific cleanup goals selected for Pu-239/240 and U-233/U234 is the maxima of Pu-239 and Pu-240, and U-233 and U-234, respectively from Table 5-14 of the DP. Only criteria for U-235 (not U-236) are provided in DP Table 5-14.

TABLE F-2D
2017 Radioactivity in Off-Site Surface Soils
at Ambient Air Monitoring Stations Surrounding the WVDP

Analyte	*Units*	*N*	*SFRSPRD (Near air sampler AF16_NNW)*	*2017 value at Background Location SFGRVAL*
Gross Alpha	µCi/g	1	1.33±0.25E-05	2.09±0.26E-05
Gross Beta	µCi/g	1	2.17±0.16E-05	2.72±0.23E-05
K-40	µCi/g	1	1.48±0.08E-05	1.20±0.08E-05
Co-60	µCi/g	1	-0.62±1.91E-08	-0.24±1.83E-08
Sr-90	µCi/g	1	1.00±5.11E-08	4.54±5.54E-08
Cs-137	µCi/g	1	6.32±0.50E-07	3.35±0.40E-07
U-232	µCi/g	1	1.49±4.52E-08	0.14±4.06E-08
U-233/234	µCi/g	1	8.00±1.59E-07	6.97±1.37E-07
U-235/236	µCi/g	1	1.18±0.63E-07	8.28±5.25E-08
U-238	µCi/g	1	8.49±1.61E-07	8.12±1.45E-07
Total U	µg/g	1	1.77±0.10E+00	2.60±0.14E+00
Pu-238	µCi/g	1	1.57±1.56E-08	-0.41±1.67E-08
Pu-239/240	µCi/g	1	1.76±1.83E-08	0.68±2.85E-08
Am-241	µCi/g	1	0.80±1.48E-08	0.76±1.49E-08

Analyte	*Units*	*N*	*SFFXVRD (near AF07_SE)*	*SFRT240 (near AF03_NE)*	*2017 value at Background Location SFGRVAL*
Gross Alpha	µCi/g	1	1.61±0.24E-05	1.46±0.36E-05	2.09±0.26E-05
Gross Beta	µCi/g	1	1.75±0.16E-05	1.72±0.21E-05	2.72±0.23E-05
K-40	µCi/g	1	1.06±0.09E-05	1.17±0.07E-05	1.20±0.08E-05
Co-60	µCi/g	1	0.10±2.01E-08	-0.29±1.59E-08	-0.24±1.83E-08
Sr-90	µCi/g	1	-1.92±4.54E-08	5.10±5.82E-08	4.54±5.54E-08
Cs-137	µCi/g	1	1.70±3.77E-08	3.35±0.36E-07	3.35±0.40E-07
Pu-238	µCi/g	1	-0.43±1.49E-08	0.87±1.61E-08	-0.41±1.67E-08
Pu-239/240	µCi/g	1	-1.97±1.57E-08	1.73±2.01E-08	0.68±2.85E-08
Am-241	µCi/g	1	0.14±1.88E-08	-0.37±1.31E-08	0.76±1.49E-08

N- number of samples.

TABLE F-2E
2017 Radioactivity in Off-Site Stream Sediments on Cattaraugus and Buttermilk Creeks

Analyte	Units	N	On Cattaraugus Creek		
			SFCCSED (Downstream at Felton Bridge)	SFSDSED (Downstream at Springville Dam)	Background Location SFBISED [a] (Upstream at Bigelow Bridge)
Gross Alpha	µCi/g	1	1.08±0.24E-05	1.10±0.20E-05	1.16±0.35E-05
Gross Beta	µCi/g	1	1.69±0.15E-05	1.27±0.17E-05	1.69±0.29E-05
K-40	µCi/g	1	1.20±0.07E-05	1.25±0.07E-05	1.37±0.15E-05
Co-60	µCi/g	1	-0.35±1.34E-08	-0.49±1.65E-08	0.02±1.62E-08
Sr-90	µCi/g	1	-4.00±3.97E-08	0.05±5.02E-08	0.04±4.97E-08
Cs-137	µCi/g	1	6.46±2.47E-08	1.02±0.28E-07	3.73±2.27E-08
U-232	µCi/g	1	-0.67±3.14E-08	2.00±3.02E-08	0.00±5.52E-08
U-233/234	µCi/g	1	6.14±1.10E-07	7.96±1.28E-07	5.42±1.19E-07
U-235/236	µCi/g	1	8.99±4.58E-08	6.29±4.30E-08	5.73±3.88E-08
U-238	µCi/g	1	6.66±1.15E-07	8.67±1.36E-07	5.30±1.14E-07
Total U	µg/g	1	1.59±0.08E+00	1.64±0.09E+00	1.91±0.04E+00
Pu-238	µCi/g	1	-0.11±1.63E-08	-0.94±2.25E-08	1.11±1.86E-08
Pu-239/240	µCi/g	1	-0.68±1.77E-08	1.12±1.94E-08	1.44±1.44E-08
Am-241	µCi/g	1	-0.06±1.97E-08	0.00±1.25E-08	1.70±2.24E-08

Analyte	Units	N	On Buttermilk Creek	
			SFTCSED (Downstream at Thomas Corners Bridge)	Background Location SFBCSED [b,c] (Upstream on Fox Valley Road)
Gross Alpha	µCi/g	1	9.08±2.02E-06	8.67±2.80E-06
Gross Beta	µCi/g	1	1.79±0.14E-05	1.78±0.28E-05
K-40	µCi/g	1	1.27±0.06E-05	1.30±0.11E-05
Co-60	µCi/g	1	0.95±1.12E-08	-0.03±1.91E-08
Sr-90	µCi/g	1	1.61±5.13E-08	1.40±3.25E-08
Cs-137	µCi/g	1	7.53±0.37E-07	3.12±2.72E-08
U-232	µCi/g	1	2.24±3.38E-08	0.69±3.26E-08
U-233/234	µCi/g	1	5.38±0.98E-07	6.46±1.21E-07
U-235/236	µCi/g	1	9.37±4.23E-08	6.22±3.85E-08
U-238	µCi/g	1	6.32±1.05E-07	7.03±1.29E-07
Total U	µg/g	1	1.51±0.08E+00	1.90±0.07E+00
Pu-238	µCi/g	1	1.15±3.22E-08	0.39±1.74E-08
Pu-239/240	µCi/g	1	0.00±2.29E-08	0.49±1.86E-08
Am-241	µCi/g	1	0.32±2.04E-08	0.48±1.61E-08

N - number of samples.

[a] Sediment sampling at Bigelow Bridge (SFBISED), the upstream Cattaraugus Creek background, was discontinued in 2005. The 10-year (1995-2004) historical average at SFBISED is used as the comparative reference for the two Cattaraugus Creek locations.

[b] Sampling data at Fox Valley Road (SFBCSED), the upstream Buttermilk Creek background, is presented as an average of the last 15 years (2002-2017) as a comparative reference for the sample from Buttermilk Creek at Thomas Corners, immediately downstream of facility effluents.

[c] NOTE: The background concentrations reported for SFBCSED in the 2012 ASER on Table F-2E represent just the 2012 results, not the 10-year average as indicated by the 2012 *b* footnote. This error is annotated here in order to facilitate current and future data evaluations.

APPENDIX G

Summary of Direct Radiation Monitoring Data

TABLE G-1

Summary of 2017 Semiannual Averages of Off-Site TLD Measurements[a]

(mR±2 SD/quarter)

Location Number[b]	*1st Half*	*2nd Half*	*Location Average*	*Background DFTLD23*
DFTLD01	16±1	17±1	17±1	16±1
DFTLD02	16±1	16±1	16±1	
DFTLD03	13±1	14±1	13±1	
DFTLD04	15±1	15±2	15±1	
DFTLD05	15±1	15±1	15±1	
DFTLD06	14±1	15±1	15±1	
DFTLD07	13±1	14±1	13±1	
DFTLD08	15±1	20±2	17±2	
DFTLD09	14±1	15±1	15±1	
DFTLD10	13±1	14±1	14±1	
DFTLD11	14±1	14±1	14±1	
DFTLD12	14±1	16±1	15±1	
DFTLD13	16±1	17±1	16±1	
DFTLD14	14±1	15±1	15±1	
DFTLD15	14±1	15±1	15±1	
DFTLD16	15±1	15±1	15±1	
DFTLD20	12±1	13±1	13±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 G-2

Summary of 2017 Semiannual Averages of On-Site TLD Measurements[a]

(mR±2SD/quarter)

Location Number[b]	*1st Half*	*2nd Half*	*Location Average*
DNTLD24	786±56	771±56	779±56
DNTLD28	17±1	18±1	17±1
DNTLD32	19±3	17±1	18±2
DNTLD33	17±1	18±1	18±1
DNTLD35	16±1	18±2	17±2
DNTLD36	14±1	16±1	15±1
DNTLD38	46±9	49±8	47±8
DNTLD40	104±11	120±13	112±12
DNTLD43	13±1	14±1	14±1
DNTLD44	17±1	19±2	18±2

[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 H

Summary of Quality Assurance Crosscheck Analyses

TABLE H-1
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a] ; Study 36; March 2017

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?[b]*	*Analyzed by:*
MAPEP – 17 – RdF36, Air Filter – Radiological							
Am-241	Air Filter	Bq/sample	0.0386	0.0376	0.0263 - 0.0489	Yes	GEL
Cs-137	Air Filter	Bq/sample	0.603	0.685	0.480 - 0.891	Yes	ES
Co-60	Air Filter	Bq/sample	0.751	0.78	0.55 - 1.01	Yes	ES
Cs-137	Air Filter	Bq/sample	0.781	0.685	0.480 - 0.891	Yes	GEL
Co-60	Air Filter	Bq/sample	0.863	0.78	0.55 - 1.01	Yes	GEL
Pu-238	Air Filter	Bq/sample	0.0539	0.0598	0.0419 - 0.0777	Yes	GEL
Pu-239/240	Air Filter	Bq/sample	0.0419	0.0460	0.0322 - 0.0598	Yes	GEL
Sr-90	Air Filter	Bq/sample	0.543	0.651	0.456 - 0.846	Yes	GEL
U-234/233	Air Filter	Bq/sample	0.105	0.104	0.073 - 0.135	Yes	GEL
U-238	Air Filter	Bq/sample	0.106	0.107	0.075 - 0.139	Yes	GEL
U – total	Air Filter	µg/sample	8.55	8.7	6.1 - 11.3	Yes	GEL
MAPEP – 17 – XaW36, Water – Alkaline							
Iodine-129	Water	Bq/L	0.00615	[c]	*False Positive Test*[d]	Yes	GEL
MAPEP – 17 – MaW36, Water – Radiological							
Cs-137	Water	Bq/L	11.3	11.1	7.8 - 14.4	Yes	ES
Co-60	Water	Bq/L	12.2	12.3	8.6 - 16.0	Yes	ES
H-3	Water	Bq/L	254	249	174 - 324	Yes	ES
Sr-90	Water	Bq/L	9.30	10.1	7.1 - 13.1	Yes	ES
Am-241	Water	Bq/L	0.807	0.846	0.592 - 1.100	Yes	GEL
Cs-137	Water	Bq/L	12.2	11.1	7.8 - 14.4	Yes	GEL
Co-60	Water	Bq/L	12.8	12.3	8.6 - 16.0	Yes	GEL
H-3	Water	Bq/L	245	249	174 - 324	Yes	GEL
Pu-238	Water	Bq/L	0.635	0.703	0.492 - 0.914	Yes	GEL
Pu-239/240	Water	Bq/L	0.841	0.934	0.654 - 1.214	Yes	GEL
Ra-226	Water	Bq/L	0.443	0.504	0.353 - 0.655	Yes	GEL
Sr-90	Water	Bq/L	9.27	10.1	7.1 - 13.1	Yes	GEL
Tc-99	Water	Bq/L	5.81	6.25	4.38 - 8.13	Yes	GEL
U-234/233	Water	Bq/L	1.11	1.16	0.81 - 1.51	Yes	GEL
U-238	Water	Bq/L	1.16	1.20	0.84 - 1.56	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.

TABLE H-1 *(continued)*
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a] ; Study 36; March 2017

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?* [b]	*Analyzed by:*
MAPEP – 17– MaW36, Water – Inorganic							
Antimony	Water	mg/L	10.2	10.4	7.3 - 13.5	Yes	GEL
Arsenic	Water	mg/L	1.66	1.55	1.09 - 2.02	Yes	GEL
Barium	Water	mg/L	15.7	16.8	11.8 - 21.8	Yes	GEL
Beryllium	Water	mg/L	3.73	3.89	2.72 - 5.06	Yes	GEL
Cadmium	Water	mg/L	0.314	0.34	0.24 - 0.44	Yes	GEL
Chromium	Water	mg/L	1.47	1.54	1.08 - 2.00	Yes	GEL
Cobalt	Water	mg/L	16.5	17.2	12.0 - 22.4	Yes	GEL
Copper	Water	mg/L	1.45	1.50	1.05 - 1.95	Yes	GEL
Lead	Water	mg/L	1.85	2.00	1.40 - 2.60	Yes	GEL
Mercury	Water	mg/L	0.0915	0.0966	0.0676 - 0.1256	Yes	GEL
Nickel	Water	mg/L	0.00237	0.00217	*Sensitivity Evaluation* [c]	Yes	GEL
Selenium	Water	mg/L	0.392	0.420	0.294 - 0.546	Yes	GEL
Thallium	Water	mg/L	0.751	0.844	0.591 - 1.097	Yes	GEL
Uranium – total	Water	mg/L	0.0785	0.097	0.068 - 0.126	Yes	GEL
Vanadium	Water	mg/L	11.5	11.4	8.0 - 14.8	Yes	GEL
Zinc	Water	mg/L	3.53	3.52	2.46 - 4.58	Yes	GEL
MAPEP – 17 – MaS36, Soil – Inorganic							
Antimony	Soil	mg/kg	34.5	37.3	26.1 - 48.5	Yes	GEL
Arsenic	Soil	mg/kg	89.6	95.9	67.1 - 124.7	Yes	GEL
Barium	Soil	mg/kg	32.6	32.7	22.9 - 42.5	Yes	GEL
Beryllium	Soil	mg/kg	19.6	20.4	14.3 - 26.5	Yes	GEL
Cadmium	Soil	mg/kg	2.26	2.26	1.58 - 2.94	Yes	GEL
Chromium	Soil	mg/kg	36.7	38.4	26.9 - 49.9	Yes	GEL
Cobalt	Soil	mg/kg	125	131	92 - 170	Yes	GEL
Copper	Soil	mg/kg	44.4	46.4	32.5 - 60.3	Yes	GEL
Lead	Soil	mg/kg	75.4	77.7	54.4 - 101.0	Yes	GEL
Mercury	Soil	mg/kg	0.0979	0.0909	0.0636 - 0.1182	Yes	GEL
Nickel	Soil	mg/kg	3.52	4.4	*Sensitivity Evaluation* [c]	Yes	GEL
Selenium	Soil	mg/kg	5.73	7.11	4.98 - 9.24	Yes	GEL
Silver	Soil	mg/kg	10.5	12.56	8.79 - 16.33	Yes	GEL
Thallium	Soil	mg/kg	16.9	18.1	12.7 - 23.5	Yes	GEL
Uranium - total	Soil	mg/kg	4.88	3.95	2.77 - 5.14	W	GEL
Vanadium	Soil	mg/kg	40.9	40.2	28.1 - 52.3	Yes	GEL
Zinc	Soil	mg/kg	88.9	106	74 - 138	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] A sensistivity evaluation tests the laboratory's ability to measure the analyte near the detection limit.

TABLE H-1 *(concluded)*
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a] ; Study 36; March 2017

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?* [b]	*Analyzed by:*
MAPEP – 17– MaS36, Soil – Radiological							
Am-241	Soil	Bq/kg	65.7	67.0	46.9 - 87.1	Yes	GEL
Cs-137	Soil	Bq/kg	679	611	428 - 794	Yes	GEL
Co-60	Soil	Bq/kg	958	891	624 - 1158	Yes	GEL
Pu-238	Soil	Bq/kg	0.574	0.41	*Sensitivity Evaluation* [c]	Yes	GEL
Pu-239/240	Soil	Bq/kg	51.2	59.8	41.9 - 77.7	Yes	GEL
K-40	Soil	Bq/kg	624	607	425 - 789	Yes	GEL
Sr-90	Soil	Bq/kg	548	624	437 - 811	Yes	GEL
Tc-99	Soil	Bq/kg	641	656	459 - 853	Yes	GEL
U-234/233	Soil	Bq/kg	56.9	48.1	33.7 - 62.5	Yes	GEL
U-238	Soil	Bq/kg	53.9	48.8	34.2 - 63.4	Yes	GEL
MAPEP – 17 – RdV36, Vegetation – Radiological							
Cs-137	Veg	Bq/sample	4.84	4.60	3.22 - 5.98	Yes	GEL
Co-60	Veg	Bq/sample	9.35	8.75	6.13 - 11.38	Yes	GEL
Sr-90	Veg	Bq/sample	1.50	1.75	1.23 - 2.28	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] 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 H-2
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a] ; Study 37; August 2017

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?[b]*	*Analyzed by:*
MAPEP – 17 – RdF37, Air Filter – Radiological							
Am-241	Air Filter	Bq/sample	0.0553	0.0612	0.0428 - 0.0796	Yes	GEL
Cs-137	Air Filter	Bq/sample	0.670	0.82	0.57 - 1.07	Yes	ES
Co-60	Air Filter	Bq/sample	0.559	0.68	0.48 - 0.88	Yes	ES
Cs-137	Air Filter	Bq/sample	0.884	0.82	0.57 - 1.07	Yes	GEL
Co-60	Air Filter	Bq/sample	0.749	0.68	0.48 - 0.88	Yes	GEL
Pu-238	Air Filter	Bq/sample	0.0257	0.0298	0.0209 - 0.0387	Yes	GEL
Pu-239/240	Air Filter	Bq/sample	0.0408	0.0468	0.0328 - 0.0608	Yes	GEL
Sr-90	Air Filter	Bq/sample	0.608	0.801	0.561 - 1.041	W	GEL
U-234/233	Air Filter	Bq/sample	0.0864	0.084	0.059 - 0.109	Yes	GEL
U-238	Air Filter	Bq/sample	0.0928	0.087	0.061 - 0.113	Yes	GEL
U – total	Air Filter	µg/sample	7.84	7.05	4.94 - 9.17	Yes	GEL
MAPEP – 17 – XaW37, Water – Alkaline							
Iodine-129	Water	Bq/L	2.59	*2.31*	1.62 - 3.00	Yes	GEL
MAPEP – 17 – MaW37, Water – Radiological							
Cs-137	Water	Bq/L	16.3	16.3	11.4 - 21.2	Yes	ES
Co-60	Water	Bq/L	10.4	10.7	7.5 - 13.9	Yes	ES
H-3	Water	Bq/L	254	258	181 - 335	Yes	ES
Sr-90	Water	Bq/L	7.42	7.77	5.44 - 10.10	Yes	ES
Am-241	Water	Bq/L	0.874	0.892	0.624 - 1.160	Yes	GEL
Cs-137	Water	Bq/L	16.8	16.3	11.4 - 21.2	Yes	GEL
Co-60	Water	Bq/L	10.8	10.7	7.5 - 13.9	Yes	GEL
H-3	Water	Bq/L	250	258	181 - 335	Yes	GEL
Pu-238	Water	Bq/L	0.528	0.603	0.422 - 0.784	Yes	GEL
Pu-239/240	Water	Bq/L	0.654	0.781	0.547 - 1.015	Yes	GEL
Ra-226	Water	Bq/L	0.774	0.858	0.601 - 1.115	Yes	GEL
Sr-90	Water	Bq/L	7.04	7.77	5.44 - 10.10	Yes	GEL
Tc-99	Water	Bq/L	6.41	6.73	4.71 - 8.75	Yes	GEL
U-234/233	Water	Bq/L	1.09	1.01	0.71 - 1.31	Yes	GEL
U-238	Water	Bq/L	1.14	1.04	0.73 - 1.35	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."W" - Result acceptable with warning 20% < bias < 30%.

TABLE H-2 *(continued)*
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a] ; Study 37; August 2017

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?* [b]	*Analyzed by:*
MAPEP – 17 – MaW37, Water – Inorganic							
Antimony	Water	mg/L	18.7	18.7	13.1 - 24.3	Yes	GEL
Arsenic	Water	mg/L	0.949	0.965	0.676 - 1.255	Yes	GEL
Barium	Water	mg/L	18.5	18.0	12.6 - 23.4	Yes	GEL
Beryllium	Water	mg/L	1.88	1.80	1.26 - 2.34	Yes	GEL
Cadmium	Water	mg/L	0.00227	[c]	*False Positive Test* [d]	Yes	GEL
Chromium	Water	mg/L	1.06	1.08	0.76 - 1.40	Yes	GEL
Cobalt	Water	mg/L	12.1	11.3	7.9 - 14.7	Yes	GEL
Copper	Water	mg/L	18.9	18.9	13.2 - 24.6	Yes	GEL
Lead	Water	mg/L	0.917	0.898	0.629 - 1.167	Yes	GEL
Mercury	Water	mg/L	0.000023	[c]	*False Positive Test* [d]	Yes	GEL
Nickel	Water	mg/L	10.8	10.1	7.1 - 13.1	Yes	GEL
Selenium	Water	mg/L	0.115	0.131	0.092 - 0.170	Yes	GEL
Thallium	Water	mg/L	3.72	3.64	2.55 - 4.73	Yes	GEL
Uranium – total	Water	mg/L	0.0869	0.0842	0.0589 - 0.1095	Yes	GEL
Vanadium	Water	mg/L	5.79	6.00	4.20 - 7.80	Yes	GEL
Zinc	Water	mg/L	7.55	8.08	5.66 - 10.50	Yes	GEL
MAPEP – 17 – MaS37, Soil – Inorganic							
Antimony	Soil	mg/kg	7.01	24.1	16.9 - 31.3	No	GEL
Arsenic	Soil	mg/kg	74.4	77.1	54.0 - 100.2	Yes	GEL
Barium	Soil	mg/kg	230	248	174 - 322	Yes	GEL
Beryllium	Soil	mg/kg	31.2	32.0	22.4 - 41.6	Yes	GEL
Cadmium	Soil	mg/kg	15.7	16.8	11.8 - 21.8	Yes	GEL
Chromium	Soil	mg/kg	47.9	52.3	36.6 - 68.0	Yes	GEL
Cobalt	Soil	mg/kg	15.5	17.2	12.0 - 22.4	Yes	GEL
Copper	Soil	mg/kg	267	264	185 - 343	Yes	GEL
Lead	Soil	mg/kg	45.2	52.0	36.4 - 67.6	Yes	GEL
Mercury	Soil	mg/kg	0.211	0.158	0.111 - 0.205	No	GEL
Nickel	Soil	mg/kg	111	117	82 - 152	Yes	GEL
Selenium	Soil	mg/kg	8.35	10.3	7.2 - 13.4	Yes	GEL
Silver	Soil	mg/kg	87.8	92.3	64.6 - 120.0	Yes	GEL
Thallium	Soil	mg/kg	117	128	90 - 166	Yes	GEL
Uranium – total	Soil	mg/kg	15.9	17.7	12.4 - 23.0	Yes	GEL
Vanadium	Soil	mg/kg	225	240	168 - 312	Yes	GEL
Zinc	Soil	mg/kg	243	283	198 - 368	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
[d] 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 H-2 *(concluded)*
Crosscheck Sample Comparisons From the DOE Mixed Analyte Performance Evaluation Program (MAPEP)[a]; Study 37; August 2017

Analyte	*Matrix*	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?[b]*	*Analyzed by:*
MAPEP – 17 – MaS37, Soil – Radiological							
Am-241	Soil	Bq/kg	63.1	58.8	41.2 - 76.4	Yes	GEL
Cs-137	Soil	Bq/kg	772	722	505 - 939	Yes	GEL
Co-60	Soil	Bq/kg	0.179	[c]	*False Positive Test[d]*	Yes	GEL
Pu-238	Soil	Bq/kg	85.8	92	64 - 120	Yes	GEL
Pu-239/240	Soil	Bq/kg	64.9	68.8	48.2 - 89.4	Yes	GEL
K-40	Soil	Bq/kg	631	592	414 - 770	Yes	GEL
Sr-90	Soil	Bq/kg	240	289	202 - 376	Yes	GEL
Tc-99	Soil	Bq/kg	1170	1195	837 - 1554	Yes	GEL
U-234/233	Soil	Bq/kg	72	69	48 - 90	Yes	GEL
U-238	Soil	Bq/kg	209	219	153 - 285	Yes	GEL
MAPEP – 17 – RdV37, Vegetation – Radiological							
Cs-137	Veg	Bq/sample	0.0191	[c]	*False Positive Test[d]*	Yes	GEL
Co-60	Veg	Bq/sample	2.24	2.07	1.45 - 2.69	Yes	GEL
Sr-90	Veg	Bq/sample	0.960	1.23	0.86 - 1.60	W	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 H-3

Comparisons of Results From Crosscheck Samples Analyzed for Water Quality Parameters as Part of the EPA's Discharge Monitoring Report - Quality Assurance (DMR-QA) Study 37; 2017; for the National Pollutant Discharge Elimination System (NPDES)

Analyte	*Units*	*Reference Value*	*Reported Value*	*Acceptance Range*	*Accept?* [a]	*Analyzed by:*
Aluminum	µg/L	846	906	688 - 994	Yes	TestAmerica
Aluminum	µg/L	2,780	2,970	2310 - 3170	Yes	GEL
Ammonia (as N)	mg/L	18	17.4	14.5 - 21.3	Yes	TestAmerica
Antimony	µg/L	681	676	556 - 785	Yes	TestAmerica
Arsenic (EPA 200.8)	µg/L	188	182	148 - 227	Yes	TestAmerica
Barium	µg/L	1,620	1,560	1370 - 1860	Yes	TestAmerica
Biochemical oxygen demand	mg/L	132.0	139.0	67.7 - 220	Yes	TestAmerica
Biochemical oxygen demand	mg/L	93.0	94.0	49.8 - 136	Yes	GEL
Cadmium (EPA 200.8)	µg/L	372	360	316 - 428	Yes	TestAmerica
Chlorine (total residual)	µg/L	70.2	70	10.2 - 130	Yes	PSO
Chromium (EPA 200.8)	µg/L	720	719	612 - 828	Yes	TestAmerica
Chromium (hexavalent)	µg/L	583	502	489 - 669	Yes	TestAmerica
Cobalt	µg/L	622	590	528 - 715	Yes	TestAmerica
Copper (EPA 200.8)	µg/L	268	258	228 - 308	Yes	TestAmerica
Copper (EPA 200.8)	µg/L	445	443	378 - 512	Yes	GEL
Cyanide, total	mg/L	0.194	0.190	0.126 - 0.262	Yes	TestAmerica
Iron	µg/L	2,210	2,300	1880 - 2550	Yes	TestAmerica
Iron	µg/L	2,300	2,330	1960 - 2640	Yes	GEL
Lead (EPA 200.8)	µg/L	1,070	1,030	906 - 1230	Yes	TestAmerica
Lead (EPA 200.8)	µg/L	480	452	408 - 552	Yes	GEL
Manganese	µg/L	1,750	1,840	1490 - 2020	Yes	TestAmerica
Mercury (EPA 1631E)	µg/L	13.3	12.7	9.31 - 17.3	Yes	GEL
Nickel	µg/L	899	871	791 - 1010	Yes	TestAmerica
Nitrate (as N)	mg/L	8.13	8.25	6.68 - 9.54	Yes	TestAmerica
Nitrite (as N)	mg/L	3.83	3.68	3.33 - 4.35	Yes	TestAmerica
Oil & Grease (Gravimetric)	mg/L	59.0	50.1	39.2 - 70.9	Yes	TestAmerica
Oil & Grease (Gravimetric)	mg/L	55.5	50.4	36.4 - 67.1	Yes	GEL
pH	SU	5.54	5.58	5.34 - 5.74	Yes	ES
Phosphorus (total, as P)	mg/L	1.31	1.27	1.03 - 1.58	Yes	TestAmerica
Phosphorus (total, as P)	mg/L	5.79	5.2	4.80 - 6.71	Yes	GEL
Selenium (EPA 200.8)	µg/L	458	434	390 - 527	Yes	TestAmerica
Sulfate	mg/L	34.9	37.3	28.3 - 40.2	Yes	TestAmerica
Settleable solids	mL/L	27.8	29.0	22.6 - 35.3	Yes	TestAmerica
Suspended solids (total)	mg/L	89.5	84.4	73.6 - 99.2	Yes	TestAmerica
Suspended solids (total)	mg/L	85.0	81	69.7 - 94.4	Yes	GEL
Total dissolved solids	mg/L	704	697	633 - 774	Yes	TestAmerica
Total dissolved solids	mg/L	196	177	151 - 241	Yes	GEL
Total Kjeldahl nitrogen (as N)	mg/L	10.1	9.01	7.42 - 12.7	Yes	TestAmerica
Vanadium	µg/L	71.4	71.4	60.7 - 82.2	Yes	TestAmerica
Zinc (EPA 200.8)	µg/L	1,480	1,430	1260 - 1700	Yes	TestAmerica
Zinc	µg/L	1,100	1,040	935 - 1260	Yes	GEL

Samples provided by Environmental Resource Associates (ERA) and Phenova.

ES - WVDP Environmental Services

GEL - GEL Laboratories, LLC.

TestAmerica - TestAmerica Laboratories, Inc., Buffalo.

PSO - Plant Systems Operations.

[a] "Yes" - Result acceptable; "No" - Result not acceptable.

TABLE H-3 (*concluded*)
Comparisons of Results From Crosscheck Samples Analyzed for Water Quality Parameters as Part of the EPA's Discharge Monitoring Report - Quality Assurance (DMR-QA) Study 37; 2017; for the National Pollutant Discharge Elimination System (NPDES)

Analyte	*Units*	*Reported Value*	*Reference Value*	*Acceptance Range*	*Accept?* [a]	*Analyzed by:*
Toxicity						
Fathead Minnow Acute MHSF 25° - LC50 754	%	20.1	19.9	3.05 - 36.8	Yes	New England Bioassay
Fathead Minnow Chronic MHSF - Survival NOEC 756	%	25.0	12.5	6.25 - 25.0	Yes	New England Bioassay
Ceriodaphnia Acute MHSF 25° - LC50 764	%	64.9	42.5	1.32 - 83.8	Yes	New England Bioassay
Ceriodaphnia Chronic MHSF - Survival NOEC 766	%	25.0	25.0	12.5 - 50.0	Yes	New England Bioassay
Ceriodaphnia Chronic MHSF - Reproduction IC25 767	%	23.9	22.2	7.97 - 36.5	Yes	New England Bioassay
Ceriodaphnia Chronic MHSF - Reproduction NOEC 768	%	25.0	12.5	6.25 - 25.0	Yes	New England Bioassay
Fathead Minnow Chronic MHSF - Growth IC25 (ON) 808	%	31.0	23.5	8.68 - 38.3	Yes	New England Bioassay
Fathead Minnow Chronic MHSF - Growth NOEC (ON) 810	%	25.0	12.5	6.25 - 25.0	Yes	New England Bioassay

[a] "Yes" - Result acceptable; "No" - Result not acceptable.

APPENDIX I

West Valley Demonstration Project Act

(As presented in Exhibit G of the Cooperative Agreement between USDOE and NYSERDA for the WNYNSC 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,

West Valley Demonstration Project Act. 42 USC 2021a note.

SECTION 1. This Act may be cited as the "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:

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:

Hearings.

(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.

(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.

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(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.